Sheffield Hallam University

Physical Activity Referral Schemes: socio-demographic patterning of exposure, uptake and attendance

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Abstract

Background. Despite the prevalence of Physical Activity Referral Schemes (PARS) in Britain, to date, there has been no attempt to elucidate their public health role. The nature of this role will depend upon who schemes are accessible to, and appropriate for. ***Objective.*** The aim of the present research was to provide a rigorous account of socio-demographic bias in referral to, and attendance of a county-wide PARS by tracking participant progress, from point of referral to the end of their involvement with the scheme. ***Methods.*** Epidemiological methods were applied to analyse data from people referred to the Somerset-wide ProActive PARS over a three-year period. For all Somerset residents referred, age, gender, and the deprivation level (measured by the Townsend score) and urban-rural character of their area of residence were used to make socio-demographic comparisons with the county population as a whole. Mann-Whitney and Kruskal-Wallis difference tests were used to compare socio-economic characteristics. Binary logistic regression analysis was used to identify socio-demographic characteristics associated with referral uptake (attending $\geq$1 session) and completion of physical activity programmes ($\geq$80% attendance). ***Results.*** The proportion of referred participants (n=3569) who were female was above the county average (61.1 *vs.* 51.4%). Referrals increased markedly with age from 6.6% (<30 yrs) to 22.7% (50-59 yrs), dropping off sharply thereafter ($\geq$60 yrs). The mean Townsend deprivation score for participant area of residence was greater than the county average (0.33 *vs.* 0.00, p<0.001). These patterns indicated that, with the exception of older adults, those groups most likely to consult primary care were referred most frequently. Regression analysis (n=2864) revealed that increasing age (Exp(B)=1.014, p<0.001) and urban residency (Exp(B)=1.317, p<0.001) increased the likelihood of referral uptake. Uptake was less likely for those living in more deprived areas (Exp(B)=0.933, p<0.001). In participants who took up referral, the likelihood of completion was lower in women than men (Exp(B)=0.818, p=0.041) but increased with age (Exp(B)=1.018, p<0.001). ***Conclusion.*** Younger people, residents of deprived and rural areas, and women appear less likely to progress through schemes or complete PARS programmes, regardless of relative scheme exposure. PARS appear more appropriate for adults of middle-to-old age who are more likely to require supervision and should be targeted accordingly. To promote physical activity in a preventive capacity and to increase activity across the socio-economic strata is likely to require broader and multi-faceted environmental and policy-led interventions to promote habitual activity, rather than attempting to increase recreational activity through individual-orientated such as PARS.

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Ta.

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Gidlow, C., Johnston, L., Crone, D., Ellis, N. and James, D. (2006). A systematic review of evidence of the relationship between socio-economic position and physical activity *Health Education Journal,* 65*(4): 366-395.*

Glossary

Term	Definition
Census	Decennial official tally of the population to compile demographic, economic and social data pertaining to the population.
Counties	Regions created by territorial division for the purposes of local Government. Originated as administrative areas, but have been adopted for geographic purposes.
Demographic	Relating to population composition (e.g. age; gender; ethnicity; socio-economic position).
Deprivation	Combination of circumstances that describe relative disadvantage of areas, usually based on the characteristics of the resident population.
Deprivation indices	Composite scores that combine area-level data on several socio-economic outcomes to identify geographical areas with a combination of circumstances indicating low living standards, a high need for services, or both.
Enumeration district (ED)	Smaller divisions of wards (electoral). Typically contain approximately 500 residents. Formerly the smallest areal unit for output of census data.
Exercise	Planned, structured, repetitive and purposeful physical activity.
Exercise self-efficacy	Belief that exercise is, or is not, within an individual's control (Bandura 1986).
Gender	Non-biological differences between men and women in terms of cultural, social, and psychological factors.
Geographical Information Systems (GIS)	Systems for the manipulation and presentation of georeferenced (i.e. spatial) data (Briggs and Elliott 1995).
Health and Social Needs Analysis Group *(HSNAG)*	Somerset based group responsible for collating and disseminating health and population-related data for the county.
Health authority	Organisation responsible for providing health care through the NHS, in a particular geographical area. Replaced by PCTs in 2004.
Health inequality	Disparities in health.
Housing tenure	The financial arrangements under which somebody has a right to live in a house (e.g. tenancy; owner occupied).

Inequity	Unjust or unfair.
Output area (OA)	Smallest areal unit for output of census data. Each OA contains a ≥100 residents or ≥40 households.
Physical activity	Any activity that increases energy expenditure above resting levels.
Poverty	Situation in which resources are below those demanded by the average individual or family to the extent that they are effectively excluded from ordinary patterns, customs, and activities.
Primary Care Trust (PCT)	Free standing statutory bodies responsible for delivering better health care and health improvements to the local area.
Primary health care	First care a patient receives, often GP.
Secondary health care	Services provided by medical specialists who generally do not have first contact with patients, often hospitals.
Sex (*vs*. gender)	Simple biological differences between men and women.
Social exclusion	What can happen when people or areas suffer from a combination of linked problems such as unemployment, poor skills, low incomes, poor housing, high crime environments, bad health, poverty and family breakdown.
Socio-demographic	Relating to or involving both social and demographic factors.
Socio-economic (SE)	Relating to or involving both economic and social factors.
Socio-economic position (SEP)	A generic term referring to different socio-economic measures (e.g. income; education; occupation; deprivation).
Somerset Physical Activity Group (SPAG)	Countywide multi-agency group that develops strategies for the promotion of physical activity to all sectors of the community.
Super output area (SOA)	Aggregates of OA (approximately 5, on average 1500 residents).
Unitary Authority (UA)	Created through local government reorganisation in 1990s in England and Wales. Type of local authority which is responsible for all local Government functions within its area.
Ward (electoral)	Electoral districts used in local politics. Typically areas containing 5000-6000 residents. One of the most commonly used geographical units in area-level data.

Chapter 1: Introduction

1.1 Physical activity and public health

Introduction

It is now widely accepted that regular physical activity is associated with numerous physical and mental health benefits. Physical *in*activity is known to increase the risk of several chronic diseases in adult life, including cardiovascular disease, diabetes, obesity, osteoporosis and some cancers (Pate, Pratt, Blair et al., 1995), and has been linked to a greater prevalence of mental health problems such as depression (Biddle, Fox and Boutcher, 2000; Department of Health, 2004a).

Keeping physically active is recognised as an essential component of a healthy life for people of all ages. Activity behaviour of children and young people has received increasing attention because of the rise in sedentary recreational activities and corresponding rises in childhood obesity (Davey, 2003; Department of Health, 2004b). In adults, regular physical activity can be used for the prevention and treatment of numerous diseases (Jakes and Wareham, 2003), in addition to rehabilitative uses following injury and coronary vascular disease (Jollife, Rees, Taylor et al., 2000). Finally, in older people, maintaining an active life is important for retaining independence and preventing falls, through sustained functionality, mobility and well-being (Boreham and Riddoch, 2003; Gillespie, Gillespie, Robertson et al., 2004; Taylor, Cable, Faulkner et al., 2004).

As a result of considerable epidemiological and experimental research linking regular physical activity to a wide range of positive health outcomes, changes were made to guidelines[1] for recommended weekly amounts of physical activity. This represented a shift from the traditional *exercise-for-fitness* paradigm, to one advocating more frequent, lower intensity *physical activity-for-health* (Blair, Cheng and Holder, 2001b).

[1] Previous guidelines recommending 3 x 20-min episodes of vigorous-intensity activity per week (American College of Sports Medicine, 1990) were modified to recommend the accumulation of 30 minutes of moderate-intensity activity on most days (American College of Sports Medicine, 1998; Pate et al., 1995)

However, despite apparent public awareness of health benefits associated with an active lifestyle (Blamey and Mutrie, 2004), it is estimated that approximately two-thirds of men and three-quarters of women in England are insufficiently active for health (Department of Health, 2003b). Therefore, the claim that physical activity represents public health's 'Best buy' made over a decade ago, remains as relevant as ever (Morris, 1994: p.807).

The rise of 'lifestyle diseases' in an ageing population

As illustrated in Figure 1.1, life expectancy in Britain has been increasing for many years. It is predicted that by 2020 over thirty *per* cent of the population will be aged sixty years or over, and more than half will be over fifty (DCMS, 2002; Department of Health, 2005b). Much of this increased longevity is due to economic development and medical advances that have improved treatment of diseases, and reduced the contribution of communicable and infectious diseases to public health patterns. However, a serious threat to public health still exists in the form of 'lifestyle disease' (Booth, Gordon, Carlton et al., 2000a).

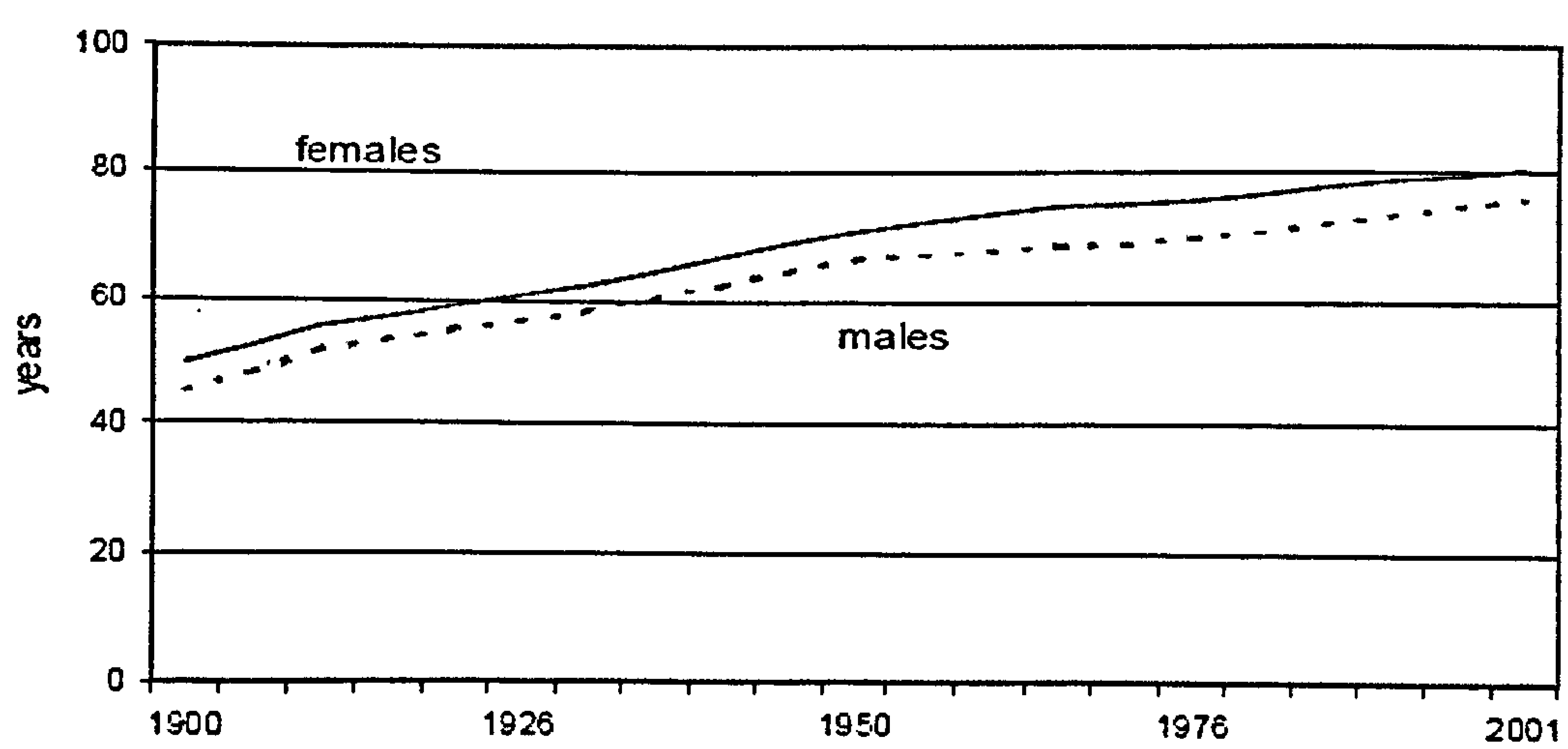

Figure 1.1 The ageing demographic of the British population (Wanless, 2003: p.5)

In relation to activity levels, despite the efforts of a growing fitness industry, any increases in recreational activity have been insufficient to compensate for the loss of energy expenditure through traditional activities as a result of societal development (King, 1999). Indeed, changes in transport, electronic communication, Internet shopping, energy-saving devices and sedentary entertainment have created a society in which sedentary behaviour is strongly reinforced (Kerr, Eves and Carroll, 2003; Prentice and Jebb, 1995; Schmid, Pratt and Howze, 1995; Sparling, Owen, Lambert et al., 2000).

Such lifestyle changes have lead to an increasing prevalence of diseases, such as cardiovascular disease, hypertension, Type II diabetes, obesity and other related morbidities (Booth et al., 2000a). As people continue to live longer, Britain is faced with the potentially disastrous consequences for the health service and the economy, of an ageing population who spend a higher proportion of their lives in ill-health. Marked changes in public health behaviour are required to retard age-related deteriorations in health that are accelerated by a physically inactive lifestyle. If not, the public health burden of the ageing population on the health service and the economy may become unmanageable (Phillips, 2002; Wanless, 2003).

Inequalities in health and physical activity

Like other health-damaging behaviours, physical *in*activity is not distributed equally across the population (Department of Health, 2003b). Certain population groups tend to be less active than others, and it is often the same groups that report the poorest health (Acheson, 1998; Department of Health, 2003a). In particular, socio-economic health inequalities have attracted a lot of attention as, for many years, researchers have observed poor health in sequentially lower socio-economic groups (Blane, 2001; Kaplan, Pamuk, Lynch et al., 1996; Wagstaff, 2002). It is, therefore, not surprising that attempts have been made to target physical activity promotion towards these groups through health promotion strategy and policy (Department of Health, 1999b).

Summary

Successfully increasing physical activity levels across the population could help to reduce the consequences of an ageing population in which chronic diseases are more prevalent. Moreover, targeting the least active groups could help to redress health inequalities, especially between socio-economic groups. Consequently, increasing amounts of research and more recently, policy, have focused on physical activity promotion. In Britain, a popular setting for such interventions has been primary care (Taylor, 2003), and out of the various types of primary care intervention, Physical Activity Referral Schemes (PARS) have arguably become the most prevalent (Crone, Johnston and Grant, 2004).

1.2 Physical Activity Referral Schemes

Physical Activity Referrals Schemes (also referred to as Exercise or GP Referral Schemes) involve the referral of primary care patients by health professionals, usually general practitioners, to exercise professionals for a programme of supervised exercise (Department of Health, 2001b). Despite the rapid proliferation of PARS since their inception in the early 1990s (Crone et al., 2004), there is little data to reliably inform *who* these schemes are accessible to, and *who* they are most suitable and effective for. Unless this is determined, it will not be possible to identify what role, if any, PARS can effectively fulfil within an overall public health strategy.

Several events must take place for an individual to receive a physical activity referral. These present opportunities for socio-demographic bias, such that some population groups could become more likely than others to be exposed to schemes. First, individuals must perceive that their health is poor or alternatively recognise the value of preventive health care. Secondly, they must be able to access primary care, and then realise access by visiting a primary healthcare professional. Thirdly, health professionals must perceive that a physical activity referral is an appropriate and potentially beneficial course of action. Finally, the patient must consent. This could be influenced by a number of factors including personal attitudes and beliefs, or feelings of obligation to follow the health professionals' advice regardless of their own apprehensions.

Following referral, it is quite possible that different socio-demographic groups will achieve differential success, in terms of referral uptake and attendance. Differences in exposure and success for different population groups are important considerations in determining who should be targeted for PARS, the way in which this should be approached, and the appropriateness of the PARS intervention.

1.3 Research Questions and thesis perspective

In recognition of this gap in the evidence base, the aims of this thesis are two-fold and are addressed through two broad research questions:

RQ1 How do socio-demographic characteristics of participants relate to their opportunity to participate in PARS?

RQ2 How does participation in PARS following referral differ between socio-demographic groups?

By identifying population groups who are neglected or over-represented on PARS, comparison with least active groups and with those identified as priorities in health promotion policy, should provide insight into how well PARS are targeted (RQ1). The second research question is concerned with differential rates of referral uptake and attendance in different socio-demographic groups (RQ2). This should promote better understanding of whether, if targeted appropriately, there is a potential role for PARS as part of the strategy to address the aforementioned public health issues. There are several noteworthy aspects of this research that illustrate why this represents an original contribution to the area, and that serve as rationale for the approach taken and ultimately the nature of the thesis.

Advantages of the study setting

The present study evaluated a well run, large-scale countywide PARS in Somerset that has previously been cited as a model for good practice (Biddle et al., 2000: p.5). Therefore, findings are used to make broader inferences regarding what might be achievable through PARS and similar approaches to physical activity promotion if well implemented on a large scale. As applied research, this study helped to address the lack of quality research of this nature (Blamey and Mutrie, 2004; Gidlow, Johnston, Crone et al., 2005). Moreover, it enabled findings to be fed back immediately to practice, resulting in several changes to the scheme operation. In addition, the researcher's personal experience of working on the scheme provided valuable insight. This helped to inform the discussion and ensure a realistic rather than idealistic perception of changes that could be made, and the potential public health impact of PARS. Recent guidance on physical activity interventions recommended against further endorsement of such schemes unless through controlled studies of effectiveness (NICE, 2006). Nevertheless, the approach of the present study is consistent with the view of a growing number of researchers who believe that, for all their intended rigour, RCTs alone cannot provide an accurate and realistic impression of how human interventions perform in practice (Blamey and Mutrie, 2004; Potvin, Hadda and Frohlich, 2001). Such experimental research undoubtedly has a valuable role but must be accompanied by other types of research to provide a more complete picture.

Furthermore, the nature of the data avoided a common limitation of PARS research. The scheme under evaluation was the first to implement data collection processes that enabled participant progress to be monitored from the earliest point in the referral process, until the end of their involvement with the scheme. These data provided a rare opportunity to study the characteristics of PARS participants on whom data are usually unavailable; i.e. the research was not restricted to only those participants who took up referral.

Thesis perspective

The perspective from which the present research was undertaken and subsequent approach relates to what has been described as the World Health Organization conception of health promotion:

> *'this conception emphasises the social and economic conditions which allow all behaviours, including unhealthy behaviours, to originate, develop and reproduce themselves over the life course and to the next generation'* (Connelly, 2002: p.692).

In contrast to the majority of previous PARS research, this is essentially public health research, which uses epidemiological methods, but considers findings from a social-ecological perspective. It is, therefore, in keeping with the ideas of Sallis and Owen (1999) who ascribe a central role to environmental and social influences on physical activity behaviour. When attempting to explain behaviour in relation to physical activity interventions (such as PARS), it is easy to become sidetracked by the abundant literature that explains behaviour and behaviour change in terms of specific psychological models. The importance of individual personal, cognitive and physiological influences is not in dispute. Rather, the social-ecological model suggests that proximal social prompts and other influences are of greater importance in shaping outlooks, attitudes and beliefs regarding health behaviour (Connelly, 2002; Lynch, Kaplan and Salonen, 1997; Sallis and Owen, 1999). Moreover, in terms of physical activity promotion, the end goal remains individual behaviour change, but the point of attack shifts from the individual to the environment in which people live (Yen and Syme, 1999). This creates the opportunity to make changes that could affect a wider audience (e.g. residents of deprived areas) rather than relying on an individualistic approach to behaviour change.

The present thesis essentially uses socio-demographic characteristics as markers for environmental influences (social and physical) that are thought to create differences in health-related behaviour observed between socio-demographic groups. In order to consider broader environmental influences and issues that could reduce the effectiveness of physical activity promotion (including PARS), a wide range of literature was consulted. This was considered necessary to provide sufficient context in which to discuss the present findings. Not only have other PARS evaluations tended to ignore this wider literature but calls for more controlled experimental research alone (NICE, 2006) ignores the ecological validity provided by applied research (Blamey and Mutrie, 2004; Potvin et al., 2001). The present research is, therefore, the first attempt to consider PARS in this wider context and as such represents the first concerted effort to elucidate the expediency of schemes in relation to important public health issues.

Only relatively recently has there been a move by some researchers to breach the middle ground between exercise science, sociology and epidemiology. This move away from over-specialisation within exercise science and towards a broader understanding has been recognised and encouraged (Blair, 2001; Smith, 2005). For the first time, this thesis aims to do so in the context of PARS. The remainder of this introductory chapter provides an outline of the thesis structure.

1.4 Thesis structure

To achieve the overall aims of the thesis in the absence of comparable PARS research (Gidlow et al., 2005), an extensive review of literature was required. It was important to explore issues in sufficient depth. Moreover, bringing together numerous areas of research that are substantial in their own right (e.g. health inequalities; physical activity epidemiology; physical activity promotion), demanded a substantial proportion of the thesis being devoted to this review (Chapters 2-7), which includes two systematic reviews accepted for publication (Gidlow, Johnston, Crone et al., in press; Gidlow et al., 2005). This format maybe unconventional but was deemed essential for the purposes of this research which maintains a focus on the "bigger picture".

- Chapter 2 describes socio-demographic inequalities in health. Its aim is to consider general patterns of health across the British population, especially socio-economic differences that are at the heart of public health policy. By exploring mechanisms through which the socio-economic environment is thought to influence health, a potential role for physical activity emerges.

- Chapter 3 examines epidemiological evidence describing physical activity behaviour in relation to socio-demographic characteristics and area of residence (both socio-economic and urban-rural). Given the methodological difficulties involved in measurement of both physical activity and socio-economic position (SEP) (and the public health importance of socio-economic health inequalities), particular attention is given to socio-economic differences. This addresses the lack of engagement with important conceptual and practical issues associated with socio-economic measurement that remains within physical activity research. Chapter 3 also considers possible social-ecological explanations for physical activity patterns described.

- Chapter 4 provides a brief history of physical activity promotion and related Government policy in Britain. The remainder of the chapter is concerned with different approaches to physical activity promotion, then focusing on primary care-based interventions. Associated problems make a case for both PARS-style interventions within this setting and for a non-experimental approach to evaluation.

- Physical Activity Referral Schemes are the focus of Chapter 5, most of which comprises a review of published PARS research in Britain (Gidlow et al., 2005). The review considers evidence excluded from previous reviews that have tended to focus on RCT-style evaluations. It confirms marked gaps in the knowledge-base relating to PARS, which the present research sets out to address.

- Chapter 6 provides a detailed breakdown of how different socio-demographic groups vary in their use of health services and health help-seeking behaviour, in addition to possible bias that might arise according to where people live. The aim of this chapter was to give an appreciation of how different population groups might experience differential exposure to PARS, which are dependent of referrals from primary care.

- The final chapter of the literature review, Chapter 7, is a thorough examination of socio-economic measurement. Given that socio-economic differences in access to and use of PARS is central to the thesis, it was essential to explore this controversial and much debated area that has been largely neglected in physical activity research. Although situated at the end of the literature review, Chapter 7 provides a reference that informs earlier critiques of studies involving socio-economic measurements (especially Chapter 3), in addition to justifying the approach to socio-economic measurement taken in the present study.

- Chapter 8 describes the context for the present study. Because this is applied research, rather than including a traditional methodology section it was important to understand the nature of the scheme under evaluation and the source of data, thus promoting an understanding of the role of PARS within public health.

- Chapters 9 and 10 are accounts of the methods used and results of analysis, respectively.

- Chapters 11 and 12 discuss the findings from each research question in turn. Emergent themes are subsequently combined in Chapter 13 to consider how the findings have changed practice, further implications for practice and research and how they relate to Government policy and wider issues. Finally, the researcher reflects on the research and considers his personal influence on the approach taken, how the process would differ if repeated, and the important contribution that the researcher's experience of working on the PARS made towards the thesis.

Chapter 2: Health Inequalities

2.1 Introduction

This chapter serves as an introduction to health inequalities, about which an enormous amount has been written and which has received varying degrees of prominence in health policy over recent decades (McDaid and Oliver, 2005). Yet despite this continued, and now increasing level of attention, health inequalities remain both difficult to measure and explain (Goldman, 2001). In the context of the present study, health inequalities are of interest for several reasons. Firstly, population groups who experience the poorest health outcomes have most to gain from health promotion interventions such as PARS. Identifying these groups should provide insight as to whether PARS (and other physical activity promotion strategies) are being appropriately targeted. Secondly, a discussion of the nature of health inequalities, the underlying causes, and the role of health behaviours, should indicate the likely effectiveness of current health and physical activity promotion policy (discussed further in Section 4.2) in reducing health inequalities. Finally, knowledge of differences in health provides context for the subsequent discussion of differences in health-help seeking behaviour (Sections 6.3.1; 6.4.2; 6.5). This is used to consider whether using primary care is likely to provide an effective means of accessing target groups.

Before engaging in this discussion it is important to first define what is meant by health *inequality* and distinguish it from the concept of health *inequity*. Equity refers to social justice or fairness, often used to relate healthcare provision to need, rather than the health discrepancies that create differences in health need. Such health differences between population groups are referred to as health inequalities. It is easy to assume that health inequalities refer to the well-documented socio-economic gradients in health. However, inequalities in health exist, whether measured in terms of mortality, life expectancy or health status, and whether categorised by socio-economic position[2] (SEP), ethnicity, age, gender or geographical location (Acheson, 1998; McDaid and Oliver, 2005). Indeed, it is thought that gender and ethnicity are the two most

[2] Throughout the thesis socio-economic position is used as the generic term to refer to all types of socio-economic measurement. Refer to Section 7.1 for a more detailed discussion.

ubiquitous and confounding factors in health research (Hunt and Annandale, 1999). Alongside these, age, SEP and geographical location will be considered in relation to health.

The present study is concerned with people accessing and being referred to a PARS. In order to do so, individuals must first initiate contact with a primary healthcare professional, which is ultimately linked to how they perceive their health (i.e. self-rated health) and subsequently respond to ill-health (refer to Sections 6.2-6.4). Therefore, the following sections focus on inequalities in self-rated health and morbidity, rather than objective health outcomes, such as mortality.

2.2 Gender, age and health

Gender, age and health are all inter-related; i.e. not only does self-rated health change over the life course but so do relative differences between men and women. Therefore, following an introduction to age-related changes in health, the relationship between health and gender will be considered alongside that for health and age.

2.2.1 Age-related changes in health

It is widely acknowledged that ageing is associated with a progressive decline in health due to deterioration in the cardiovascular system and peripheral circulation, a progressive loss of bone and muscle mass, and reduced muscle strength (Boreham and Riddoch, 2003; Taylor et al., 2004). It is also known that several chronic diseases have long incubation periods. The effects of lifestyle behaviours and individuals' social environment accumulate over their lifetimes (Blane, 2006; Boreham and Riddoch, 2003), often manifesting in disease symptoms around middle-age. It would, therefore, be expected that such biological change and deterioration would influence how individuals rate their personal health, especially from middle-aged onwards.

Data from the 2001 census were consulted to explore age-related health in terms of self-rated health status ('good' or 'fairly good' *vs.* 'not good') and the presence or absence of a long-term limiting illness (LLI). These are the two most popular single global health items in health research. Their validity is defended in more detail elsewhere (Bowling, 2005). Briefly, both measures have been shown to be associated with each other, mortality, health service use, other indicators of function and health, age, and SEP. Further, mortality is thought too insensitive to be used as a healthcare outcome indicator in developed countries (Bowling, 2005). Also, reliance on diagnoses by health professional assumes equality in rates of consultation which is not the case (Sections 6.2 and 6.3).

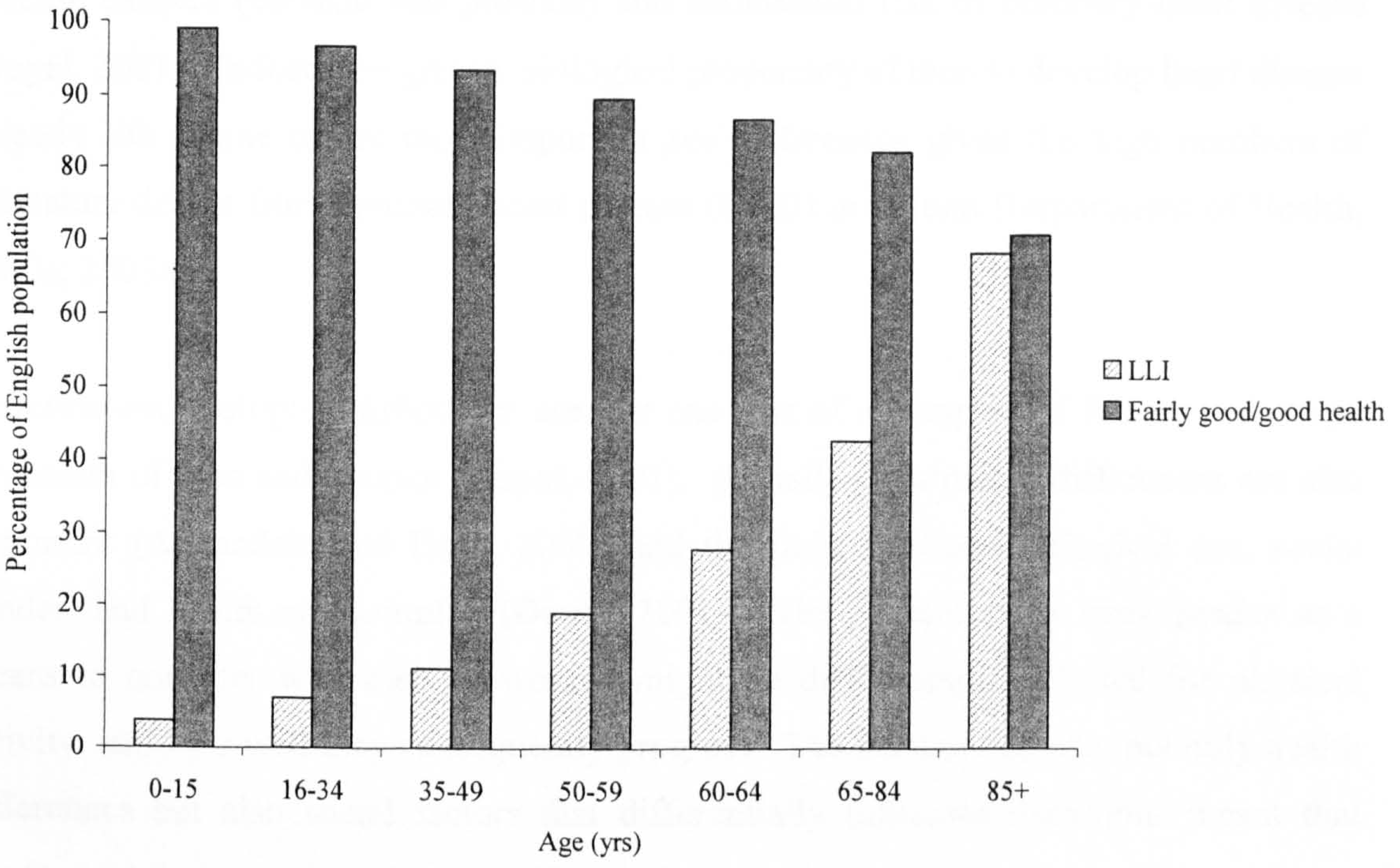

Figure 2.1 Age distribution of the English population reporting 'good' or 'fairly good' health vs. those reporting a limiting long-term illness (Casweb, 2004)

Figure 2.1 presents census 2001 data for England (refer to Appendix 1 for complete data), which clearly demonstrates that with increasing age the proportion of the population reporting 'good health' decreases, as the proportion reporting a LLI increases.

Therefore, age-related biological changes appear to be reflected in how people perceive and report their health. This is now considered in relation to gender.

2.2.2 Gender and health over the life course[3]

Sex or gender

Biological differences between men and women undoubtedly play a part in shaping distinctive male and female patterns in morbidity and mortality; the obvious difference being the additional risk for women associated with reproduction. There is also a range of genetic, hormonal and metabolic influences affecting health; for example, sex specific cancers (cervical and prostate) and differential risk of coronary heart disease (Doyal, 2001). Indeed, the greater biological propensity of men to develop heart disease in early life is one of the most important *sex* differences given the high numbers of premature deaths from coronary heart disease (CHD) in Britain (Department of Health, 2000a; 2003a).

Nevertheless, biological influences are just one part of a complex of factors that shape the health of men and women (Doyal, 2001). Socially constructed differences are also important (Annandale and Hunt, 2000) and the links between biological sex, social gender, and health are complex (Doyal, 2001). The present study uses *gender* as a means to consider why men or women might be differentially referred for physical activity, and how well they subsequently progress. The need to consider not only health differences but also social factors that differentially influence behaviour meant that gender (not sex) was the construct of interest.

The relationship between health and gender is less straightforward than that for age. Ever since the first interest in gender health inequalities in the 1970s, the majority of researchers have worked on the assumption that despite higher rates of mortality in men, women experience and report greater morbidity (MacIntyre, Ford and Hunt, 1999; MacIntyre, Hunt and Sweeting, 1996). This argument has become entrenched to the extent that inconsistencies and complexities in patterns of gender health differences have been overlooked (Hunt and Annandale, 1999; MacIntyre et al., 1996). Only relatively recently has the female excess in morbidity been challenged. As a result of the preoccupation with women's health, relatively few studies have compared men and

[3] Throughout this review, *gender* rather than *sex*, is the preferred term; sex refers to simple biological differences, whereas gender also relates to non-biological factors such as cultural, social, and psychological differences between men and women (Emslie, Hunt and MacIntyre, 1999; Malterud and Okkes, 1998)

women with the same conditions or symptoms. Those that have, produced inconsistent results, and those comparing self-rated and objectively measured health tend not to support this widely accepted hypothesis (MacIntyre et al., 1999).

There is an endless amount of available data reporting the health of men and women in various contexts and collected for various purposes. To cover this comprehensively was unrealistic and unnecessary exercise for the purpose of this discussion. Rather, a brief review of recent British studies and survey data was undertaken.

Evidence from Britain

In 1996, MacIntyre et al (1996) analysed data from over ten thousand British adults and found that in contrast to conventional wisdom there were indeed inconsistencies and complexities in gender differences for a range of health outcomes. The direction and magnitude of gender health differences varied according to age and the particular health outcome. There were no differences in the proportions of men or women reporting LLI and a female excess in the reporting of 'fair' or 'poor' health was evident in the youngest age group only (18 years). Despite a significantly higher mean number of symptoms reported in women of all ages, when subdivided into general 'malaise' or 'physical' symptoms, this pattern remained for total malaise only. When comparing gender differences in the reporting of 'current' conditions, there was again, inconsistency by age and condition. The proportion of women was significantly higher across the age range for one condition only (migraine), with no gender differences at any age for six other conditions (respiratory disorders, diabetes, hernia, epilepsy, cancer and hypertension). On the basis of these and other data, the authors challenged the accepted paradigm of greater morbidity in women as an oversimplification proposing that: 'overgeneralization has become the norm with inconsistencies and complexities in patterns of gender differences in health being overlooked' (MacIntyre et al., 1996: p.621).

These findings have been echoed in later studies. Matthews et al (1999) compared data from two cohorts of young English men and women (aged 23 and 33 years) using seven different health outcomes. There were no significant gender differences in health and the magnitude of any differences varied according to the specific health measure used and the age group. The only marked female excess was in psychological distress. In both age groups this was approximately twice as common in women compared with men (consistent with women being more likely to consult GPs for psychological reasons than men, Section 6.3.1). MacIntyre et al (1999) re-examined the gender-health relationship using data taken from a survey that categorised participants into three age groups (15, 35 and 55 years). Comparing responses of men and women to similar questions regarding general health status and LLI confirmed the importance of age, not gender, in relation to health. Although certain conditions, such as headaches, were reported more frequently by women, there was no difference overall, or in the likelihood of men and women reporting conditions judged (externally) to be 'trivial'.

In an English study of older people (≥60 years) Arber and Cooper (1999) revealed trends that they termed the 'new paradox'. Despite some expectation that self-reported health would be worse in older women, who are more likely to live alone and experience material deprivation, this was not the case. Self-reported health was similar in men and women until the age of eighty years, after which a slightly higher proportion of women reported poor health. Despite similarities in perceived health, women aged over eighty-five years were seventeen *per* cent more likely to report LLI illness and seventy-five *per* cent more likely to experience a severe disability. Therefore, it appeared that among older people, for a given age and level of disability women were *less* likely to assess their health as 'poor' compared with men, although researchers did not attempt to explain why.

Overall, with the exception of psychological conditions, the pattern of poorer health in women is dependent on age and the specific disease in question. Data from census 2001 were again obtained to confirm these messages from the literature. Figures 2.2 and 2.3 summarise the overall trends in self-reported health for England by age and gender (refer to Appendix 1 for complete data).

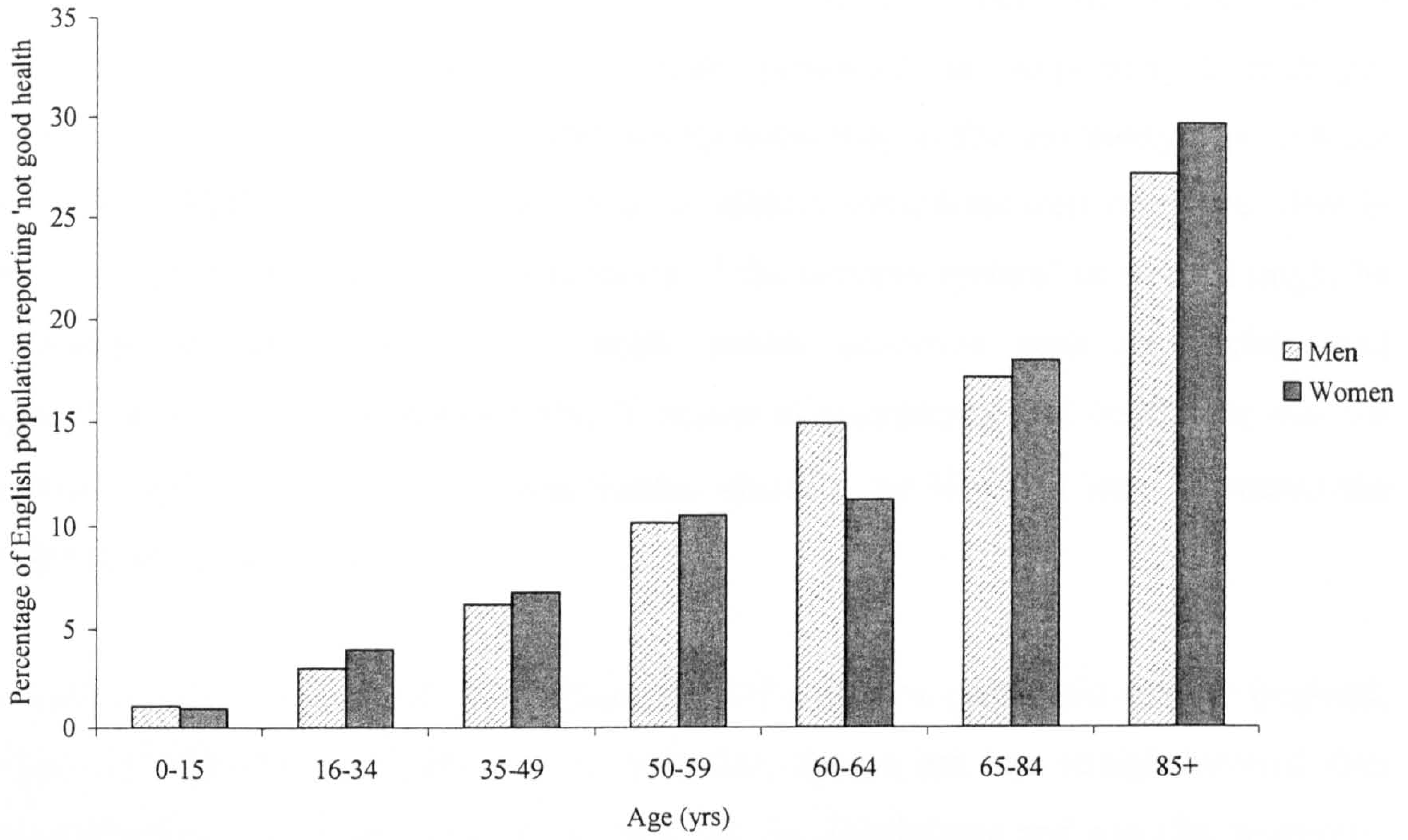

Figure 2.2 Proportion of men and women in England reporting 'not good health' in census 2001 (Casweb, 2004)

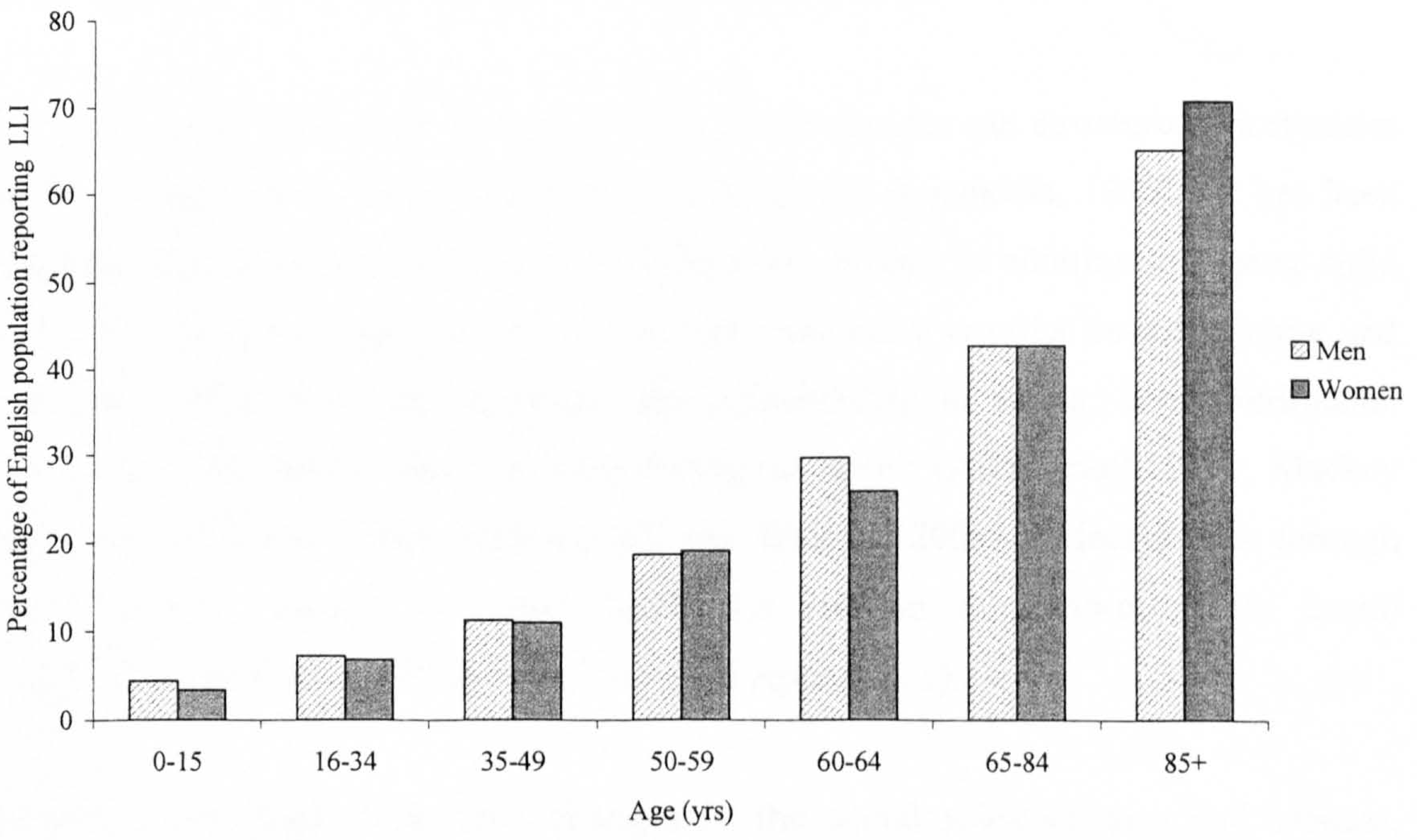

Figure 2.3 Proportion of men and women in England reporting a long-term limiting illness in census 2001 (Casweb, 2004)

Neither figure supports a marked female excess in morbidity until the age of eighty-five years, which is in keeping with the findings of Arber and Cooper (1999). To explore gender differences according to morbidity type, General Household Survey data were obtained (Office for National Statistics, 2005b; 2005f) as such information was not available through the census. The data presented in Appendix 2 highlight inconsistencies in the age-gender relationship according to the morbidity type (Office for National Statistics, 2005c). Heart and circulatory conditions were more prevalent in men. The higher prevalence of 'conditions of the nervous system' in women might be explicable through inclusion of mental health problems such as anxiety and psychological distress. A marked female excess of musculoskeletal conditions was not apparent until the age at which menopausal changes are likely to have increased the incidence of osteoporosis.

Therefore, a brief examination of recent official statistics confirmed that in England, differences between morbidity rates in men and women are less straightforward than previously thought, and generalisations that fail to consider age and specific morbidity, oversimplify this relationship.

2.2.3 Reasons for gender and age-related patterns in health

Few would argue that social factors associated with gender can structure opportunities and life chances likely to impact on health (Hunt and Annandale, 1999). It has been suggested that the traditional division of labour by gender, in addition to greater child caring and domestic responsibilities of women can create conflict between home and work life. This increases exposure and vulnerability to stress, with detrimental consequences for health, especially psychological health (Aneshensel, 1992; Mackey Jones and McKenna, 2002; McDonough and Walters, 2001). Mechanisms through which stress is thought to effect health (in relation to socio-economic health inequalities) are discussed in Section 2.4.3 (and Appendix 3).

In recent years there have been changes in the social roles of men and women, particularly in the workforce and childcare (Arber and Cooper, 1999; Bartley, Sacker, Firth et al., 1999; Hunt and Annandale, 1999; MacIntyre et al., 1996). The number of women in traditionally male occupations has increased, whilst a reducing number of women are becoming full-time child-carers. Despite these changes, British women tend to be concentrated in a small number of sectors and occupations such as clerical, service, sales and semi-professional occupations of nursing, teaching and social work

(Emslie et al., 1999). Women are still more likely to occupy low paying, less prestigious jobs, with little likelihood of advancement or autonomy (Bartley, Ferrie and Montgomery, 2006; Emslie et al., 1999), and on average earn approximately seventeen *per* cent less than men in equivalent full-time positions, and almost forty *per* cent less in part-time work (Office for National Statistics, 2005a). The reduction in the severity of the gender divide between the ages of fifteen and fifty-nine years (Figure 2.1) could be linked with a reduction in conflict between employment and family, which are more likely in younger adults.

However, compared with women, men are thought to be less knowledgeable about health (Beier and Ackerman, 2003), attach less importance to their own health (Aoun, Donovan, Johnson et al., 2003; Doyal, 2001), be less understanding of the importance of health behaviour (Aoun et al., 2003) and display higher levels of risk behaviour (Cook, 2001; Harvey, Erdos, Challinor et al., 2001). As discussed further in relation to preventive health care (Section 6.5.3), men's attitudes and behaviour in response to ill-health often reflects a socially conditioned masculine response; a response of 'soldiering on in silence' (Aoun et al., 2003: p.244) until symptoms become serious enough to prompt action (Doyal, 2001; Galdas, Cheater and Marshall, 2005). This represents a possible explanation for the apparently poorer health in men aged between sixty and sixty-five years (Figures 2.2-2.3); i.e. the age at which the likelihood of physical symptoms, especially CVD-related symptoms, are known to be more prevalent (refer to Appendix 2 for data). The likelihood is further increased by men allowing symptoms to develop through a reluctance to seek help (Section 6.3.1).

In summary, the evidence for a gender divide in health is not clear-cut or consistent. Societal changes in typically gendered roles in the home and the workforce has fuelled the ongoing debate surrounding the existence and causes of gender health inequalities. Inevitably, during the life course people undergo significant biological and social change (e.g. employment; retirement), both with implications for health. Therefore, age must always be taken into account.

2.3 Ethnicity and health

Ethnicity is considered a major confounding factor in health research (Hunt and Annandale, 1999). Indeed, differences in health between ethnic groups that are independent of other health determinants such as SEP, are well-documented (Goldman, 2001; Nazroo and Williams, 2006). Racial discrimination, operating partly through residential segregation, is thought to influence health through numerous possible pathways such as access to resources and opportunities, environmental conditions, and psychosocial factors (Goldman, 2001). Nevertheless, as described in Section 8.6, there is very little ethnic diversity in Somerset, the location of the present study (98.5% Caucasian). Consequently, ethnicity was not considered as a potential confounder and is, therefore, discussed no further. More detail regarding ethnic health inequalities, related issues and the debate surrounding possible causal mechanisms can be found elsewhere (Nazroo and Williams, 2006).

2.4 Socio-economic position and health

2.4.1 Socio-economic gradients in health: individuals and areas

The inverse association between SEP[4] and the risk of mortality and disease is one of the most pervasive and enduring observations in public health (Blane, 2001; Kaplan et al., 1996; Wagstaff, 2002). There is a wealth of evidence consistently demonstrating higher rates of premature mortality and various physical and psychological morbidities in the most socio-economically disadvantaged members of the population (Acheson, 1998; Deaton, 2002; Department of Health, 2003a; Kaplan and Keil, 1993; Marmot, Ryff, Bumpass et al., 1997; Marmot and Shipley, 1996; Murali and Oyebode, 2004). However, this does not manifest as a threshold effect such that only the most disadvantaged members of society are affected; rather associations are evident across the social strata, forming socio-economic or social *gradients* in health (Deaton, 2002; Goldman, 2001; Marmot and Wilkinson, 2006). Indeed, the importance of relative (not absolute) advantage is reflected by lower mortality in societies where inequalities are smaller, even when absolute advantage is taken into account (Kaplan and Keil, 1993;

[4] Issues relating to socio-economic measurement, terminology and definitions are covered in detail in Chapter 7. Throughout, socio-economic position (SEP) will be used as a generic term for all socio-economic measures.

Murali and Oyebode, 2004; Wilkinson, 1997). This becomes particularly pertinent when considering how relative position within society determined by material well-being, can impact on health (Section 2.4.3).

Gradients in health have been observed across the social strata regardless of the socio-economic indicator used, whether by income, social class, housing tenure, or education (Goldman, 2001; Shaw, Dorling and Davey Smith, 2006). There is further evidence that the socio-economic environment in which people live confers a health risk (Berkman and MacIntyre, 1997; Geronimus and Bound, 1998; Liberatos, Link and Kelsey, 1988; MacIntyre, Maciver and Sooman, 1993; Rosenbaum, Reynolds and Deluca, 2002) that is independent of individual SEP (Ecob and Jones, 1998; Pickett and Pearl, 2001; Shouls, Congdon and Curtis, 1996; Stafford and Marmot, 2003). In fact, many researchers claim that the socio-cultural context of individuals is the most important determinant. Therefore, where an individual lives is widely considered to be a powerful influence on health (Connelly, 2002; Marmot and Wilkinson, 2006; Pincus, Esther and DeWalt, 1998; Yen and Syme, 1999). This is confirmed to some extent by observations that people in low socio-economic groups who move from disadvantaged to middle-class environments experience improved health outcomes (MacIntyre et al., 1993) and considerable improvements in general efficacy (Rosenbaum et al., 2002). Therefore, to consider the determinants of health at an individual-level without considering environmental influences is likely to neglect the wider issues. The remainder of this section presents some of the evidence supporting the existence of the independent area-level socio-economic effect.

Several studies have specifically explored the relative importance of individual and area-level SEP in relation to health outcomes. Ecob et al (1998) analysed data on mortality and deprivation from the 1981 census employing a relatively sophisticated socio-economic area classification schema (Weber, 1978). Both individual socio-economic characteristics (housing tenure, car ownership, social class, economic activity) and area-type were associated with mortality; yet, when analysed simultaneously, significant differences in mortality between area types remained independent of individual socio-economic variables. Similar findings were reported in a slightly earlier study that analysed data from the 1991 census (Shouls et al., 1996). Data from almost three hundred districts (n=278) in Britain were used to explore the prevalence of LLI in relation to individual SEP and district-level deprivation.

Multilevel logistic regression analysis revealed that individual socio-economic characteristics explained some but not all of the variation in LLI between areas of different deprivation, indicating an independent area-level effect. The study was limited by the large scale of analysis; because data were aggregated to district level, with each district containing up to 200,000 residents, the resulting mean area deprivation values were somewhat crude, potentially masking more subtle variation and underestimating the effect. More recently, Stafford and Marmot (2003) analysed data from over ten thousand civil servants involved in the Whitehall II study. The authors explored data on three health outcomes (depression, general health, and waist-hip ratio) in relation to individuals' employment grade and ward-level deprivation measured using the Townsend score (Section 7.7.2). Researchers found that both individual SEP and area deprivation were independently associated with poor self-rated health, poor mental health and high waist-hip ratio.

There have been findings to the contrary. Like Ecob and Jones (1998), Sloggett and Joshi (1994) analysed 1981 census data on mortality and deprivation. An initial age-adjusted gradient of increasing mortality with increasing ward deprivation was dramatically reduced when individual and household information was taken into account, leading authors to conclude that the deprivation-mortality association was completely outweighed by personal factors. However, the method of area socio-economic classification was less sophisticated than that in the later study (Ecob and Jones, 1998) and therefore likely to have been less sensitive. Indeed, despite the limitation in many studies of relying on data aggregated for large areas, epidemiological evidence for the existence of an independent influence of the socio-economic context is persuasive. A recent review of epidemiological studies in this area found that in twenty-three out of twenty-five studies, the relationship between health and at least one indicator of area-level socio-economic context remained significant when indicators of individual SEP were taken into account (Pickett and Pearl, 2001). In reality, attempting to separate out the effects of an individual's socio-economic circumstances and their socio-economic environment is problematic. By controlling for individual factors, part of the contextual effect is likely to be removed (Pickett and Pearl, 2001), increasing the likelihood of underestimating the area-effect.

Geographical location is also known to be a potential health determinant; the North-South divide in England is a well-known example (Doran, Drever and Whitehead, 2004). For the present study, the potential geographical separation of participants was relatively small. However, Somerset is a largely rural county with several urban areas and therefore, possible urban-rural differences and their influence on the socio-economic area-health relationship are considered next.

2.4.2 Area of residence and health: socio-economic and urban-rural context

The majority of evidence indicates that the socio-economic environment in which people live has an impact on health. Moreover, there is increasing recognition of a range of rural health issues, such as the prevalence of mental health issues and suicide in farming populations, substance misuse within rural communities, physical and socio-cultural barriers to accessing health services, and poor health outcomes in rural dwellers for certain diseases such as cancer and asthma (Deaville, Earp, Jones et al., 2004). Clearly such issues are likely to be exacerbated by relative socio-economic disadvantage. However, public health policy and strategies designed to target the most disadvantaged areas (with the greatest health need) tend to be concentrated in areas defined by large administrative boundaries, that are considered insensitive to rural variation. This has been a source of criticism; of failing to reflect and consider problems in rural areas (refer to Section 7.8).

Deprivation indices are the standard tools used to rank areas to enable allocation of resources to the most deprived areas (Haynes and Gale, 2000; Martin, Brigham, Roderick et al., 2000). Deprivation indices discussed in more detail in Section 7.7, are composite scores calculated from several socio-economic indicators. They have associated advantages including good data availability on large samples, wide comparability and enable analyses at different scales. However, in addition to the relative insensitivity of using data aggregated to large areas, there are other associated pitfalls, which make it essential to maintain conceptual clarity about the meaning of the area-level data and avoid making claims at the individual-level (Section 7.4.1). Such problems are exacerbated in rural areas because of greater population heterogeneity (Section 7.8), which cannot be reflected by data aggregated over large areas (Farmer, Baird and Iversen, 2001; Haynes and Gale, 2000).

In recent years, concerns about using deprivation indices (often developed in urban areas) to measure area-level SEP in non-urban areas, has stimulated interest in health and the health-deprivation relationship in urban and rural areas (Deaville et al., 2004). Barnett et al (2001) conducted a study using 1991 census data from the Southwest of England. Four well-known deprivation indices described in Section 7.7.2 (Townsend score, Carstairs, Jarman score, and Department of Environment index) were used in areas of differing rurality to measure area-level SEP in relation to standardised premature LLI. Researchers found a U-shaped distribution of self-reported LLI in relation to rurality such that morbidity reduced from urban to less urban areas, rising again in the most remote rural areas. Further, rurality had an impact on the relationship between deprivation-morbidity. In urban areas, the correlation between deprivation and LLI was stronger (r=0.72) than in fringe (r=0.27) and rural areas (r=0.18). This could mean several things: either urban-rural location influences health perception; the effectiveness of deprivation indices varied between each type of area; or a combination of the two.

One year later, the same group of authors performed similar analyses using the same measures of deprivation and rurality in relation to LLI *and* mortality (Barnett, Roderick, Martin et al., 2002), thus using both subjective and objective measures of health (respectively). When the association between LLI and deprivation described previously (Barnett et al., 2001) was compared with the mortality-deprivation relationship, the latter was found to be weaker in all area-types, indicating that subjective health was more strongly associated with deprivation than actual health. Moreover, the correlation between the objective (mortality) and subjective (LLI) health outcomes became progressively weaker from urban areas (r=0.55), to fringe areas (r=0.21), and rural areas (r=016). This suggests that living in a rural area might affect individuals' perceptions of their personal health.

Another study similarly explored subjective (LLI) and objective (mortality rates) health outcomes in relation to deprivation, in four area types: large urban, small urban, outer rural, and inner rural (Haynes and Gale, 2000). Again, there was a U-shaped pattern for deprivation across area types of increasing rurality. For example, the mean Townsend scores in increasingly rural areas were 0.74 (large urban) -0.41 (small urban), -2.78 (inner rural) and -1.74 (outer rural), with lower Townsend scores indicating least deprivation in inner rural areas. Similar U-shaped patterns for both mortality and morbidity showed that residents of inner rural areas also experienced the best health. However, as reported by Barnett and colleagues (2002), differences in health between residents of different types of area were more marked for the subjective (LLI) health outcome, compared with objectively measured mortality rates. This confirms the possibility that rural residency can have a negative impact on health perception a pattern replicated in two studies conducted in the southwest of England (Jordan, Roderick, Martin et al., 2004a; Martin et al., 2000). Both reported U-shaped distributions of morbidity and mortality across areas of increasing rurality and in both cases, this pattern was more marked for self-reported morbidity than mortality (objective).

Summary

In summary, there is little doubt that a relationship exists between health and both individual and area-level SEP. Urban-rural area of residence exhibits a relationship with health similar to that for deprivation, which appears to be stronger for perceived rather than actual health outcomes. This might be a consequence of people living in more remote rural areas, who are more limited in terms of access to services and health care, feeling more limited by their health compared with their urban counterparts (Jordan et al., 2004a). Therefore, relative rurality-urbanicity should be considered when using area-level data in places like Somerset in which substantial urban-rural contrast exists.

Now that some of the evidence for socio-economic health inequalities and some implications of geographical location have been considered, the following section introduces some of the current theory relating to causes of these inequalities. The purpose of this is to provide context which will enable an informed discussion about how health promotion, and specifically physical activity promotion, are being used to help tackle health inequalities, and the appropriateness of this approach (refer to Section 4.2).

2.4.3 How does socio-economic position influence health?

In 1997, it was estimated that in Britain alone, approximately eight hundred empirical and conceptual papers had been written on the topic of health inequalities in the preceding two decades (MacIntyre, 1997). The abundance of studies describing health inequalities led many researchers to investigate the underlying mechanisms by which socio-economic disadvantage engenders ill-health (Blane, 2001; Carlisle, 2001; Deaton, 2002; Goldman, 2001; Gottfredson, 2004; MacIntyre, 1997; Wagstaff, 2002). The considerable volume of related literature prevents a comprehensive review of this area. Rather, some contemporary theories are introduced to demonstrate how current health and physical activity promotion policy and strategies sit in relation to mechanisms thought to be involved.

Before discussing some of the various mechanisms, the nature and direction of the health-SEP relationship is considered as it represents a further source of contention (Goldman, 2001; MacIntyre, 1997).

Nature and direction of the health-SEP relationship

Three broad explanations have been offered as being the primary type of mechanism: *causal* mechanisms, whereby SEP affects health status; *selection* pathways, through which a person's health status affects their social position (also known as reverse causation, health-related social mobility, social drift, and social selection); and *artefactual* mechanisms, which suggest that observed patterns merely reflect the method of measurement and associated error.

A general consensus is observed among researchers from different disciplines that disparities in health are driven by a complex set of causal processes, rather than through selection or artefact (Deaton, 2002; Goldman, 2001). However, the latter are not dismissed (Bartley et al., 2006; MacIntyre, 1997). In some cases, ill-health can lead to downward social mobility indicating reverse causation. For example, those who are ill during childhood may have subsequently lower educational and occupational achievements than peers from a similar social class in childhood. Yet such selection processes are thought to make only a minor contribution to the overall association between health and SEP (Goldman, 2001; MacIntyre, 1997). Similarly, the existence of artefactual mechanisms is not disputed. Variations in how researchers measure SEP and their choice of health outcome will inevitably influence the emergent patterns and are an important consideration when interpreting data. Yet the relation between SEP and health pervades across time, place, gender and age, and is observed using a broad set of health and SEP variables. Therefore, artefact is generally not considered as a fundamental mechanism through which health outcomes become socially patterned (Goldman, 2001; Gottfredson, 2004; MacIntyre, 1997). Consequently, the remainder of this discussion focuses on causal mechanisms.

Proposed causal mechanisms

There are many proposed causal factors, including access to medical care, access to information, poor environmental conditions, social support, perceived control, and health behaviour and lifestyle (Marmot and Wilkinson, 2006). How these interact with one another in defined causal mechanisms is a much debated area of ongoing research (Carlisle, 2001). The multitude of potentially influential factors pose a challenge to researchers who tend to be limited by a reliance on data from large-scale surveys (Forbes and Wainwright, 2001) that have not, and indeed would struggle to take into account all possible determinants. Indeed, those who study specific narrow ranges of factors inevitably conclude that causes are much wider and more complex (Goldman, 2001).

Three contemporary alternative causal mechanisms that have been considered in recent years are introduced. There is some inconsistency with authors' terminology and categorisation of various mechanisms. For the purposes of this discussion the models will be categorised and named as described by Carlisle (2001), although additional sources that described similar concepts are drawn upon (Goldman, 2001; MacIntyre, 1997; Marmot and Wilkinson, 2006). The three models discussed are the *poverty/deprivation* model, the *psychosocial stress* model, and the *individual deficit* model.

The *poverty/deprivation* model implicates inequitable material and social conditions, and variation in the distribution of resources as the main causal mechanism. Material differences are posited as the fundamental root cause through which societal divisions are created, that are in turn reflected by discrepancies in health. This type of model is often thought of as the major contributor to social patterning in health (Gottfredson, 2004; MacIntyre, 1997; Wilkinson, 1997), although critics view this explanation as incomplete. They argue that this does not explain the apparent importance of relative (not absolute) SEP in relation to health, observed even amongst those higher up the social strata. The *psychosocial stress* model recognises this phenomenon, focusing less on material advantage and more on relative positions within society's hierarchy and how the nature of social relations between groups can influence their health according to their respective social position (Brunner and Marmot, 2006; Carlisle, 2001; Goldman, 2001). Finally, some researchers point the finger at neither material wealth nor the social environment but at the individual, in what has been termed the *individual deficit* model. This suggests that both the deprivation and psychosocial models are based on misplaced belief that failure to achieve equality is somehow unjust and preventable. The individual deficit model proposes that inequalities in health are an unavoidable consequence of differences between individuals; those of higher intelligence are thought more predisposed to achieve highly in education, be successful in the workplace, earn higher incomes and therefore secure better access to resources, in addition to being more able to manage their own health (Gottfredson, 2004).

Nevertheless, boundaries between different types of explanation tend to be fluid, not clear-cut (Carlisle, 2001). It is very difficult to separate out these different models as there is clearly scope for interaction and overlap. This will be discussed further in this section, but first, a relatively recent advance in understanding of the pathways linking social environment and health is outlined briefly.

Biological consequences of socio-economic disadvantage: the stress pathway

One would expect a shift worker in a routine occupation, living in rented local authority accommodation within a deprived area to experience poorer health than a well-paid, professional, living in middle-class suburbia. But *how* environmental factors (either material or psychosocial) can engender health-damaging physiological change is less well studied. Only in the past decade has this been covered in any detail due to the incorporation of physiological measures in large-scale population-based surveys (Brunner and Marmot, 2006; Goldman, 2001).

The key biological process implicated in the health-environment connection is the stress or 'fight-or-flight' response. In the face of an environmental stressor, such as a physical threat, an array of metabolic and physiological changes take place to allow immediate physical exertion ('fight-or-flight'). The physiological consequences include increases in heart rate, blood pressure and blood concentrations of glucose and fatty acids. This response has evolved because it confers the advantage of enabling short bursts of physical exertion when required. Ideally, changes should return to baseline rapidly after the stressful event. Repeated frequent activation of the fight-or-flight response from excessive environmental challenges can act to blunt the response, which slows the return to baseline conditions, eventually leading to elevated baseline levels (Brunner and Marmot, 2006; Goldman, 2001). Clearly, elevated resting heart rate, blood pressure and blood glucose and fatty acid concentrations (amongst other changes) increase the risk of numerous chronic lifestyle diseases including hypertension, Type 2 diabetes and CHD.

Researchers have now linked chronic stress associated with daily life for people lower down the social strata as a cause of ill-health through over-stimulation of the stress response (Aneshensel, 1992; Bosma, Marmot, Hemingway et al., 1997). Even for those with material resources adequate for a healthy existence, there are many possible sources of such stress: financial strain, a lack of social support, monotonous work with poor pay and lower control at work (Brunner and Marmot, 2006); i.e. poor rewards for the demands of daily life (Aneshensel, 1992; Marmot, Siegrist and Tores, 2006). Indeed, adverse changes in the psychosocial work environment, such as reductions in decision latitude, increased demand, and reduced social support have been associated with long spells of sickness absence (Head, Kivimaki, Martikainen et al., 2006). A more detailed discussion of this and supporting epidemiological evidence is provided in Appendix 3.

In summary, the stress response pathway is a likely candidate through which the environment impacts on health. This knowledge has provided insight regarding causal mechanisms and ultimately, has resulted in psychosocial explanations coming to prominence in this area. Nevertheless, as will become clear in the following subsection, there is substantial overlap and interaction between the three aforementioned models (deprivation, psychosocial and individual), all of which contribute towards the health-SEP relationship.

Which causal mechanism?

In relation to the environment and health, the majority of evidence points towards material conditions as the underlying root cause of socio-economic health inequalities (MacIntyre, 1997; Wilkinson, 1997). Material differences may have preceded and, indeed, created societal divisions that have determined the nature of social relations between groups at different positions in society's hierarchy. However, it is increasingly thought that the psychosocial consequences of these social relations constitute a fundamental part of the mechanism through which material differences create health divides (Marmot and Wilkinson, 2006). The nature of relations between people from different socio-economic groups influences how individuals perceive themselves relative to others, how they interact with others in different socio-economic groups, and their social opportunities. All of these psychosocial factors have consequences for health (Goldman, 2001; Wilkinson, 2006).

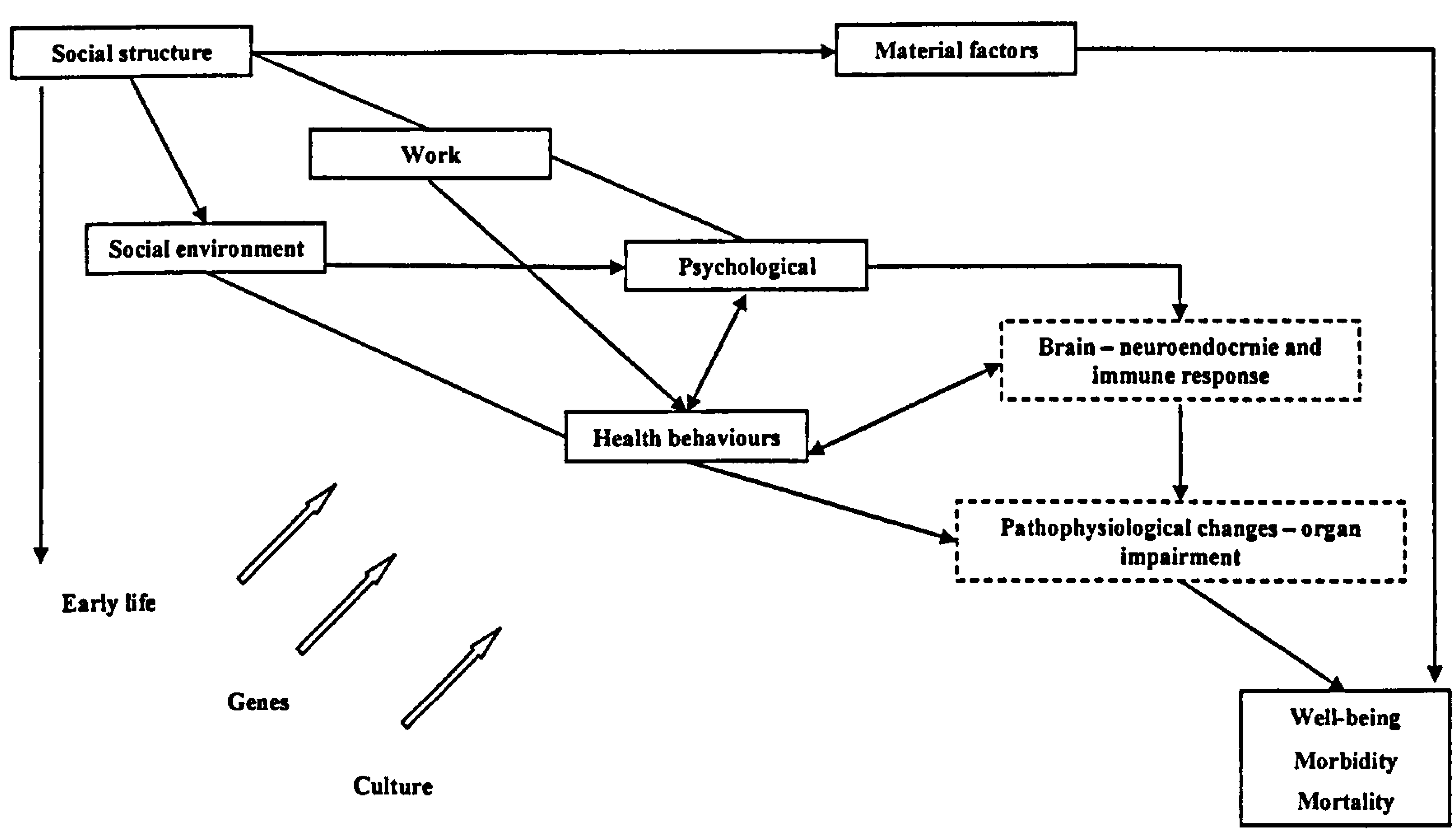

Figure 2.4 Diagrammatic representation of the social determinants of health (Taken from Brunner and Marmot, 2006: p.9)

This type of mechanism is especially plausible in modern industrialised countries. In Britain, although some will suffer poor health as a *direct* consequence of material resources that are inadequate for a healthy existence, this is not the case for the majority; *relative* material well-being and social position, rather than *absolute* living standards, are more potent for health (Deaton, 2002; Kaplan and Keil, 1993; Murali and Oyebode, 2004; Wilkinson, 1997).

As indicated in Figure 2.4, a disadvantaged environment might refer to work, home, or the social environment of a person's neighbourhood and so on. The diagram illustrates that health behaviour is considered an important component in the link between disadvantage and ill-health, regardless of which causal mechanism is thought most important (deprivation, psychosocial or individual). This theme is central to the present thesis which is based around a PARS. As part of an overall public health strategy such schemes hope to improve public health, a priority of which is reducing health inequalities. The following section therefore, considers social patterning of health behaviours in relation to health inequalities.

Before continuing, it is first important to highlight a weakness of the diagram, which relates to the influence of genes. Figure 2.4 illustrates proposed pathways and inter-relationships through which various causal mechanisms could operate, and act via the stress response to detrimental physiological ends. This diagram offers a somewhat limited interpretation of the interaction between genes and the environment. There is increasing recognition genes not only have a role in pre-determining behaviour and health (Bouchard and Rankinen, 2006) but that they absorb formative experiences and can react to social cues. It is increasingly thought that genes cannot be understood simply as an individual's blueprint after which the environmental influences take over (as the diagram would seem to suggest). Rather they are active during life. They respond to the environment and as such can be thought of as both a cause and consequence of behaviour and by association, health (Ridley, 2004). The present research is concerned with socio-environmental influences on people's behaviour in relation to a PARS. It is beyond the scope of such a thesis to try to consider (or quantify) the relative contributions of genetic and environmental influences and how
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unnecessary but the importance of genes and their interactive relationship with individuals' experiences and behaviour should be recognised.

2.5 Health behaviours and socio-economic health inequalities

As detailed previously (Section 2.2.3) for age-gender differences in health-awareness and knowledge, social environmental influences can be linked to health behaviour (discussed further in Sections 3.3.4-5 and 3.4.3 in relation to physical activity).

Historically, inequalities in health primarily manifested as differences in communicable diseases and infections that occurred most frequently in lower socio-economic groups as a result of such factors as inadequate housing, overcrowding, and exposure to cold. As noted in the introduction (Section 1.1), in modern Britain (and other developed countries), this is thought to account for a far smaller proportion of the variation in health because minimal living conditions required for a life free from disease are accessible to most (Brunner and Marmot, 2006; Wilkinson, 2006). As a result, people are living longer but the evolution of Western lifestyles (e.g. wide availability of energy-rich foods; reduced need for activity) means that lifestyle-related diseases now pose the greatest threat to public health (Booth et al., 2000a; Davey, 2003; Prentice and Jebb, 1995).

As Figure 2.5 illustrates, social patterning has been observed in smoking (Acheson, 1998; Department of Health, 1998; 2003b) and dietary behaviour (Acheson, 1998; Department of Health, 2003b; 2005a; Shelton, 2005); although the excessive alcohol consumption appears to be more prevalent in higher socio-economic groups (Department of Health, 2003b; Wanless, 2003). The nature of the relationship between physical activity and SEP has been questioned (Macintyre and Mutrie, 2004). However, epidemiological evidence reviewed in detail in Section 3.4.2 consistently demonstrates a positive association when socio-measurement issues are considered (Gidlow et al., in press).

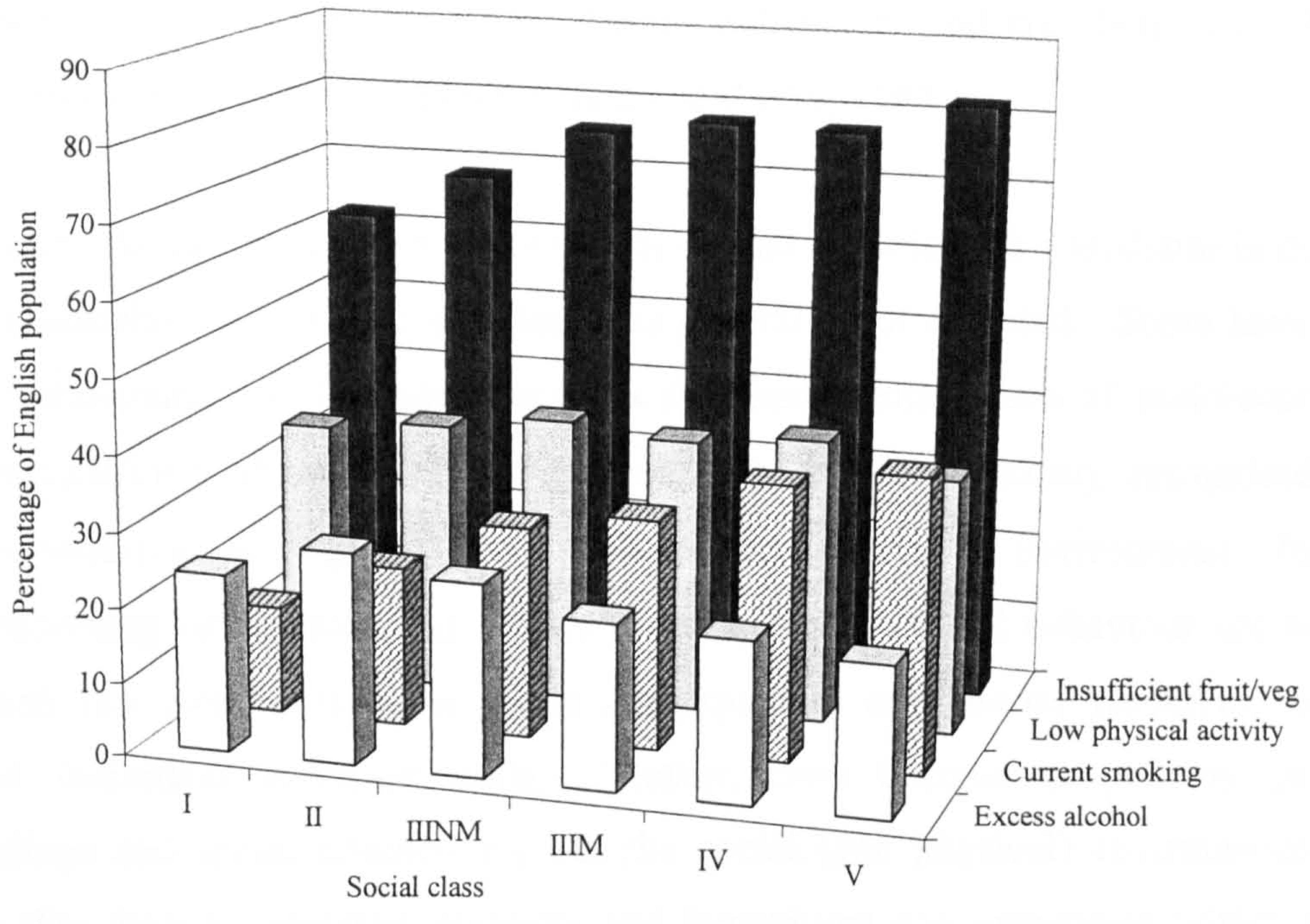

Figure 2.5 Variation in lifestyle behaviour by social class (data taken from Wanless, 2003: p.30-31)

Demonstrating gradients in behaviours across the socio-economic spectrum that mirror those for health, is made difficult by variation and inconsistency in socio-economic measurement (Section 7.1-7.4). There are additional problems in accurately quantifying health behaviours, especially dietary behaviour and physical activity. As complex habitual behaviours they are prone to recall error in retrospective research, are likely to be influenced if monitored prospectively (Hawthorne effect), and are prone to social desirability bias (Bingham, 1991; Shephard, 2002; Wareham and Rennie, 1998). Therefore, there will always be debate regarding whether effects are genuine or artefactual. However, the direction of relationships is consistent and it is possible that difficulties in measurement lead to underestimation of socio-economic effects.

In relation to SEP, those in the lower socio-economic groups are thought to place less value on their health and health behaviour (Clark, 1995; Clark, Patrick, Grembowski et al., 1995; Stronks, Van de Mheen and Looman, 1997; Wardle and Steptoe, 2003), perceive a lower level of control over their health and health behaviour (Lantz, House, Lepowski et al., 1998; Stronks et al., 1997; Wardle and Steptoe, 2003), and exhibit more fatalistic attitudes (Lynch et al., 1997; Stronks et al., 1997; Wardle, McCaffery, Nadel et al., 2004). Concomitantly, higher SEP is associated with a more health-promoting attitude towards behaviour, health behaviours and risk behaviour (Cook, 2001; Lynch et al., 1997; Stronegger, Freidl and Rasky, 1997).

In summary, the existence of a role for health-related behaviour as a mediator in the link between material circumstance and health is generally not disputed. Some have even posited behavioural and lifestyle factors as *the* fundamental cause of socio-economic health inequalities (Pitts, 1996). However, it is more commonly recognised that people's behaviour is shaped by their socio-cultural context or environment. Indeed, social patterning of attitudes and beliefs towards health related behaviour are neither considered (by most) simply as direct consequences of material resources, nor as inherited individual character traits. Rather, they become shaped by peoples surroundings and social interactions; i.e. the social (and physical) environment, and through this, health damaging outlooks and behaviours can perpetuate within lower socio-economic groups (Section 3.4.3 discussion relating to physical activity). Therefore, health-related behaviour cannot be understood without considering the underlying socio-economic determinants (Connelly, 2002; Lynch et al., 1997; Stronegger et al., 1997).

2.6 Policy response to socio-economic health inequalities in Britain

2.6.1 Recent policies, strategies and the role for health behaviours

In Britain, ever since the second half of the 19th century it has been recognised that the poorest sections of the community are most likely to suffer disease and early death (MacIntyre, 1997). In 1980 the Government commissioned *Black Report* (Department of Health and Social Security, 1980) observed a widening of the health gap. As a result, health inequalities rose to the top of the public health agenda, prompting far greater input to and output from research over the following twenty years (MacIntyre, 1997). Despite this, socio-economic health inequalities have continued to increase in Britain at a greater rate than in most other industrialised and developing countries (Carlisle, 2001), for which the Thatcher Government (1979-1990) has been criticised (MacIntyre, 1997; Shaw, Dorling, Mitchell et al., 2005).

Since taking office in 1997, the Labour Government has placed socio-economic health inequalities at the heart of public health policy. The *Independent Inquiry into Inequalities in Health* (Department of Health, 1999b) clearly set out the rationale for making them a priority and made recommendations for action. These included the development of public health policy to reduce inequalities and to evaluate all policies likely to have a direct or indirect impact on health in terms of their impact on health inequalities. *Saving Lives: Our Healthier Nation* (Department of Health, 2000a) was the first White Paper of the Labour Government to outline this renewed intent. Since then, the importance of targeting more disadvantaged members of society has been a key objective in several National Service Framework documents aimed at reducing coronary heart disease (Department of Health, 2000a), diabetes (Department of Health, 2001a), mental health problems (Department of Health, 1999a) and problems faced by older people (Department of Health, 2001c).

In recognition of social patterning of the major lifestyle behaviours (Figure 2.5), more recent public health strategy documents have maintained the focus on health inequalities by setting out plans to target the health behaviour of the more disadvantaged members of the population (DCMS, 2002; Department of Health, 1998; 2004b; 2005a). In addition to longstanding objectives of achieving equity in treatment of disease (through the NHS), the focus on lifestyle behaviours represents an attempt by the Government to shift responsibility for health back to the individual (and away from the state) and move towards disease prevention rather than treatment (Garman, 2005; Guthrie, 2001; Shaw et al., 2005). Section 4.2 discusses recent public health policy in more detail in relation to physical activity promotion.

2.6.2 The advantages of targeting health behaviour

Given that the most disadvantaged members of society tend to lead less healthy lifestyles (Acheson, 1998; Department of Health, 2003b), it is not surprising that targeted strategies to change health-related behaviours are seen as a potentially cost-effective approach that tackles the immediate causes of lifestyle disease, rather than the symptoms (i.e. prevention not treatment). The Government has, however, been criticised. The health promotion approach has been described as 'evil and redundant'; a strategy intended to divert attention away from the politicians and back to those living in poverty who are in no position to tackle the circumstances that are damaging their health (Guthrie, 2001). This relates back to the notion that behaviour is more a product of the social and economic environment than the result of individuals' free and deliberate choice (Connelly, 2002; Lynch et al., 1997; Yen and Syme, 1999). Indeed, it is widely accepted that a socio-economic disadvantaged environment is likely to make people more resistant to change and present greater barriers to positive behaviour change (Chinn, White, Harland et al., 1999; Coggins, Swanston and Crombie, 1999; Jarvis and Wardle, 2006); yet there are several reasons which make a reasonable case for using health promotion in this context.

Firstly, positive lifestyle behaviours confer numerous benefits for both physical and mental health (Section 1.1) as well as potential social benefits (Collins, 2004). As detailed previously, there is evidence that lifestyle behaviours can be influenced by the socio-economic environment and that context can be a more potent influence on health and arguably by association, health-related attitude/behaviour, than individual SEP (MacIntyre et al., 1993; Rosenbaum et al., 2002). Social modelling is an important way in which health-damaging behaviours become entrenched in lower socio-economic groups (Sallis and Owen, 1999). For example, the greater prevalence of smoking in deprived areas means that children are more exposed to smoking as they grow up; it becomes modelled as a behavioural norm as well as being readily available (Jarvis and Wardle, 2006). The end result is continuity of a health-damaging behaviour over subsequent generations. Physical and social environmental influences associated with health-related behaviour are considered for physical activity in Chapter 3 (3.3.4-5 and 3.4.3). Therefore, attempting to improve health behaviour of those living in relative socio-economic disadvantage (who are more likely to be sedentary, smoke, eat unhealthy diets, and experience poor health), could help to break the perpetuation of unhealthy behaviour by changing the models of behavioural norms.

Secondly, targeting preventive health behaviour strategies in lower socio-economic groups could help to reduce the strain on the health service. Although lower socio-economic groups are more likely to seek help in primary care (Section 6.4.1), they are generally less likely to seek help for preventive reasons (Section 6.5.4). Because those lower down the social strata tend to experience poorer health, and are often more reluctant to manage their own health or take preventive action, appropriate and effective targeting of health promotion strategies could potentially reduce the disproportionate burden that this population group place on the NHS.

Thirdly, health promotion to effect behaviour change is no small task. It is, however, a less daunting challenge than attempting to tackle the most upstream factors behind health inequalities, i.e. a redistribution of wealth to reduce underlying material differences and subsequent social structures thought to create health-promoting or damaging environments. Nevertheless, these two approaches do not have to be mutually exclusive. Although underlying material differences may persist, attempting to improve public health behaviour remains a worthwhile goal of great potential, and one that fits within an overall strategy (Coggins et al., 1999).

2.7 Summary

Different population groups experience differential health. Out of the types of health inequality discussed in this chapter (by gender, age, ethnicity and SEP), the evidence for socio-economic inequalities in health is most consistent and persuasive, and has certainly received the most attention. In Britain, gender health differences depend on the morbidity in question and age. As mentioned previously, ethnicity was not considered an important factor in the context of the present study because of ethnic homogeneity within the study area. Biological changes associated with the ageing process make age-related health differences less preventable (although reducible) than the marked differences in health by SEP. It is this latter phenomenon which has become a focal point of public health policy.

Scathing criticisms directed towards the health promotion approach are on one level understandable; if this were the only effort made to address health inequalities, it may well prove inadequate. However, attempting to positively influence the attitudes towards, and nature of, lifestyle behaviours in more disadvantaged population groups still represents a positive step. Disadvantaged members of the population are likely to face greater barriers to positive behaviour change. However, strategies attempting to break the continuity of health damaging behaviour in this section of the population are not futile but should form part of an overall programme that also attempts to tackle the wider causes such as the environments that place constraints on behaviour. Finally, behaviour has the advantage of being possibly the most malleable form of protection from ill-health. It can respond to norms of a person's current social context while physiological status accumulates past events, habits and exposures (Blane, 2006). Therefore, providing the opportunity for those living in more deprived areas to make positive changes to their health behaviour could help to counteract previous exposures and break the cultural and social norms that have shaped current behaviour.

*

Chapter 3

In keeping with the focus of the present study, the following chapter is concerned with physical activity. As a result of inequalities in health and the numerous physical and mental health benefits associated with physical activity there has been increasing interest in how it is socially patterned and the potential relationship with health inequalities. Chapter 3 describes some variation in physical activity levels across different socio-demographic groups and by area of residence, with a particular focus on socio-economic variation which has been the focus of so much attention.

Chapter 3: Epidemiology of physical activity

3.1 Introduction

Evidence from reviews of physical activity correlates have consistently found that gender, age, ethnicity, and various measures of SEP represent the strongest socio-demographic correlates of physical activity (Bauman, Sallis, Dzewaltowski et al., 2002; King, Blair, Bild et al., 1992; Sallis and Owen, 1999; Stephens and Caspersen, 1994; Trost, Owen, Bauman et al., 2002). In order to establish whether or not PARS are available and successful for members of the population who are most in need, it is necessary to consider not only health, but the socio-demographic differences in physical activity levels and possible reasons for discrepancies.

This chapter, therefore, describes how and why physical activity behaviour varies according to gender (Section 3.3), age (Section 3.3), SEP (Section 3.4) and urban-rural location (Section 3.5). The latter was considered an important inclusion given the setting of the present study (Section 8.5). Despite consistent ethnic differences such as lower activity levels in non-white members of developed societies (Bauman et al., 2002; King et al., 1992; Sallis and Owen, 1999; Stephens and Caspersen, 1994), the lack of ethnic diversity in Somerset (Section 8.6), meant that it was not necessary to review this evidence.

Much of this chapter is devoted to a systematic review[5] of evidence for socio-economic differences in physical activity levels (Gidlow et al., in press). The primary reason for conducting a more detailed review for SEP (compared with other characteristics) is that, although recognised as an important correlate of physical activity, SEP measurement is a controversial and much debated area of research (refer to Section 7.1), which can be approached in numerous different ways (Sections 7.4-7.7). As a result of this and the difficulty of accurately quantifying physical activity (described in Section 3.2) it was necessary to give careful consideration to this relationship in the context of study methods and quality, something that has been lacking in physical activity research. Furthermore, gender inequalities in health are relatively small and vary with age (Section 2.2.2), whereas biological changes make age-related declines in health, to some

[5] The information that formed the basis for Section 3.6 is a summary of a systematic review accepted for publication in October 2005 (Gidlow et al., in press).(Gidlow et al., in press)

extent, less preventable (Section 2.2.1). Socio-economic health inequalities on the other hand are marked, consistent and considered an unnecessary product of circumstances. As a result, health and physical activity promotion strategies have often been targeted at lower socio-economic groups (Section 4.2). Therefore, reducing socio-economic differences in physical activity represents a potential means of tackling health inequalities. However, evidence for the SEP-physical activity relationship has so far not been considered with adequate rigour; nor has it been used to critique how well current physical activity interventions can realistically reach and be successful for disadvantaged groups, an omission that the present study aims to address.

In the context of the present research, in order to determine whether the PARS model is likely to be more or less appropriate for different sections of the sedentary population, it is useful to consider some of the factors posited as explanations for socio-demographic patterning in physical activity. Therefore, following descriptions of differences in physical activity between socio-demographic population groups, existing literature is used to outline potential social and physical environmental contributors to the observed patterns. As described in Section 1.3, this essentially takes a social ecological perspective (Sallis and Owen, 1999). By emphasising the wider determinants of health behaviour this avoids focusing too heavily on the individualistic psychological line of inquiry that has continued 'without really "striking gold" in terms of identifying the solve-all correlate(s) that could really improve public health interventions' (Bauman, 2005: p.535). Therefore, although adverse environmental influences do not make health promoting behaviour impossible, individual's associated beliefs, attitudes and subsequent physical activity behaviour are shaped by their social and physical environment. It is this premise upon which socio-demographic patterning of physical [illegible]
3).

Initially, issues and problems relating to the measurement of physical activity are introduced to help inform judgements about the quality of evidence discussed in this chapter and appropriate interpretation of study findings.

3.2 Measurement of physical activity

Physical activity is characterised by frequency, intensity, duration and mode (Montoye, 2000; Shephard, 2002) and is therefore difficult to measure. Traditionally, epidemiologists have emphasised feasibility over validity, relying on statistical power from large sample sizes (Shephard, 2002; Wareham and Rennie, 1998). Most commonly physical activity is self-reported through retrospective questionnaires, favoured for their relatively low cost and ease of administration. However, when compared with physical activity measured objectively using motion sensors, questionnaires were found to explain between twenty-two and seventy *per* cent of the variance (Shephard, 2002).

There are three main threats to the validity and reliability of self-reports. Firstly, there is the potential for error in the recall of previous activity including recall bias (recalling more structured high-intensity activities more easily), overestimation of activity by less fit individuals and social desirability bias (Cooper, 2003; Duncan, Sydeman, Perri et al., 2001; Wareham and Rennie, 1998). Secondly, there is inconsistency in whether researchers measure habitual or total physical activity, leisure-time (LTPA), work-related (WRPA), or household physical activity. Leisure-time and higher intensity activities are often chosen because they are easier to recall and quantify than lower intensity habitual activities, such as walking or household chores (Cooper, 2003; Duncan et al., 2001). Thirdly, different questionnaires capture physical activity in different ways. Some simply measure frequency of episodes of particular activities; others use activity duration and frequency; or sometimes a measure of intensity is included or assumed depending on activity type (Duncan et al., 2001; Wareham and Rennie, 1998).

In recent years, recognition of the need for more precise physical activity measurement has increasingly turned attention towards objective measures, using devices such as heart rate monitors, pedometers, and accelerometers, which can be worn for several days or weeks to capture habitual physical activity (Bassett Jr, 2000; Wareham and Rennie, 1998). They circumvent some of the problems associated with self-reports and enable more accurate measurement of low intensity activities that are more difficult to recall and quantify but account for most daily activity (Cooper, 2003). However, in addition to several weaknesses that are common to all types of device (e.g. the requirement that participants wear monitors for several days or weeks; behaviour modification whilst wearing monitors; and the cost of devices), each has its own limitations.[6]

In practice such objective methods are rarely employed in favour of retrospective self-report that can be administered to a large number of people, quickly, and at low-cost. With such methodological issues in mind, the remainder of the chapter discusses, in turn, the relationships between physical activity and the different socio-demographic correlates and considers possible explanations for these patterns.

3.3 Physical activity, age and gender

3.3.1 Physical activity and gender

Historically, there have been deep-rooted gender differences in physical activity with a relatively consistent division of labour between men (the "hunters") and women (the "gatherers"). With the advent of agriculture activity levels rose but male-female differences were again consistent, determined by the respective roles within agriculture. Industrialisation, however, resulted in a dramatic fall in activity levels (Panter-Brick, 2003). Moreover, in modern industrialised societies, developments in transport, electronic communication, energy-saving devices and so on (Kerr et al., 2003; Prentice and Jebb, 1995; Schmid et al., 1995; Sparling et al., 2000) have meant a reduction in the prevalence of physically demanding occupations traditionally performed by men (Kerr et al., 2003; Prentice and Jebb, 1995; Schmid et al., 1995; Sparling et al., 2000). Consequently, relative physical activity levels in men and women have become less dependent on occupation and for the majority of people in Britain, activity levels outside of the workplace are likely to act as the more important discriminator between individual's physical activity levels.

[6] A review of objective physical activity measurement can be found in Cooper (2003)

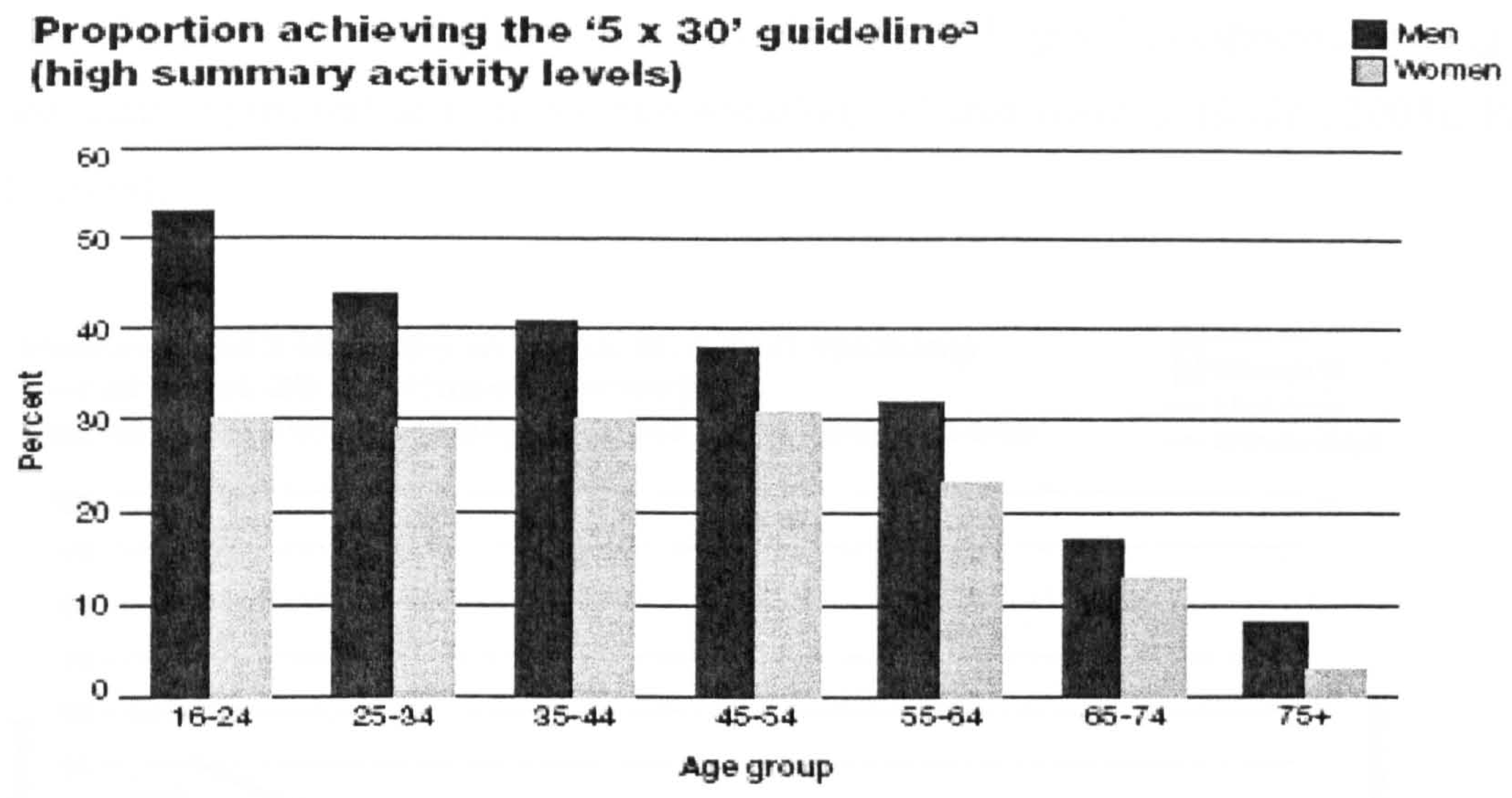

Figure 3.1 Proportion of men and women meeting the current physical activity guidelines (Department of Health, 2003b: p.114)

Both recent literature and data from national surveys indicate that British men are generally more active than women (Allied Dunbar et al, 1992; Department of Health, 2000b; 2003b; Wardle and Steptoe, 2003). Yet on closer examination the nature of this difference depends on the type of physical activity in question as illustrated by Figures 3.1-3.4 taken from the Health Survey of England (HSE: Department of Health, 2003b).

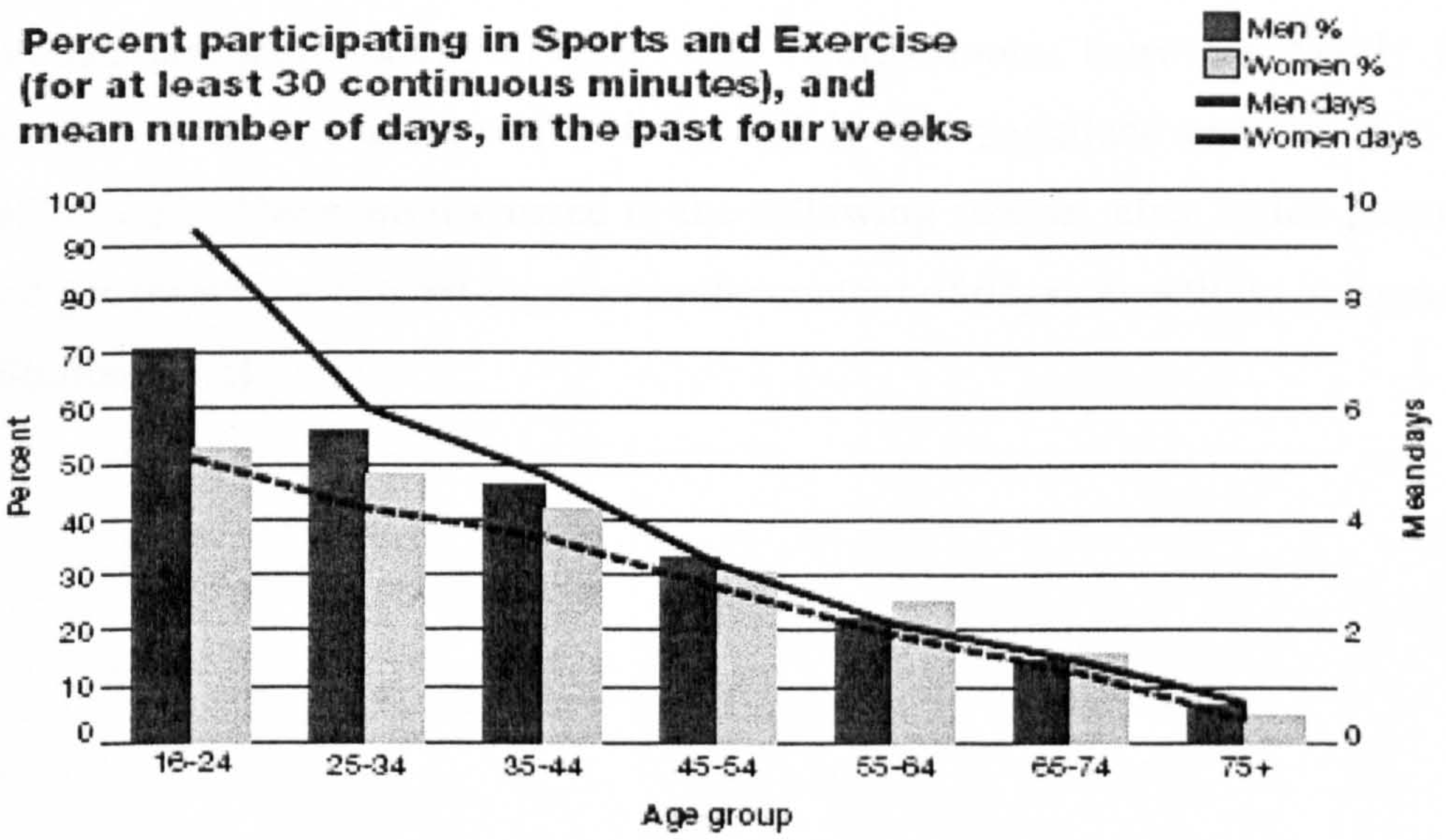

Figure 3.2 Proportion of men and women participating in sport and exercise (Department of Health, 2003b: p.112)

Figure 3.1 shows that a higher proportion of men of all ages (but especially young men) meet current physical activity recommendations[7] (Department of Health, 2004a; Pate et al., 1995).

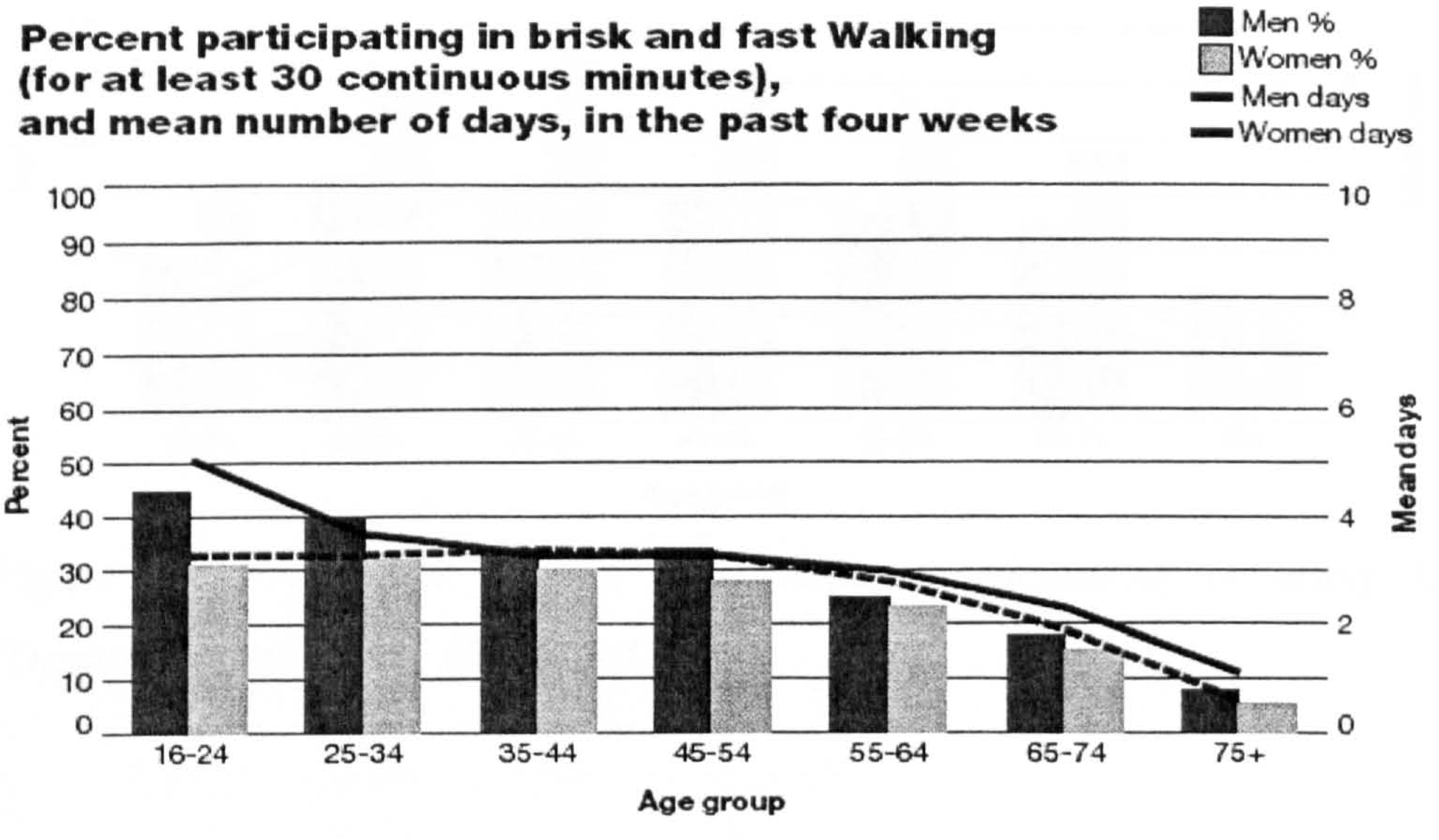

Figure 3.3 Proportion of men and women participating in brisk and fast walking (Department of Health, 2003b:p.113)

Yet although a higher proportion of men in most age groups appear to undertake sport or exercise (Figure 3.2) and brisk-fast walking (Figure 3.3), far more women are active through domestic activity (Figure 3.4). Furthermore, there are clearly age-related changes in the prevalence of activity, and in the magnitude and direction of gender differences. These are discussed in the following section, after which patterns for age and gender are considered together in the context of physical activity outcome measures (Section 3.3.3).

[7] ≥30 minutes of moderate intensity activity on five or more days of the week

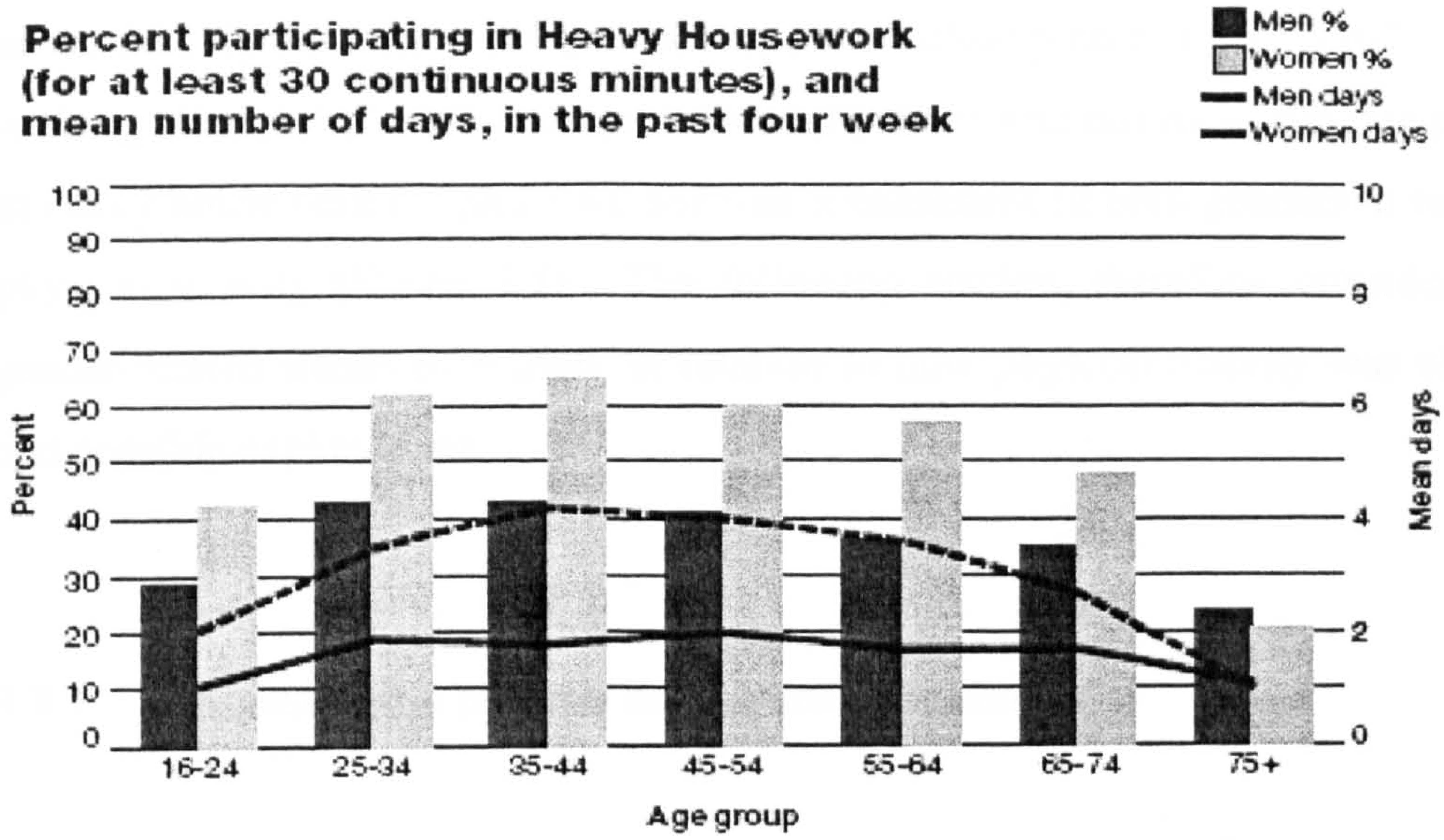

Figure 3.4 Proportion of men and women participating in heavy housework (Department of Health, 2003b: p.113)

3.3.2 Physical activity and age

Cross-sectional surveys of physical activity consistently report a decline in adult[8] physical activity with age (King, Rejeski and Buchner, 1998; Sallis and Owen, 1999; Stephens and Caspersen, 1994; Trost et al., 2002), which continues into old age (Booth, Owen, Bauman et al., 2000b; Kaplan, Newsom, McFarland et al., 2001; Lim and Taylor, 2005; Taylor et al., 2004). Indeed, an earlier review of physical activity correlates in older adults found that approximately fifty *per* cent of those aged over sixty-five who were physically inactive, had no intention of starting an exercise programme (Dishman, 1994). Therefore, promoting physical activity in sedentary older adults is recognised as a considerable challenge (Michaels Miller and Iris, 2002; Tai, Gould and Iliffe, 1997).

Data from the HSE confirm the steady reduction with age, in the prevalence of sufficiently active adults, which becomes steeper in late middle- to early old-age and continues in the oldest age groups (Figure 3.1). Again, age-related changes were dependent on the type of activity (Figures 3.2-3.4). A marked decline in the prevalence of men and women performing sports or exercise each week is apparent across the age

[8] Children and adolescents were not considered because physical activity through schools complicates comparisons with adult populations (Sallis, Zakarin, Hovell et al., 1996) and Physical Activity Referral Schemes (PARS) tend to be restricted to adult populations.

spectrum (Figure 3.2), and a similar but less marked pattern is observed for brisk-fast walking (Figure 3.3). However, this overall pattern was not replicated for participation in heavy housework (Figure 3.4), nor was it consistent in both genders in terms of total physical activity (Figure 3.1). The following section, therefore, considers age- and gender-related trends in activity in relation to how physical activity was characterised and possible explanations.

3.3.3 Age, gender and physical activity measurement

Epidemiological evidence has shown that in adults, gender and age are the two most consistent demographic correlates of physical activity (Sallis and Owen, 1999; Stephens and Caspersen, 1994; Trost et al., 2002). However, the definition of physical activity can obscure the relationship (Stephens and Caspersen, 1994).

Firstly, the inclusion of intensity measures tends to increase the likelihood of gender and age differences. Within the same population, definitions of 'moderate intensity' physical activity based on frequency and duration tend to produce small gender differences, whereas those incorporating intensity tend to produce larger differences (Stephens and Caspersen, 1994). Further, time spent in lower intensity activities tends to increase with age and women are usually found to do more than men (Dishman and Sallis, 1994; Stephens and Caspersen, 1994). The opposite is usually found for vigorous intensity activity (Grzywacz and Marks, 2001; King et al., 1998; Salmon, Owen, Bauman et al., 2000; Stephens and Caspersen, 1994; Wardle and Steptoe, 2003). The questions used in the HSE 2003 asked participants about the frequency of participation in different types of activity that lasted thirty minutes or more. Although only questions relating to sport/exercise and walking enquired about intensity, assumptions were made on the basis of the activity type and respondents' descriptions, in order to calculate overall physical activity levels. As only data relating to the prevalence of moderate-vigorous intensity activity were reported (as shown in Figures 3.2-3.4) the likelihood of age and gender differences would have been increased.

Secondly, gender and age patterns vary according to the nature of the activity (e.g. sports; household activity). In terms of meeting current physical activity guidelines (which reflects overall activity) the age-related decline in men was evident across the age spectrum (Figure 3.1), whereas the proportion of adult women meeting guidelines remained relatively constant at (approx. 30%), only declining in those aged fifty-five years and over. This substantial difference in overall activity levels between *young* men and women that reduced with age, but becoming more marked again in later old age (≥75 years) appeared to reflect male excess in reporting of sport, exercise and walking (Figure 3.2 and 3.3). Patterns for heavy housework were entirely different. At almost all ages the prevalence of women performing household physical activity was markedly higher, especially between the ages of twenty-five and sixty-five years.

Furthermore, the lack of attention devoted to measuring occupational activity reflects the perception that it makes a relatively small contribution to overall physical activity levels. The survey included a single question asking respondents about physical activity levels at work (not at all, not very, fairly, active) and responses were 'taken into account' (Department of Health, 2003b: p.110).

In summary, for most types of physical activity men report higher levels than women, (especially in young adulthood), and age-related declines in physical activity mean that older people tend to be least active. Reasons why this should be the case are considered next.

3.3.4 Why are older people less active?

There is a strong and consistent correlation between perceived barriers to physical activity and physical activity levels (Sallis and Owen, 1999). Types of barrier differ between population subgroups defined by age, gender and SEP. Most consistently reported as the primary barrier is a perceived lack of time for activity (Allied Dunbar et al, 1992; Fogelman, Bloch and Kahan, 2004; Sallis and Owen, 1999; Trost et al., 2002). However, as adults reach old age the prevalence decreases (Allied Dunbar et al., 1992). Younger and middle-aged adults are likely to have a greater number of commitments that might be prioritised at the expense of physical activity (e.g. work; young family; other interests). For many adults of retirement age and older, the absence of dependent offspring and possible reduction in work commitments through semi-retirement or retirement are likely contributors to the replacement of time constraints by ill-health as the primary reason for inactivity (Allied Dunbar et al, 1992).

Older adults are more likely to report fear of falling, physical limitation, fear of exacerbating medical conditions and so on, as reasons for being inactive (Clark and Nothwehr, 1999; Lim and Taylor, 2005; Tai et al., 1997; Trost et al., 2002); some researchers have reported that more than two thirds of adults over the age of fifty-five report physical symptoms as a barrier to physical activity (Clark, 1999). This is perhaps not surprising given the age-related deterioration in health described earlier (Section 2.2.1). Furthermore, there is evidence that older people define their health through what they are able to do (Michaels Miller and Iris, 2002). Therefore, inactive older adults who are likely to be less functionally able than those who have maintained active lifestyles are more likely to perceive health barriers.

Other barriers frequently cited by older adults include lack of knowledge about how to get involved, transport problems and access to places to be active (Booth et al., 2000b; Clark, 1999; Crombie, Irvine, Williams et al., 2004; Tai et al., 1997; Zunft, Friebe, Seppelt et al., 1999). Self-efficacy for exercise emerges as a likely candidate to explain, at least in part, why older people are less active. Self-efficacy for exercise is largely determined by previous personal experience (Bandura, 1986) and there is considerable evidence that self-efficacy is an important correlate of physical activity in this population group (Clark, 1999; Conn, 1998; Grembowski, Patrick, Diehr et al., 1993; Resnick, Palmer, Jenkins et al., 2000); i.e. the *most* inactive older adults tend to be those who have never been active in the past (Michaels Miller and Iris, 2002).

However, in addition to personal experience of exercise, the other major source of self-efficacy is vicarious experience; the observing of exercise behaviour in others (Bandura, 1986). This relates to social environmental influences, specifically through social modelling and social support. The nature of accepted behavioural norms for habitual activity changes as a person gets older, with relative inactivity and sedentary recreation considered as normal in older people (Tai et al., 1997). Indeed, there is some evidence of a stigma associated with exercise such that some older people can perceive themselves as 'too old' to participate (Allied Dunbar et al, 1992). Therefore, as adults reach old age and the frequency with which they observe physical activity in their peers decreases, sedentary behaviour becomes reinforced through social modelling (Bennett and Murphy, 1997; Tai et al., 1997). The likely outcome of this is that already sedentary adults will remain inactive and those who may have been active in the past become more likely to reduce their physical activity. This is echoed again through the apparent importance of older people having others to exercise with, because using physical activity as a means of socialisation and contact emerge as primary motivators for exercise, or barriers in their absence (Booth et al., 2000b; Crombie et al., 2004; Michaels Miller and Iris, 2002).

Therefore, despite having more time for physical activity than earlier in life, older people tend to feel more constrained by their health and by a social environment that is less conducive to physical activity. When these kinds of influences are considered, the physical activity patterns described earlier in this section are not surprising; i.e. age is associated with steep declines in sport and exercise participation (Figure 3.2), but lesser declines in more habitual activities (e.g. walking and household chores), that are less dependent upon self-efficacy, social support, and the behaviour of peers.

3.3.5 Why are women less active than men?

Compared with age, gender differences in physical activity behaviour appear less determined by health differences and more dependent on differences in the social roles of men and women, and the constraints these impose.

Insufficient time is the most commonly reported physical activity barrier in both men and women but differences in the nature of time constraints illustrate an important social difference. The primary reasons reported by women tend to be related to family and domestic duties, whereas men are more likely to cite work commitments (Allied Dunbar et al, 1992; Sallis and Owen, 1999). A survey for Sport England also found that the proportion of women reporting childcare provision as an important factor was four times greater than in men (12 *vs.* 3%: Sport England 1999[9]). As discussed in relation to health (Section 2.2.3), despite recent changes in the social roles of men and women, it is thought that women remain responsible for the majority of domestic duties and are moiré likely to fill carer roles than men (Kar, Pascual and Chickering, 1999; Maher and Green, 2000; McMunn, Breeze, Goodman et al., 2006). As a decreasing number of women become full-time child carers or homemakers, and an increasing number take up employment, many experience conflict between priorities of home and work life that

[9] Cited in Aitchison (2003)

make them more likely to prioritise others over themselves (Mackey Jones and McKenna, 2002). Whether it is a difference in the amount of leisure time or the way in which this time is constrained (Aitchison, 2003), women appear less likely to spend it performing physical activity. The suggestion that this is linked to multiple social roles and greater domestic responsibilities is strengthened by the finding that far more women report household physical activity despite being less active overall, and through sport, exercise or walking (Figures 3.1-3.4).

Consistent gender differences in motives for exercise have also been reported. Men tend to be more driven by factors relating to performance (or mastery) and competition. Women, on the other hand, are more likely to be motivated by appearance, weight management, socialisation and health-fitness (Biddle and Mutrie, 2001; Burton, Turrell and Oldenburg, 2003; Cash, Novy and Grant, 1994; Finkenberg, DiNucci, McCune et al., 1994; Sherwood and Jeffrey, 2000).

Men's personal experience of physical activity (and to a lesser extent, behaviour of peers) is an important determinant of activity behaviour through conferring confidence. Conversely, there is a general theme that compared with men, physical activity in women is more susceptible to the influence of others; i.e. their social environment. Women are thought more susceptible to social cues (Sallis, Hovell and Hofstetter, 1992), which explains their greater responsiveness to health promotion (Doyal, 2001) and participation in physical activity research (Section 4.5.3)

However, women's social susceptibility can also work to their detriment. Perceived levels of social support from friends and family, either directly (having somebody to exercise with) or indirectly (through advice and encouragement), appear to have a greater influence on women's activity behaviour (Allied Dunbar et al, 1992; Burton et al., 2003; Kaplan and Lazarus, 1991; Kaplan et al., 2001; Sallis et al., 1992; Sherwood and Jeffrey, 2000). National surveys have found that a higher proportion of English women (than men) report having nobody to exercise with as a barrier to physical activity (22 vs. 14%: Allied Dunbar et al, 1992) and having friends to exercise with as an important incentive (15 *vs.* 7%: Sport England 1999[10]). By the same token, significant predictors of decreasing physical activity in women include feeling socially isolated, personal uncertainty and not belonging to a religious or community group.

[10] Cited in Aitchison (2003)

Physical activity in men on the other hand appears far less susceptible to these social influences (Kaplan and Lazarus, 1991). The influence of social factors has also been echoed in all-female studies (Ainsworth, Wilcox, Thompson et al., 2003; Eyler, 2003; Wilbur, Chandler, Dancy et al., 2003).

Finally, just as women tend to be more motivated to exercise in order to improve appearance or for weight management, their behaviour can be negatively influenced by poor self-perception and ultimately, their belief about how others perceive them. That women tend to be more concerned about body image and appearance than men (Ryan, Frederick, Lepes et al., 1997) has been linked to greater societal emphasis placed on women's body appearance (Matlin, 1993). Indeed, the literature indicates that girls and women are much more negative about their bodies (Gill, 2002), which is known to have an impact on physical activity participation (Leary, 1992; McDermott, 2000). Again, this has been illustrated in national surveys. Compared with men, substantially higher proportions of English women perceived themselves as 'too fat' (14 *vs*. 7%) or 'too shy or embarrassed' (12 *vs*. 4%) to participate in physical activity, in addition to claiming not to be the 'sporty type' (Allied Dunbar et al, 1992). Similarly, the Sport England survey found that more than twice as many women than men reported 'overcoming embarrassment' and 'lack of confidence' as the most important factor for physical activity participation (9 vs. 4%: Sport England 1999[11]).

Overall, lower physical activity in many women is a likely consequence of the social environment, which in this context refers to differences in social roles of men and women, and how they perceive themselves and believe others will perceive them. The possible advantage of greater social susceptibility is an increased likelihood of physical activity promotion messages and interventions reaching and being heard by women (Doyal, 2001).

[11] Cited in Aitchison (2003)

3.4 Physical activity and socio-economic position

3.4.1 Problems of measurement

Physical activity and socio-economic measurement

Socio-economic health inequalities (Section 2.4) and evidence of similar social patterning in health behaviours such as smoking and dietary behaviour (Section 2.5), has led to increasing interest in physical activity inequalities over recent years (DCMS, Coggins et al., 1999; 2002; Department of Health, 2004b). However, the aforementioned problems associated with accurately quantifying physical activity, especially lower intensity activities which comprise most habitual activity (Section 3.2), in addition to the controversy surrounding socio-economic measurement (Section 7.1).

Measurement of both SEP (Carr-Hill and Chalmers-Dixon, 2002; Jones and Cameron, 1984; Liberatos et al., 1988) and physical activity (Montoye, Kemper, Saris et al., 1996) are hindered by the absence of a 'gold-standard'. Furthermore, both are multi-dimensional (Cooper, 2003; Liberatos et al., 1988), which leaves researchers with a choice: either measure a single component as a proxy for overall physical activity or SEP; or use a composite SEP score (or deprivation index) or measure total (habitual) physical activity. The resulting diversity in how researchers choose to measure the physical activity-SEP relationship could potentially give rise to conflicting outcomes that are more a consequence of the choice of measurement methods than a reflection of the phenomenon of interest. Considerate interpretation is therefore essential.

Section 3.4.2 reports on a systematic review conducted to establish the strength of epidemiological evidence for the relationship between physical activity and SEP. The review was restricted to studies conducted in Western countries because of the small number of British studies and a tendency for British researchers to use the same socio-economic variable: occupational social class. Consequently, an examination of British research alone would have been insufficient to provide an informed view of how differences in measurement might influence outcomes. Furthermore, including evidence from studies all over the world would have introduced further international and cultural variations that could have obscured the relationship; primarily because the physical activity-SEP relationship is thought to be largely dependent on a country's level of development (Kim, Symons and Popkin, 2004). In developing countries, an active lifestyle is often a necessity for those at the bottom of the social strata. In contrast, as a result of economic development and technological advances, less healthy behaviours have evolved in developed countries such that healthy lifestyles require deliberate choices that the affluent can most easily afford (Kim et al., 2004; Yu, Nissinen, Vartianen et al., 2000). A country's development might also influence the relative contributions of different types of activity to daily energy expenditure (i.e. leisure-time, work-related and household activity). As detailed previously, there is an increasing prevalence of sedentary occupations in developed societies (Kerr et al., 2003; Prentice and Jebb, 1995; Schmid et al., 1995; Sparling et al., 2000); yet in less developed countries with less advanced labour-saving developments, the balance between LTPA and other traditional sources of activity is likely to be different. As a result of these and numerous other likely contributory factors, the present discussion is limited to evidence from Western countries in an attempt to minimise such regional and cultural effects.

3.4.2 Systematic review of the physical activity and socio-economic position

Available evidence

This section presents a summary of the systematic review of epidemiological evidence for a SEP-physical activity relationship: (i) to determine if there is strong evidence of a positive gradient of increasing physical activity across the social strata, and (ii) to explore patterns for different socio-economic indicators.

The review was limited to studies of adult populations conducted in Western countries that reported a recognised socio-economic outcome(s) (i.e. social class, income, education, asset-based, or based on area of residence) in relation to physical activity. A search for literature identified twenty-nine cross-sectional and five longitudinal studies (total of 34) conducted in ten different countries, which met the inclusion criteria (Table 3.2): America (n=16), Australia (n=6), Canada (n=3), Spain (n=1), Britain (n=3), Finland (n=1), Sweden (n=1), France (n =1), the Netherlands (n=1) and Greece (n=1). Two cross-sectional studies by Crespo et al (1999; 2000) reported different analyses of data from the same sample and are, therefore, treated as a single study (n=33). Table

3.1 presents the frequency with which different indicators were reported and physical activity-SEP relationships were observed.

Table 3.1 Frequency of studies using different socio-economic indicators and presence of relationships with physical activity

		Number of studies		
Socio-economic indicator	Total	Positive relationships	No relationship	Negative relationships
Social class	8	8	-	-
Income	15	9	5	1
Education	21	15	6	-
Asset-based	1	-	1	-
Area of residence	4	4	-	-

Note: Crespo et al (1999; 2000) included as single study

Table 3.2 summarises study design and sample characteristics presented by country of origin. Over half of studies were American, all of which reported income and education. Consequently, education was the most frequently reported and social class the least popular socio-economic indicator. Table 3.3 summarises the main outcomes by socio-economic indicator to facilitate identification of consistent themes.

Study quality

In order to make an informed judgement about the strength of evidence from the present review it was necessary to assess the quality of included studies. A quality assessment instrument was developed. Criteria were derived from criticisms of epidemiological studies (Pocock, Collier, Dandreo et al., 2004) and issues relating specifically to the measurement of physical activity and SEP. Using these criteria (Appendix 4), quality assessment was undertaken independently by two experienced assessors. Studies were assigned a quality rating (*QR*) between 1 and 6 (*QR1* = highest quality to *QR6* = poorest quality); where disagreements occurred, they were discussed until a consensus was reached.

Two-thirds of studies (n=22) relied on data from previous health surveys whose original focus and methods therefore dictated study quality. This is a possible explanation for common methodological weaknesses, including the use of unvalidated self-reported measures of physical activity (n=17), failure to justify the choice of socio-economic indicator(s) (n=16), dichotomising socio-economic variables even in large samples (n=10) and failure to report response rate (n=8). Further, although several authors gave some justification for their choice of socio-economic indicators by citing findings from previous research, few provided a conceptual rationale. Failure to do so is a major criticism within the socio-economic measurement literature (Jones and Cameron, 1984; Liberatos et al., 1988).

Study samples were generally large (range=84 to 61,239; mean=6960[12]). Where response rate was reported it was relatively high, with some exceptions (range=31.3 to 97.5; mean=68.0%[13]). This reduced the potential influence of response bias in most studies, which would be expected to increase the proportion of high SEP respondents. Therefore, poor (or unspecified) response rates were an important limitation. In addition to the likely influence of some response bias, the representativeness of samples was further reduced by over half of studies delimiting to certain age groups (Table 3.2).

In most cases researchers conducted multivariate analysis and reported significance levels. Logistic regression was most commonly used and, therefore, the frequent use of dichotomous physical activity outcomes was not viewed as a weakness because a binary dependent variable is a requirement of basic logistic regression analysis (Kirkwood and Sterne, 2003). The following sections describe the main findings (Table 3.3), with consideration for the methodological strengths and weaknesses.

[12] Calculated using numbers available for analysis in longitudinal studies

[13] Calculated from mean response at baseline and follow-up in longitudinal studies

Table 3.2 Study design and sample characteristics for studies of the socio-economic position and physical activity

Country	Study	Study Sample	Data Origin	Methods	Socio-economic Measures	Physical Activity Measure: Description	Physical Activity Measure: Validated	Quality Rating
Britain	Boniface et al 2001	N= 1166 Men Age 18-49 yrs	Not original data (1984-5 and 1991-2)	Longitudinal Interviews	Occupation: I-V (British Registrar Generals) and occupational disadvantage score:(Cambridge scale) Education: no qualifications, up to GCSE, A-level+ Housing tenure: privately owned, the local authority owned	Moderate-vigorous: number of 20-minute episodes in past 2 wks	N	4
	Wardle and Steptoe 2003	N=1691 758 men 933 women Aged >16 yrs	Original data	Cross-sectional Interviews	Occupation: I-V (British Registrar Generals)	Vigorous: in last wk (y/n)	N	3
	Bartley et al 2004	N=5458 4037 men 1421 women Aged 35-55 yrs Civil servants	Not original data (1991)	Prospective study (cross-sectional results reported)	Occupation: high, middle, low	Habitual: hrs mild, moderate and vigorous activity per wk (none/light, moderate, and vigorous categories)	N	3
America	Ford et al 1991	N=559 179 men 380 women Aged 18-89 yrs	1980 census data	Cross-sectional Interviews	Area of residence: low vs. high SES	Walking WRPA LTPA Household	Y	4
	Kaplan and Lazarus 1991	N=4025 adults 1787 men 2238 women Aged ≥20 yrs	Not original data (1965- and 1974)	Longitudinal Interviews	Occupation: blue-collar, white-collar, homemaker Household income: quintiles (adjusted) Education: 0-8, 9-11, 12, 13+ yrs	LTPA: frequency of given activities (often, sometimes, never)	Y	4
	Clark 1995	N=6780 Approx 63% women Aged 70+ White and African Americans	Not original data (1984)	Cross-sectional Interviews	Income: 7 categories (from <$5,000 to >$25,000) Education: completed <8 years vs. 9+ years	Get as much as needed? Have regular exercise routine? Physical activity cf. peers Rate level of physical activity cf. 1 yr ago Frequency of walking 1 or more mile	N	5

Country	Study	Study Sample	Data Origin	Methods	Socio-economic Measures	Physical Activity Measure: Description	Physical Activity Measure: Validated	Quality Rating
America cont...	Lantz et al 1998	N=3617 1358 men 2259 women Aged ≥ 25 yrs	Not original data (1986)	Cross-sectional (baseline data from longitudinal study) Interviews	Income: <\$10,000, 10,000-29,999, >30,000 Education: <12 yrs, 12-15 yrs, ≥30,000	Habitual activity: frequency of sports, exercise, gardening, yard work, walking (placed in quintiles)	N	3
	McTiernan et al 1998	N=492 Women Aged 50-64 yrs	Original data	Cross-sectional survey Interviews	Income: <\$15,000, \$15,000-30,000, \$30,000-45,000, >\$45,000 Education: ≤12 yrs, >12 yrs	LTPA: frequency, duration in past 2 yrs	N	4
	Yen and Kaplan 1998	N=1451 618 men 833 women Aged 20 in 1965	Not original data (1965-74)	Longitudinal survey Questionnaire	Area of residence: poverty vs. non-poverty area based on census	LTPA: single question about frequency of sports, swimming, long walks, gardening, physical exercises	Y	3
	Crespo et al 1999; 2000	N= 18,825 Aged ≥20 yrs White , Mexican and African Americans	Not original data (1988-94)	Cross-sectional survey Interviews	Occupation: w-collar professional, w-collar other, b-collar (plus 2 non-working categories) Income: 5 categories (\$<10,000 to >\$50,000) Education: <12 yrs, 12 yrs, 13-15 yrs, 16+ yrs	LTPA: participation of named activities in past month (+ 4 open ended Qs on other activity)	N	5
	Grzywacz and Marks 2001	N=3032 1471 men 1561 women Aged 25-74 yrs	Not original data (1995)	Cross-sectional Telephone interviews	Education: yrs (12 categories) Household income – continuous variable	Vigorous: frequency of activities	Y	2
	Nies and Kershaw 2002	N =198 Women Aged 30-60 yrs White/African American	Original data	Cross-sectional survey Questionnaire	Income: assumed continuous, not stated Education: ≤high school, vs. >high school, graduate school vs. <graduate school	7-day PAR: calculate EE Time to walk 1 mile	Y	5
	Parks et al 2002	N=1818 Men and women Aged 18-65+ yrs	Original data	Cross-sectional Telephone interviews	Education: <high school, high school graduate, some college/tech school, college/post grad Household income: <\$20,000, >\$20,000	Habitual activity: meeting and not meeting recommended guidelines (from non-/ occupational walking, moderate LTPA, vigorous LTPA	Y	3

Country	Study	Study Sample	Data Origin	Methods	Socio-economic Measures	Physical Activity Measure		Quality Rating
						Description	Validated	
America cont....	Ainsworth et al 2003	N=917 Women Aged 20-50 yrs African-American	Original data	Cross-sectional Telephone interviews	Income: < $15, 000, $15,000-$35, 000, ≥ $35,000 Education: college graduate, some college, high school/GED, < high school	Habitual Activity: meeting recommendations, insufficiently active, and active	Y	3
	Dowda et al 2003	N=4152 1922 men 2230 women Aged 18-30 yrs White/Black,/Mexican Americans	Not original data (1988-94)	Cross-sectional Interviews	Education: yrs of education as continuous variable and dichotomised as <12 yrs, ≥12 yrs	LTPA: frequency of named activities	N	6
	Eyler 2003	N= 1000 Women Aged 20-50 yrs White-American Rural area	Original data	Cross-sectional survey Interview	Income: < $15, 000, $15,000-$35, 000, ≥ $35,000 Education: college graduate, some college, high school/GED, < high school	Habitual Activity: meeting recommendations, insufficiently active, and active	Y	3
	Wilbur et al 2003	N= 399 Women Aged 20-50 yrs African-American Urban area	Original data	Cross-sectional survey Interview	Income: < $15, 000, $15,000-$35, 000, ≥ $35,000 Education: college graduate, some college, high school/GED, < high school	Habitual Activity: meeting recommendations, insufficiently active, active	Y	4
	Tudor-Locke et al 2004	N = 209 76 men, 133 Women Aged ≥ 18 yrs (mean ~ 48 yrs)	Original data	Experimental study Interview	Income: < $20, 000, $20,000-$44, 999, ≥ $45,000 Education: < high school, at least some college	Pedometer worn for 7 days	Y	4
Australia	MacDougall et al 1997	N=1765 Men and women Age 17-75yrs	Not original data (1987)	Cross-sectional Postal questionnaire	Education: none/primary, secondary, trade or business, tertiary Income: <$15,000, ≥ $15,000	SR physical activity - vig, mod, low (vig were excluded)	N	4
	Kendig et al 1998	N=1000 Men and women Aged 65+ yrs	Not original data (1994)	Cross-sectional Interviews and questionnaire	Occupation: managers, profs, clerks/sales/services, tradesmen, labourers/operatives Education achievement: 4 categories Income: above/below pension Housing tenure: own vs. rent	Mod-vig: dichotomised as have or have not engaged in activity resulting in breathing harder, puff/pant in past 2 weeks.	N	3

Country	Study	Study Sample	Data Origin	Methods	Socio-economic Measures	Physical Activity Measure		Quality Rating
						Description	Validated	
Australia cont....	Burton and Turrell 2000	N=24252 Aged 18-64 yrs	Not original data (1995)	Cross-sectional Questionnaire	Occupation – professional, white-collar, blue-collar (from Aus Standard Classification)	LTPA: dichotomised as sufficient or insufficient for health	N	3
	Salmon et al 2000	N=7935 3795 men 4140 women Aged 20-60+ yrs Mean age ~42 yrs	Not original data (1989)	Cross-sectional Questionnaire	Education: university, 12 yrs, <12 yrs Occupation: 3 economically active categories	LTPA: any Vigorous WRPA+household activity	Y	2
	Giles-Corti and Donovan 2002	N=1803 Aged 18-59 yrs Men and women	Original data	Cross-sectional Interviews	Area of residence: based on Social Advantage Index: - low SES (<20th percentile) - high SES (>80th percentile)	Physical activity recall (past 2 weeks) and calculated EE	N	3
	Kavanagh et al 2005	N=2349 1023 men 1326 women Aged ≥18 yrs	Original data	Cross-sectional Questionnaire	Area of residence: low, medium and high depending on % households in area with incomes <$400/wk	Habitual activity: meeting recommendations or not based on frequency and duration of walking, vigorous gardening, other moderate and vigorous activity in past week. Plus 4 question regarding walking, jogging, cycling, swimming	Y	2
Canada	Millar and Stephens 1993	N=11200 (1985) N=11924 (1991) Men and women Aged ≥25 yrs	Not original data (1985-91)	Longitudinal survey with 6-yr follow-up Interviews	Education: <high school grad, high school grad, post secondary education (not uni), University	LTPA: duration and freq of activities Asked about 2 most frequent activities and assigned EE depending on light/mod/vig intensity	N	5
	Pomerleau et al 1997	N=61239 Aged ≥19 yrs	Not original data (1990)	Cross-sectional survey Interviews	Occupational prestige: Low, intermediate, high Education: post-secondary, some post-secondary, secondary, some secondary, primary or less Household income: $<12,000, $12,000-19,999, $20,000-29,999	LTPA: frequent, duration, and number of activities in past month – dichotomised as active (≥1.5 kcal/kg/d) vs. inactive (<1.5 kcal/kg/d)	N	3
	Kaplan et al 2001	N=12611 6306 men 6305 women Aged 65+	Not original data (1996-7)	Cross-sectional survey Questionnaire	Education: <secondary, secondary, some postsecondary, postsecondary	LTPA monthly moderate bouts of >15 min – dichotomised as frequent/infrequent	N	3

Country	Study	Study Sample	Data Origin	Methods	Socio-economic Measures	Physical Activity Measure		Quality Rating
						Description	Validated	
Spain	Schroder et al 2004	N= 1577 838 men 910 women Aged 25-74 yrs	Not original data (1994-6)	Cross-sectional survey Questionnaire	Education: < primary school, primary school, secondary school, > secondary school	LTPA: Minnesota physical activity questionnaire	Y	2
Finland	Laaksonen et al 2003	N=19982 9324 men 10658 women Aged 25-64 yrs	Not original data (2001)	Cross-sectional survey Questionnaires	Income: quintiles of household income	LTPA: active more vs. less than 4 times/wk	N	3
Sweden	Lindstrom et al 2001	N=11837 5380 men 6457 women aged 45-64 yrs	Not original data (1992-4)	Cross-sectional Questionnaire	Occupation: high level non-manual, middle-level non-manual, low level non-manual, skilled manual, unskilled manual	LTPA: 17-item questionnaire – mins/wk for each season spent in 17 activities – Low LTPA defined as lowest quartile of the population (<33.4min/wk walking)	Y	3
Netherlands	Droomers et al 2001	N= 3793 Men and women Aged 15-74 yrs	Not original data (1991 and 1997)	Longitudinal Questionnaires	Income: quintiles Education: higher vocational schooling and university, intermediate schooling, lower secondary or vocational schooling, primary school	LTPA: Time spent walking, cycling, gardening, it sports	N	3
Greece	Papadopoulou et al 2003	N=84 65 men, 19 women Aged 65+yrs At rehab centre	Original data	Cross-sectional survey Interview	Income: poverty level, above poverty level Education level: categorisation not specified	Not described	Y	6
France	Betrais et al 2004	N= 7404 Men and women Aged 45-68 yrs	Not original data (1998)	Cross-sectional survey	Education: primary, high school, university	LTPA: in past yr	Y	4

SE, socio-economic; SES, socio-economic status; PA, physical activity; LTPA, leisure-time physical activity, WRPA, work-related physical activity; vig, vigorous; mod, moderate; cont, continuous

Table 3.3 Main outcomes for studies of the socio-economic position and physical activity by socio-economic indicator

Socio-economic indicator	Study	Country	Sample size	No. SE categories*	Type of Physical Activity	Significant SEP-PA associations	Direction (+/-)	Sig level	Other factors
Occupational Social Class	Kaplan and Lazarus 1991 (L)	America	4025	3	Change in LTPA	No association		NS	
	Pomerleau et al 1997	Canada	61239	3	LTPA	Lower inactivity in highest occupational prestige group	+	P<0.0500	
	Kendig et al 1998	Australia	1000	5	Moderate-Vigorous	Lower activity in lowest class versus highest occupational class	+	P<0.0500	
	Crespo et al 1999 ; 2000	America	18225	3	LTPA	Higher inactivity in lowest occupational class	+	Not given	
	Burton and Turrell 2000	Australia	24454	3	LTPA	Positive gradient in women	+	P<0.0500	Gender differences
						Higher inactivity in lowest versus higher occupational classes	+	P<0.0500	
	Salmon et al 2000	Australia	7935	4	LTPA	Positive gradient in women Higher in highest versus lowest occupational class in men	+ +	P<0.0010 P<0.0010	Gender differences
					Vigorous WRPA + household activity	Higher in highest vs. intermediate occupational class in women	+	P<0.0100	
	Boniface et al 2002 (L)	Britain	1166	3	Change in Moderate-Vigorous	No association		NS	Age differences
	Lindstrom et al 2001	Sweden	11837	5	LTPA	Lower activity in lowest vs. highest occupational class	+	P<0.0010	
	Wardle and Steptoe 2003	Britain	1691	3	Vigorous	Positive gradient	+	P<0.0500	
	Bartley et al 2004	Britain	5458	3	Habitual	Positive gradient in men Lower activity in lowest vs. highest occupational class in women	+ +	P<0.0500 P<0.0500	Gender differences
Income (household)	Kaplan and Lazarus 1991 (L)	America	4025	5	Change in LTPA	Negative changes associated with being in the least versus most educated group	+	P<0.0500	Gender differences
	Clark et al 1995	America	6780	7	Habitual	No association		NS	
	MacDougall et al 1997 [50]	Australia	1765	2	LTPA	No association		NS	
	Pomerleau et al 2003	Canada	61239	3	LTPA	Lower inactivity in the highest versus lower income groups	+	P<0.0001	
	Kendig et al 1998	Australia	1000	2	Moderate-Vigorous	Lower activity in low vs. high income group	+	P<0.0500	
	Lantz et al 1998	America	3617	3	Habitual	Positive gradient	+	P<0.001	
	McTiernan et al 1998	America	492	4	LTPA	Lower activity in lowest vs. highest income group	+	P<0.0010	Female sample

Socio-economic indicator	Study	Country	Sample size	No. SE categories*	Type of Physical Activity	Significant SEP-PA associations	Direction (+/-)	Sig level	Other factors
Income cont...	Crespo et al 1999 ; 2000	America	18225	3	LTPA	Higher inactivity in lowest income groups	+	Not given	Ethnic differences
	Droomers et al 2001 (L)	Netherlands	3793	5	Change in LTPA	Greater increases in highest vs. the lowest income group (<45 yrs)	+	P<0.01	Age differences
						Greater increases in highest vs. the lowest income group (>45 yrs)	+	P<0.001	
	Grzywacz and Marks 2001	America	3032	Cont	Vigorous	Positive gradient in women only	+	P<0.0500	Gender differences
	Nies and Kershaw 2002	America	1998	-	Habitual	No association		NS	Female sample
	Parks et al 2002	America	1818	2	Meeting guidelines for habitual activity	Lower % met guidelines in low vs. high income group	+	Not given	
	Ainsworth et al 2003	America	917	3	Some vs. no habitual activity	No association		NS	Female sample
					Meeting guidelines for habitual activity	No association		NS	
	Eyler et al 2003	America	1000	3	Some vs. no habitual activity	No association		P<0.0500	Female sample
					Meeting guidelines for habitual activity	Higher % met guidelines in highest income group	+		
	Laaksonen et al 2003	Finland	19982	5	LTPA	Lower activity in the highest versus lower income groups in women only	-	P<0.0500	Gender differences
	Papadopoulou et al 2003	Greece	84	2	Not specified	Lower activity in high vs. low income level	+	P<0.0500	
	Wilbur et al 2003	America	399	3	Some vs. no habitual activity	No association		NS	Female sample
					Meeting guidelines for habitual activity	No association		NS	
	Tudor-Locke et al 2004	America	209	3	Habitual activity	Positive gradient	+	P=0.0060	
Education	Kaplan and Lazarus 1991 (L)	America	4025	4	Change in LTPA	No association		NS	
	Millar and Stephens 1993 (L)	Canada	11200 (b) 11924 (f-u)	4	LTPA	Lower prevalence of inactivity in most vs. least educated at baseline and follow-up	+	Not given	
	Clark et al 1995	America	6780	Cont	Habitual activity	Positive gradient	+	P<0.0010	Ethnic differences
	MacDougall et al 1997	Australia	1765	4	LTPA	Lower inactivity in most vs. least educated group	+	P<0.0500	

Socio-economic indicator	Study	Country	Sample size	No. SE categories*	Type of Physical Activity	Significant SEP-PA associations	Direction (+/-)	Sig level	Other factors
Education cont...	Pomerleau et al 1997	Canada	61239	5	LTPA	No association	NS	NS	
	Kendig et al 1998	Australia	1000	4	Moderate-Vigorous	No association		NS	
	Lantz et al 1998	America	3617	3	Habitual	Positive gradient	+	P<0.001	
	McTiernan et al 1998	America	492	2	LTPA	Lower inactivity in low versus high education group	+	P≤0.0100	Female sample
	Crespo et al 1999 ; 2000	America	18225	3	LTPA	Positive gradient	+	Not given	Ethnic differences
	Salmon et al 2000	Australia	7935	3	LTPA	Positive gradient	+	P<0.010	Gender differences
					Vigorous WRPA + household activity	Positive gradient in women Lower in least vs. most educated men	+ +	P<0.0010 P<0.0010	
	Boniface et al 2001 (L)	Britain	1166	3	Change in Moderate-Vigorous	Positive association with uptake (35-49 yrs) Positive association with continuation (18-34 yrs)	+ +	P=0.0200 P=0.0300	Age differences
	Droomers et al 2001 (L)	Netherlands	3793	4	Change in LTPA	Positive gradients and (<45 yrs) Greater decreases in least vs. most educated group (>45 yrs)	+	P<0.0500 P<0.0500	Age differences
	Grzywacz and Marks 2001	America	3032	12	Vigorous	Higher in most vs. least educated	+	P≤0.0010	Gender and age differences
	Kaplan et al 2001	Canada	12611	4	LTPA	Higher in most vs. least educated group Highest in intermediate group	+	P<0.0010 P<0.0010	
	Nies and Kershaw 2002	America	198	4	Habitual	No association		NS	Female sample
	Parks et al 2002	America	1818	4	Meeting guidelines for habitual activity	No association		NS	
	Ainsworth et al 2003	America	917	3	Some vs. no habitual activity	Lower % performed some vs. no activity in less educated groups	+	P<0.05	Female sample
					Meeting guidelines for habitual activity	No association (for meeting vs. not meeting guidelines)		NS	
	Dowda et al 2003	America	4152	Cont	LTPA	Positive gradient in White and Mexican Americans	+	P<0.0010	Ethnic differences
	Eyler et al 2003	America	1000	4	Some vs. no habitual activity	No association		NS	Female sample
					Meeting guidelines for habitual activity	No association		NS	
	Papadopoulou et al 2003	Greece	84	Not specified	Not specified	No association	+	NS	
	Wilbur et al 2003	America	399	4	Some vs. no habitual activity	Lower % performed some vs. no activity in lowest versus highest education groups	+	P<0.0500	Female sample
					Meeting guidelines for habitual activity	No association (for meeting vs. not meeting guidelines)		NS	

Socio-economic indicator	Study	Country	Sample size	No. SE categories*	Type of Physical Activity	Significant SEP-PA associations	Direction (+/-)	Sig level	Other factors
Education cont...	Betrais et al 2004	France	7404	3	Meeting guidelines for LTPA	Higher in most vs. least educated group in women only	+	P<0.0500	Gender differences
	Schroder et al 2004	Spain	1748	4	LTPA	No association		NS	
	Tudor-Locke et al 2004	America	209	2	Habitual	Positive gradient	+	P<0.0001	
Area of Residence	Ford et al 1991	America	559	2	LTPA	Higher in high SEP women only	+	P<0.0001	Gender differences
					WRPA	Lower in high SEP women only	-	P<0.0001	
					Walking	Lower in high SEP men only	-	P=0.0227	
					Household	Lower in high SEP men and women	-	P≤0.0070	
	Yen and Kaplan 1998 (L)	America	1737	2	Change in LTPA	Greater reduction in LTPA in poverty areas	+	P=0.0001	Ethnic differences
	Giles-Corti and Donovan 2002	Australia	1803	2	Meeting guidelines:				
					- total activity	Lower in low versus high SEP group	+	P<0.0500	
					- vigorous activity	Lower in low versus high SEP group	+	P<0.0500	
	Kavanagh et al 2005	Australia	2349	3	Meeting guidelines for total physical activity	Lower in low versus high SEP group	+	P<0.0500	
					Walking	No association		NS	
					Cycling	No association		NS	
					Jogging	Lower in low versus high SEP group	+	P<0.0500	
					Swimming	No association		NS	
Housing tenure	Kendig et al 1998	Australia	1000	2	Moderate-Vigorous	No association		NS	
	Boniface et al 2002 (L)	Britain	1166	2	Change in Moderate-Vigorous	Great uptake for those in private housing (18-34 yrs)	+	P=0.0500	Age differences
						Great uptake for those in private housing (35-49 yrs	+	P=0.0480	

Note: a. All studies are cross-sectional unless (L) =longitudinal

b. If a significant effect was represented by Odds Ratios and 95% Confidence Intervals but a P-value not given, it is reported as P<0.05

c. Positive or negative direction: with respect to physical activity-SEP relationship, even if outcomes reported in terms of inactivity-SEP

Sig, significant; NS, non-significant; SE, socio-economic; SEP, socio-economic position; PA, physical activity; LTPA, leisure-time physical activity, WRPA, work-related physical activity; vig, vigorous; mod, moderate; cont, continuous; bl, baseline; f-u, follow-up

Outcomes for occupational social class

(i) Study design

Out of ten studies that reported occupational class, only one collected original data (Wardle and Steptoe, 2003); the remainder relied on existing survey data and were often compromised by the original focus of the survey or its quality. Despite generally large samples (range=1000 to 61,239), all but one study (Lindstrom, Hason and Ostergren, 2001) used just three occupational classes, which reduces the sensitivity of classification and increases intraclass heterogeneity. In most studies that specified, non-working adults were excluded from analyses or treated separately (Burton and Turrell, 2000; Lindstrom et al., 2001; Salmon et al., 2000; Wardle and Steptoe, 2003). This is a potential limitation given that several studies included samples with both young and older adults who are more likely to be students and retired respectively (Burton and Turrell, 2000; Crespo et al., 1999; Crespo et al., 2000; Pomerleau, Pederson, Ostbye et al., 1997; Salmon et al., 2000; Wardle and Steptoe, 2003). Therefore, the proportion of non-working adults is likely to have been higher in these studies.

(ii) Positive associations

As Table 3.3 illustrates, all eight cross-sectional studies reported significantly higher physical activity in the highest versus lowest social classes. Four of these found positive gradients across classes: for vigorous physical activity (Wardle and Steptoe, 2003); habitual physical activity (Bartley, Martikainen, Shipley et al., 2004); and LTPA (Burton and Turrell, 2000; Salmon et al., 2000), although these were significant in women only in the latter two Australian studies.

Significant differences were reported between LTPA in the high versus lower occupational classes in five studies (Crespo et al., 1999; 2000; Kaplan and Lazarus, 1991; Kendig, Browning and Teshuva, 1998; Lindstrom et al., 2001; Pomerleau et al., 1997).

The only study to measure social class and physical activity in *older* adults (Kendig et al., 1998) reported high versus low social class differences for moderate-vigorous intensity activity in the expected direction. In addition to crude physical activity measurement, occupational classification in older adults according to last occupation would not have adequately accounted for those who chose semi-retirement or less demanding occupations nearer to retirement that might have been unrepresentative of lifetime social class.

One of two longitudinal studies, neither of which were of high-quality, reported a positive association between physical activity and high versus low occupational class in basic regression analysis (Kaplan and Lazarus, 1991).

(iii) No association

The other longitudinal study found that occupational class was not a significant predictor of uptake or maintenance of physical activity in British men (Boniface, Cottee and Skinner, 2001).

Outcomes for Income

(i) Study design

Out of the eighteen studies that measured income only six analysed original data (Ainsworth et al., 2003; McTiernan, Stanford, Daling et al., 1998; Nies and Kershaw, 2002; Papadopoulou, Papadopoulou, Zerva et al., 2003; Parks, Housemann and Brownson, 2003; Tudor-Locke, Ham, Macera et al., 2004), which was reflected in generally smaller sample sizes in these studies compared with the analyses of existing survey data. Similar to social class measurement, the majority of studies used only two or three income categories, with five studies employing four or more categories (Clark, 1995; Droomers, Schrivers and Machenback, 2001; Kaplan and Lazarus, 1991; Laaksonen, Prattala, Helasoja et al., 2003; McTiernan et al., 1998) and just one using a continuous income variable (Grzywacz and Marks, 2001). The consequences in terms of misclassification might be less serious than for occupation because income boundaries are clear (e.g. $20,000-25,000) although arbitrary. Conversely, the absence of such a linear scale for a diverse range of occupations makes boundaries less defined and has resulted in debate about conceptual validity of various occupational classifications (Jones and Cameron, 1984). Eight studies focused on middle-aged

(Ainsworth et al., 2003; Eyler, 2003; Wilbur et al., 2003), or middle-aged and older adults (Clark, 1995; Kendig et al., 1998; McTiernan et al., 1998; Nies and Kershaw, 2002; Papadopoulou et al., 2003). The remainder included a full age range. Age is likely to be a less important consideration when using income rather than social class or education: non-working individuals can still be classified by income but are often excluded from occupational classification; current income is unaffected by temporal change, unlike education, the value of which has altered with changes in the education system and employment market.

(ii) Positive associations

Nine cross-sectional studies found that income and physical activity were positively related. Six reported no relationship. A negative association was reported in one of only two European studies (Laaksonen et al., 2003). Three studies reported a positive gradient between income and physical activity in terms of habitual activity (Lantz et al., 1998; Tudor-Locke et al., 2004) and vigorous intensity activity (Grzywacz and Marks, 2001). Tudor-Locke et al (2004) were the only researchers, to investigate the SEP-physical activity relationship using an objective physical activity measure (accelerometers), although this resulted in a poor response rate (31.1%) and small sample size (n=209).

Four cross-sectional studies observed greater activity in the highest versus lowest income groups, in terms of LTPA (Crespo et al., 1999; 2000; McTiernan et al., 1998) and the likelihood of meeting physical activity recommendations (Eyler, 2003; Parks et al., 2003). The Greek study of older adults similarly reported a positive income effect but there are serious questions regarding the study quality in addition to the small and unrepresentative sample (Papadopoulou et al., 2003). The study of older Australians was methodologically stronger (Kendig et al., 1998). Researchers compared moderate-vigorous activity. Higher levels were reported by those with incomes above pension level (or otherwise). This might be a more appropriate discriminator than absolute income in older people, as used by Clark et al (1995). Parks et al (2003) reported a positive income effect that only became apparent once the sample was divided according to urban-suburban-rural area of residence. This highlighted the potential for environmental factors to mask socio-economic effects on physical activity in studies conducted across large geographical areas.

Out of the two longitudinal studies that both reported a positive income effect (Droomers et al., 2001; Kaplan and Lazarus, 1991), the earlier study found this was significant in women only when all possible confounding variables were considered.

(iii) No association

Failure to find a significant relationship in six studies (Ainsworth et al., 2003; Clark, 1995; MacDougall, Cooke, Owen et al., 1997; Nies and Kershaw, 2002; Pomerleau et al., 1997; Wilbur et al., 2003), could have been attributable to ethnic variation in four of them; two analysed survey data on African-American women (Ainsworth et al., 2003; Wilbur et al., 2003); one of the better quality studies involved a multi-ethnic sample of women (Nies and Kershaw, 2002); and the study by Clark et al (1995), who investigated a multi-ethnic sample of older Americans. However, in the latter study, the measurement of absolute income (rather than relative to pension level) could explain why findings disagreed with the study of older Australians (Kendig et al., 1998). In the remaining two studies that did not find a significant relationship, ethnicity was not reported (MacDougall et al., 1997; Pomerleau et al., 1997).

(iv) Negative association

The only study to report a negative relationship between any socio-economic variables and physical activity was conducted in Finland, and the effect was only significant in women (Laaksonen et al., 2003). Finland is considered somewhat of an exception when it comes to physical activity patterns. Not only is the prevalence of physical activity participation consistently higher than in other Western countries (DCMS: 2002; Stephens and Caspersen, 1994) but there is relative equality in activity levels between the sexes and education groups, and little age-related decline (Stephens and Caspersen, 1994).

Outcomes for Education

(i) Study design

Education was the most commonly employed socio-economic indicator. Out of twenty-four studies that reported education (number of yrs or educational achievement), six analysed original data (Ainsworth et al., 2003; McTiernan et al., 1998; Nies and Kershaw, 2002; Papadopoulou et al., 2003; Parks et al., 2003; Tudor-Locke et al., 2004). Given the aforementioned temporal changes in the value of education, it is worth noting that almost half of the studies limited the sample age ranges, either to young or middle-aged (Ainsworth et al., 2003; Dowda, Ainsworth, Addy et al., 2003; Eyler, 2003; Wilbur et al., 2003), or middle-aged and older adults (Bertrais, Preziosi, Mennen et al., 2004; Clark, 1995; Kaplan et al., 2001; Kendig et al., 1998; McTiernan et al., 1998; Papadopoulou et al., 2003). This should have reduced potential effects.

(ii) Positive associations

As illustrated in Table 3.3 the majority of cross-sectional studies found positive relationships between education and physical activity. Seven did not. Positive *gradients* were reported in six studies (mostly those with a broad age range), in terms of habitual activity (Clark, 1995; Lantz et al., 1998; Tudor-Locke et al., 2004) or LTPA (Crespo et al., 1999; 2000; Dowda et al., 2003; Salmon et al., 2000). These relationships were stronger than found for income or social class in several cases (Clark, 1995; Crespo et al., 1999; 2000; Lantz et al., 1998; Tudor-Locke et al., 2004). Although Dowda et al (2003) reported this relationship in a multi-ethnic sample of young adults (18-30 years), an independent ethnic effect was evident and the study had numerous methodological weaknesses.

The remaining positive associations generally manifested as differences between the most and least educated groups in terms of LTPA (Kaplan et al., 2001; MacDougall et al., 1997; McTiernan et al., 1998; Pomerleau et al., 1997; Salmon et al., 2000), vigorous activity (Grzywacz and Marks, 2001), habitual activity (Ainsworth et al., 2003; Bertrais et al., 2004; Wilbur et al., 2003) and the likelihood of meeting physical activity guidelines (Parks et al., 2003). Again, in studies that measured more than one socio-economic indicator the relationships between physical activity and education were often stronger or more consistent than found for other socio-economic indicators (Ainsworth et al., 2003; Grzywacz and Marks, 2001; MacDougall et al., 1997; Pomerleau et al., 1997; Salmon et al., 2000; Wilbur et al., 2003). Indeed, five studies found that education, not income, was significantly related to physical activity in multivariate analysis (Ainsworth et al., 2003; Clark, 1995; MacDougall et al., 1997; Pomerleau et al., 1997; Wilbur et al., 2003) despite ethnic variation in three of these.

Four longitudinal studies measured education. Three reported a positive effect of education on changes in LTPA (Droomers et al., 2001; Kaplan et al., 2001) and habitual physical activity (Boniface et al., 2001). Data from repeated Canadian Health Surveys (Millar and Stephens, 1993) indicated a positive effect of education on LTPA at two time points, although researchers failed to report significance levels or confidence intervals.

(iii) No associations

In contrast, out of the seven studies that failed to find significant association, three found that income and *not* education predicted activity outcomes (Kendig et al., 1998; Papadopoulou et al., 2003; Parks et al., 2003). However, the quality of the Greek study has already been brought into question (Papadopoulou et al., 2003). Urban-rural differences and ethnicity might have contributed towards the absence of associations in two analyses of all-female data samples (Eyler, 2003; Nies and Kershaw, 2002), which conflicted three other all-female studies (Ainsworth et al., 2003; McTiernan et al., 1998; Wilbur et al., 2003). However, differences between studies make it difficult to determine the dominant influence.

Outcomes for Area of Residence

Despite the wide availability of area-level socio-economic data from censuses, only four studies socially stratified by area of residence (Ford, Merritt, Heath et al., 1991; Giles-Corti and Donovan, 2002b; Kavanagh, Goller, King et al., 2005; Yen and Kaplan, 1998). Study populations were surprisingly small (n=559-1803), a likely consequence of collecting additional individual-level socio-economic data. Nevertheless, four found a significant socio-economic area effect. Independent effects in the expected direction were reported in terms of LTPA (Yen and Kaplan, 1998), meeting physical activity guidelines (Giles-Corti and Donovan, 2002b; Kavanagh et al., 2005) and the various physical activity categories in an earlier American study (Ford et al., 1991); relationships were, however, more striking for women in the latter.

Despite similarities, some study differences are noteworthy. Firstly, there was variation in area classification: Yen and Kaplan (1998) compared poverty and non-poverty areas according to the 1965 census. Giles-Corti and Donovan (2002b) compared those living in areas at the top and bottom of the socio-economic scale (<20th *vs.* >80th percentile). Kavanagh (2005) stratified their sample into three area types on the basis of the percentages of households with low incomes (<\$400 per wk), whereas Ford et al (1991) did not specify. Secondly, all studies reported significant differences in individual-level education and income between residents of high and low SEP areas. However, two of these studies also found an independent area socio-economic effect (Kavanagh et al., 2005; Yen and Kaplan, 1998), which is consistent with health inequalities literature (Section 2.4.1). Thirdly, ethnicity was an important factor in both American studies (Ford et al., 1991; Yen and Kaplan, 1998). Caucasians and African-Americans were over-represented in high and low SEP areas respectively, and Yen and Kaplan (1998) reported that adjusting for ethnicity reduced the SEP-physical activity difference by more than half (55%). Finally, the only study to measure physical environmental variables found that objectively measured environmental variables offset SEP differences (Giles-Corti and Donovan, 2002b).

Outcomes for Asset-based Indicators

Housing tenure was the only asset-based socio-economic indicator used as a main socio-economic variable in just two studies. The investigation of older Australian adults failed to find significant differences in moderate-vigorous activity between homeowners and those renting properties (Kendig et al., 1998). The longitudinal British study found that uptake of LTPA was positively influenced by home ownership (Boniface et al., 2001).

Discussion

The recent growth of interest surrounding socio-economic inequalities in physical activity was evident because out of thirty-five studies, thirty-one were conducted in the last decade and twenty-four since 2000. Despite the wide availability of area-level socio-economic data from censuses, most researchers favoured using individual-level data. In many cases this involved analysis of existing survey data collected up to twenty (and in one case, forty) years earlier. Possibly as a consequence of this reliance on old data, the scope and quality of physical activity or SEP measurement were often limited.

(i) Is there strong evidence of a SEP-physical activity relationship?

Regardless of the socio-economic indicator, higher levels of leisure-time or moderate-vigorous activity (which are often equivalent) in those at the top versus the bottom of the socio-economic strata were consistently demonstrated. Gradients of increasing physical activity in sequentially higher socio-economic groups were reported less frequently. This could be the result of either crude SEP or physical activity measurement able to detect only extreme differences, or alternatively those closer to the middle of the social strata might have similar physical activity levels. Where significant relationships were not reported, often ethnic and possibly urban-rural differences were likely confounders. Most studies were delimited to measurement of LTPA (or similar outcomes), often favoured as they are more easily recalled than less structured lower intensity activities (Cooper, 2003; Montoye et al., 1996). Indeed, work-related physical activity was reported as a separate outcome in only one study. Self-reporting of any physical activity is fraught with problems that make accurate and reliable measurement of habitual activity virtually impossible. Some studies that attempted to measure habitual physical activity reported relationships that were on the whole, less consistent. However, the only studies to measure physical activity objectively (Tudor-Locke et al., 2004) found a strong positive association between habitual activity and both income and education.

Although longitudinal studies are intended to give a better impression of causality than simple prevalence or cross-sectional studies, failure to report socio-economic data at follow-up in three out of five longitudinal studies (Boniface et al., 2001; Droomers et al., 2001; Kaplan and Lazarus, 1991) and the absence of statistical analyses in another (Millar and Stephens, 1993), meant that this was not the case.

Within the evidence hierarchy, observational studies such as those reviewed here are positioned near the bottom (NHS Centre for Reviews and Dissemination, 2001). Guidelines on the strength of evidence from reviews (National Institute of Health and National Heart Lung and Blood Institute, 1998) state that those including primarily non-randomised trials or observational studies rank third in the hierarchy (Category C from A to D). On this basis it would not be possible to claim that evidence from the present review was *strong*. This said, evidence for the presence of a socio-economic effect on physical activity was *consistent* despite the range of approaches, and variable study quality and, therefore, should not be dismissed but used to inform how to improve future investigations of this relationship.

(ii) Differences between socio-economic indicators

Most studies defined SEP by occupational social class, income or education. Occupational social class is categorical by its very nature but with few exceptions income and education were categorised, often with large samples stratified into just two or three socio-economic groups. This reduces the sensitivity of measurements and increases within-group heterogeneity. Presumably in many cases, such restrictions were imposed by the pre-collected survey data.

In general, associations between physical activity and education tended to be stronger and more resistant to ethnic variation than those for income or occupational social class. The potential problem of reporting education in populations with a broad age range (Section 7.6.1) was not apparent. Social classification by occupation was less commonly used (than income and education) because historically, the lack of a clearly defined class structure in America has restricted its use in American epidemiology (which was dominant in the present review). Most classified occupation using skill-based distinctions, similar to the much criticised British Registrar General's schema (refer to Section 7.6.2); another likely consequence of relying on old survey data. Nevertheless, all of the studies found a positive association, with some inconsistencies by gender, although only one of these involved a multi-ethnic sample. Income produced the least consistent trends, which could be the result of a number of factors:

inaccurate reporting of sensitive income data; failure of many studies to adjust for household size; insensitivity of broad income categories; ethnic variation. Alternatively, income might be less strongly related to physical activity.

Use of asset-based indicators and area-level socio-economic classification was rare. The latter was always validated by differences in individual-level socio-economic data, although independent area-level effects were also evident. This supports the notion that the socio-physical environment can influence health and health behaviours independent of individuals' circumstances (Jarvis and Wardle, 2006; MacIntyre et al., 1993; Marmot et al., 2006) as did the apparent environmental influence reported in other featured studies (Giles-Corti and Donovan, 2002b; Parks et al., 2003) and discussed in Section 3.5. Furthermore, a strong ethnic effect was evident at the area-level with disproportionately high concentrations of different ethnic groups in different socio-economic areas. Again, this does not have serious implications in the context of the present study but should be considered in research involving multiethnic samples.

(iii) Other factors

Several studies found that relationships between SEP and leisure-time or vigorous-intensity activity were stronger in women than men (Bertrais et al., 2004; Burton and Turrell, 2000; Ford et al., 1991; Kaplan and Lazarus, 1991; Kendig et al., 1998; Salmon et al., 2000), compared with just one study that found the opposite (Bartley et al., 2004). Five all-female studies compared with a single all-male study (Boniface et al., 2001) is a likely reflection of the common perception that women experience poorer health (Section 2.2.2) and are less active than men. However, attempting to draw meaningful conclusions from this pattern is complicated by diversity in study designs and samples. Age was identified as an important factor in fewer studies and no consistent themes emerged.

Conclusion

In summary, there was consistent evidence of a higher prevalence or higher levels of leisure-time or moderate-vigorous intensity physical activity in those at the top of the socio-economic strata compared with those at the bottom. However, the assumption that socio-economic gradients for health are mirrored by those for physical activity was not justified. In order to determine whether this is an accurate reflection or a result of insensitive measurement, objective physical activity measurement and greater consistency in socio-economic measurement are required. In practice the former is unlikely in anything other than small populations, whereas collecting original data would enable the use of a more up-to-date and sensitive socio-economic classification, employed with a clear conceptual rationale. Which measurements are most appropriate will always vary by region or country, and ethnicity and environmental variables are important considerations. In Britain, differences in our education systems and the lack of income data hinder comparisons with American research, which dominated this review.

There is scope for further use of area-level socio-economic measurement in epidemiology in Britain. Increasing interest in the impact of the environment and physical activity (Foster and Hillsdon, 2004; Kerr et al., 2003) combined with consistent evidence of independent socio-economic area effects on health, means that there is justification for further investigating the impact of the socio-economic environment on physical activity. Furthermore, the most up-to-date and sophisticated socio-economic measurements are readily available in the census, which enables the study of large samples, although this tends to result in compromises in the quality of physical activity measurement. As discussed further in Section 4.3.2, interventions to modify the physical activity behaviour of an individual can be difficult to implement, require skill and training, and are often labour-intensive and costly. Therefore, community-level interventions with the potential to modify the behaviour of a larger number of people could be targeted at deprived communities on the basis of such area-level data. Indeed, two recent studies have used this approach by socially stratifying according to area of residence and using accelerometry to quantify habitual physical activity (Janssen, Boyce, Simpson et al., 2006; Kelly, Reilly, Fisher et al., 2005). Neither reported significant area socio-economic effects for physical activity but both were conducted in children-adolescents and for the reasons outlined in Section 3.3.2, can not be used to make inferences regarding adult populations. Nevertheless, these represent encouraging and much needed methodological developments.

From an epidemiological perspective, the present study is concerned with how an individual's social and physical environment can influence access to and attendance of PARS. Sections 3.3-3.4 have described patterns that demonstrate the importance for physical activity of not only individuals' socio-demographic characteristics but also their socio-economic environment (i.e. area of residence). As awareness of the importance of the environment on physical activity levels increases, it is worth considering aspects of a socio-economically disadvantaged environment that can reduce physical activity.

3.4.3 Why are lower socio-economic groups less physically active?

There are clear socio-economic differentials for both health (Section 2.4) and health-related behaviour (Section 2.5). In order to effectively promote physical activity to redress such socio-economic inequalities and to determine the likely effectiveness of existing strategies in this capacity, it is important to consider socio-economic differences in correlates of physical activity. This section considers some specific ways in which a disadvantaged socio-economic environment is thought to be detrimental for physical activity behaviour.

Firstly, the offspring of disadvantaged parents are more likely to inherit the financial and practical constraints of their parents, which can similarly impair their opportunities for physical activity (Coggins et al., 1999; Droomers, Schrivers, Van de Mheen et al., 1998). However, the pattern of physical inactivity in lower socio-economic groups that pervades generations has been attributed, at least in part, to the influence of social modelling. The example of social modelling of smoking behaviour in lower socio-economic groups was described earlier (Section 2.5). In relation to physical activity, because members of lower socio-economic groups tend to be less active (Section 3.4.2), those who grow up in a disadvantaged environment are less likely to observe frequent exercise behaviour. Consequently, sedentary behaviour becomes modelled as the norm and continues to pass from one generation to the next.

Secondly, confidence to become more active (self-efficacy) is likely to be lower in lower socio-economic groups. As described above, those in disadvantaged environments are more likely to be inactive themselves and less frequently observe activity in others, thus lacking both personal and vicarious experiences that promote self-efficacy. This can also be linked with social support. Differences have been reported for several measures of social support in both quantitative (Brownson, Baker, Housemann et al., 2001; Droomers et al., 1998; Parks et al., 2003) and qualitative research (Burton et al., 2003), which indicate lower perceived social support for exercise in lower socio-economic groups. In fact, there is some evidence not only of a lack of positive social support, but also a perception that physical activity would be discouraged, and of disdainful attitudes towards physical activity behaviour (Brownson et al., 2001; Burton et al., 2003; Parks et al., 2003).

Thirdly, socio-economic patterning in reported barriers to physical activity has been observed, in terms of both the number of perceived barriers (Chinn et al., 1999; Coggins et al., 1999) and the types of barrier reported. The aforementioned barrier of insufficient time, which has proved most popular in the general adult population, is less commonly cited as the primary barrier in lower socio-economic groups in quantitative research (Allied Dunbar et al., 1992; Chinn et al., 1999). Similarly, qualitative research involving men and women from a range of socio-economic groups has revealed that time constraints imposed by erratic and demanding work schedules are commonly reported in the highest socio-economic groups. In contrast, lower socio-economic groups appear to feel more constrained by inconvenient access to facilities and barriers relating to their own health status, such as weight, mood, and stress (Burton et al., 2003). This links to the final two points that relate to socio-economic differences in health and access to facilities.

Clearly, the poorer health experienced by lower socio-economic groups, increases the likelihood of ill-health being a barrier to activity. In particular, stress and stressful life events have been identified as specific barriers (Lynch et al., 1997; Sallis and Owen, 1999) that could contribute to socio-economic differences in activity. Referring back to Section 2.4.3, an adverse socio-economic environment is thought to impair health through increasing exposure to life stressors. Therefore, in addition to causing health-damaging physiological changes, greater stress associated with a disadvantaged environment could also impair health by reducing the likelihood of undertaking physical activity.

Finally, the observation by Burton et al (2003) of lower socio-economic groups feeling more constrained by a lack of access to the leisure facilities is supported elsewhere. Socio-economic disadvantage has been associated with perceptions of poor accessibility to physical activity facilities, even when this is not the case. A group of Australian researchers reported that despite having better objectively determined geographical access to most recreational leisure facilities, residents of more disadvantaged areas were *less* likely to use them compared with those in more affluent areas (Giles-Corti and Donovan, 2002b). Similarly, findings from an earlier American study found that perceived convenience of facilities and neighbourhood SEP were positively associated (Sallis, Johnson, Calfas et al., 1997). The authors of the latter study even concluded that area SEP accounted for most of the association between physical activity and environmental characteristics. Others have reported genuine socio-economic discrepancies, with poor neighbourhoods having significantly fewer physical activity facilities than in more affluent areas (Estabrooks, Lee and Gyurcsik, 2003; Sallis, Hovell, Hofstetter et al., 1990). Overall, it would appear that people living in socio-economic disadvantage tend to experience more barriers to accessing leisure facilities, either real or perceived. In either case, the likelihood of using facilities is reduced (Linenger, Chesson and Nice, 1991; Sallis et al., 1990; Sallis et al., 1997).

Clearly, certain environmental factors associated with socio-economic disadvantage are important influences on physical activity behaviour. The physical environment is the focus of the penultimate section. Specifically, Section 3.5 explores the evidence for urban-rural differences in physical activity, which was considered of particular importance levels given the largely rural nature of the study area for the present research (Section 8.6)

3.5 Physical activity and urban-rural residence

With recognition of the large numbers of people that could be reached by environmental physical activity interventions (Section 4.3.2), attention that has traditionally centred around behavioural models to effect individual behaviour change, is increasingly turning towards ecological models of health behaviour; i.e. the impact of the environment on physical activity (Bauman, 2005; Owen, Humpel, Leslie et al., 2004; Owen, Spathonis and Leslie, 2005). Findings from much of this research would suggest that people in rural areas are likely to be less active than their urban counterparts as a result of constraints imposed by their environment, yet specific urban-rural comparisons are relatively rare (Bertrais et al., 2004; Morgan, Armstrong, Huppert et al., 2000).

3.5.1 Walking and the physical environment

Many of the more recent studies have focused on walking behaviour, attempting to assess neighbourhood "walkability", measured both objectively and on the basis of residents' opinions. Researchers tend to find that neighbourhoods rated as having high walkability tend to have characteristics associated with inner urban areas, and less with sprawling urban, suburban or rural areas. These included higher residential density, a mixture of land used for residential, business and retail, greater street connectivity, and better safety (Leslie, Saelens, Frank et al., 2005; Saelens, Sallis, Black et al., 2003). In turn these factors have been associated with higher levels of self-reported walking (Saelens et al., 2003). Overall patterns were confirmed by a recent review of environmental influences on walking (Owen et al., 2004), despite variation between studies in terms of size of population, nationality (American, Australian and British), and sometimes gender distribution (with some female dominance). Similarly, a study of Belgian adults reported that time spent sitting (i.e. sedentary) was positively associated with distances to shops and businesses, less convenient local shops, and higher perceived criminality in the neighbourhood (De Bourdeaudhuij, Sallis and Saelens, 2003). This indicates that non-recreational physical activity might be an important contributor to overall daily activity. Nevertheless, Foster et al (2004) found gender differences in barriers to walking, with women more concerned by safety and the locality of shops and men concerned with access to local parks. Therefore, each should be considered in relation to socio-demographics.

These overall patterns are consistent with studies that have specifically investigated the effect of urban form from an environmental planner's perspectives. Here the focus has tended to be on behaviour of making trips from one place to another in terms of travel frequency, distance and mode, and how this relates to environmental variables (Ewing, 2005). Again, the same patterns emerge of reduced active transport (mainly walking) in areas with lower density of buildings and street networks, and where buildings are almost exclusively residential rather than a mixture of business and residential addresses (Berrigan and Troiano, 2002; Craig, Brownson, Cragg et al., 2002; Ewing, Schmid, Killingsworth et al., 2003).

These kind of environmental characteristics that appear to discourage an important component of habitual activity are of interest not only to urban planners, but also for comparisons between activity in urban and rural areas. Residents of rural areas often lack convenient amenities and centres of activity in close proximity, which could similarly discourage non-recreational activity such as walking or cycling for transport.

3.5.2 Access to leisure facilities

It is widely acknowledged that access to services and facilities is poorer in rural areas (Cox, 1998; DEFRA, 2000; Phillimore and Reading, 1992) and therefore participation in facility-based activities is likely to be lower. Although not making specific urban-rural comparisons, several studies have found that access to leisure facilities can impact on physical activity (Linenger et al., 1991; Sallis et al., 1990; Sallis et al., 1997).

One of the first studies in this area to use an objective measure of access to the physical activity facilities (Sallis et al., 1990) found that the density of total facilities within one kilometre of participant residents was significantly higher in the group classified as exercisers (≥3 x 20 min vigorous per week) compared with the sedentary group. Moreover, this pattern was evident for the density of pay, but not free facilities, at all measured distances (1, 2, 3, 4, and 5km). These patterns were not, however, replicated when measures of perceived facility convenience were used instead of distance, possibly a result of socio-economic variation in perception. In contrast, several years later researchers used a forty-three-item self-report questionnaire to assess the impact of perceived physical environment on activity and reported significant relationships (Sallis et al., 1997). Reporting the presence of home exercise equipment was associated with strength and vigorous physical activity, and convenient facilities were positively associated with vigorous physical activity. Perceived nature of the neighbourhood environment on the other hand, in terms of crime, hills, pavements, business versus residential, and so on, was not associated with any physical activity; yet, when significant socio-economic variation in all three perceived environmental variables was taken into account it appeared that much of the association between environmental scales and physical activity was mediated by socio-economic factors (as described in Section 3.4).

Australian researchers used objective environmental measurements to investigate the effect of spatial access on facilities use (Giles-Corti and Donovan, 2002a). They found a positive relationship between use and access to several facilities and places to be active, and compared with respondents in the top quartile for access, respondents in the second, third and bottom quartiles, had a reduced chance of achieving recommended activity levels.

Finally, a study conducted in a naval base used a multi-component intervention to make the environment more conducive to activity (e.g. provision of cycle paths; exercise equipment; extended hours at recreation facilities) and reported positive results (Linenger et al., 1991). After one year, the change from baseline comparing the intervention with control naval base and community populations revealed significant improvements in fitness in the intervention group. Clearly the study sample was not representative and the focus was improving fitness rather than activity levels *per se*. Nevertheless, it provides further confirmation of the impact of access to facilities.

The general themes discussed in this section so far make a strong conceptual case for differences in lower physical activity in residents of rural versus urban areas. Yet, despite interest in urban-rural differences in access to health care, deprivation levels, and other environmental stressors, relatively few have explored the impact of urban-rural location on health behaviours (Bertrais et al., 2004; Morgan et al., 2000). The following section introduces the available evidence relating specifically to physical activity.

3.5.3 Evidence for urban-rural differences in physical activity

Large-scale British surveys that measure physical activity levels, such as the Health Survey England 2003 (Department of Health, 2003b), tend not to compare populations residing in urban or rural areas. A search of recent literature revealed numerous studies that made this comparison but research was predominantly American. Only one British study was found (Morgan et al., 2000). Researchers used data from the Healthy Ageing Study, a longitudinal study of healthy older people (≥65 years). They compared approximately one thousand urban residents of Nottingham with an equal number of people living in rural Cambridgeshire. After adjusting for socio-demographic factors there were significant differences between the walking behaviour of rural and urban residents. Older residents of Nottingham reported a median of seven hours walking over the previous fortnight compared with just four hours in Cambridgeshire. This is consistent with evidence discussed in Section 3.7.1. Although the differences for total physical activity were not significant, this could be attributable to low levels of participation in sport and exercise in older people thus reducing the impact of poor access to facilities in rural areas. Alternatively, geographical variation could have offset any urban-rural differences, as reported elsewhere (Martin, Kirkner, Mayo et al., 2005; Wilcox, Castro, King et al., 2000).

Findings from American and Australian research support the notion that people living in rural areas are less active and less likely to meet physical activity guidelines than those in urban and suburban areas (Martin et al., 2005; Parks et al., 2003; Wilcox et al., 2000). A review of physical activity correlates included six studies from America and Australia that found physical activity (mostly LTPA) was significantly lower among rural residents (Trost et al., 2002). Nevertheless, the strength of this relationship can vary by geographical region (Martin et al., 2005; Wilcox et al., 2000) and by socio-demographic factors (Martin et al., 2005; Parks et al., 2003; Wilcox et al., 2000).

There is further evidence which emphasises the need for caution through highlighting variations in this relationship according to the nature of the population and type of measurement. A French study investigated the likelihood of adults (aged 45-60 years) meeting recommendations for weekly physical activity[14] (Bertrais et al., 2004). Multivariate analysis revealed that in men, the probability of meeting physical activity recommendations was not related to relative urbanicity of areas; in women however, not residing in urban areas was associated with an increased likelihood of meeting these guidelines. This effect was greatest for women living outside of urban areas, for whom the increased likelihood of being sufficiently active was approaching twice that of their

[14] 5 x 30-min moderate-, or 3 x 20-min vigorous-intensity activity

urban counterparts. The authors did not speculate as to the reasons behind gender differences.

An earlier review of physical activity correlates concluded that compared with demographic factors, physical environmental factors may be more consistent correlates of physical activity in both community and supervised settings (Sallis and Owen, 1999). Indeed, although characteristics of rural areas might be expected to increase recreational walking and other outdoor, non-facility based activities (e.g. attractive scenery; less traffic), the relative inaccessibility of services and amenities apparently exerts a strong negative influence, in addition to reducing peoples' propensity to access recreational leisure facilities.

The present section provided an overview of patterns for physical activity behaviour that could apply to residents of urban and rural areas of Somerset. These make a strong conceptual case for rural dwellers being less active and facing greater barriers to becoming active, despite the relatively small corpus compared with age, gender and socio-economic physical activity patterns.

3.6 Summary

The socio-demographic patterns for physical activity discussed indicate that, overall, low physical activity is associated with being female, increasing age, socio-economic disadvantage, and rural residency. Likely explanations for these patterns can be linked to social and physical environmental influences. Age-gender differences in physical activity behaviour appear largely determined by social environmental factors (e.g. social roles; time commitments; behaviour of peers), in addition to motivation or barriers related to ill-health. Socio-economic disadvantage is likely to influence physical activity behaviour through the physical and social environment in terms of practical constraints (e.g. finance; transport), perceived opportunities to become active (e.g. perceived access to facilities and places to be active), social behavioural norms, and the consequences for individuals attitudes and beliefs. Such physical activity patterns and the different correlates in different socio-demographic groups are important considerations for physical activity promotion, in terms of who should be targeted and how best to increase physical activity.

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Chapter 4

Some background to physical activity and health was provided in the introductory chapter (Section 1.1). Chapters 2 and 3 have discussed social patterning in health and physical activity, with consideration of underlying social and physical and environmental explanations. Chapter 4 now explores physical activity-related policy in Britain and some of the various strategies used in efforts to promote physical activity. The need to consider socio-demographic patterns for physical activity and likely explanations becomes all the more apparent in order to determine whether existing physical activity promotion strategies are reaching, and are effective for those with the greatest need; i.e. the least active groups with the poorest health outcomes.

Chapter 4: Physical Activity Policy and Promotion in Britain

4.1 Introduction

The purpose of the present chapter was manifold: to describe in more detail the increasing emphasis that Government has placed on the promotion of health behaviour (Section 2.5-2.6); to identify priority groups targeted for such strategies and how these relate to overall public health issues; to consider different levels on which physical activity promotion can operate; and to describe problems associated with popular primary care-based interventions, which make a good case for PARS (discussed further in Chapter 5).

4.2 Development of physical activity and public health policy in Britain

The recent Government *Physical activity action plan* to physical activity promotion demonstrated clear recognition of the problem of sedentary behaviour in Britain and the potential gain from effective intervention (Department of Health, 2005b). However, this apparent intention to act comes many years after acknowledgement of the health benefits of physical activity. The Allied Dunbar National Fitness Survey (Allied Dunbar et al, 1992) was something of a milestone in this area. It was an ambitious national survey of English adults (n=4316) that was fundamental in drawing attention to the problem of inactivity in England. It highlighted that more than half of the adult population were insufficiently active for health according to the guidelines at the time,[15] and identified socio-demographic differences in activity discussed in the previous chapter (Sections 3.3-3.4); i.e. women, older people and lower socio-economic (and ethnic[16]) groups tended to be less active. These findings have been echoed in the Health Education Authority's subsequent *National Survey of Activity and Health* (Walker and Hoinville, 1995) and in the Department of Health's *Health Surveys for England* from 1991 onwards (Mullineaux, Barnes and Barnes, 2001).

In 1992, *The Health of the Nation* (Department of Health, 1992) White paper set out the Conservative Government's public health strategy, which recognised a role for physical

[15] $\geq$3 x 20 min vigorous-intensity activity per week (American College of Sports Medicine, 1990)
[16] Ethnic variation in physical activity was not considered relevant to the present study because of the homogeneity of the Somerset population (Section 8.5).

activity as part of the overall strategy and led to the establishment of the Physical Activity Task Force. However, it was not for another three years, and following changes to the physical activity guidelines[17], that the Department of Health commissioned the first major national physical activity promotion campaign. Conducted by the Health Education Authority, the three-year *ACTIVE* for LIFE campaign (Hillsdon, Cavill, Nanchalal et al., 2001) promoted uptake of moderate-intensity activity on most days (in accordance with modified guidelines). Advertising, public relations and publicity were used in conjunction with a mass media public education programme over three-phases. Further, the campaign specifically targeted several priority groups: young women (16-24 yrs), middle-aged men (45 –55 years), the over-fifties, members of lower socio-economic groups, ethnic minorities, and people with disabilities. Concurrent surveys (n=3189) revealed a small but significant rise in public awareness of the new recommendations (3.7% increase) that was higher in men and lower socio-economic groups, which suggested partial success in targeting. There was, however, no evidence of corresponding improvements in physical activity levels, thus indicating a gap between public knowledge and behaviour (Hillsdon et al., 2001).

The current Labour Government was elected in 1997 and since that time physical activity promotion has played an increasing role in public health policy. There has been a definite move towards promotion of health behaviours in an attempt to shift responsibility for personal health to the individual and away from the state (Section 2.6). *Saving Lives: Our Healthier Nation* (Department of Health, 1999b) identified physical activity as one of the ways in which individuals could improve their own health. Specific targets included promoting greater participation by building on existing initiatives, such as 'exercise on prescription' schemes, providing a range of affordable sports and leisure opportunities, and targeting programmes at specific population groups. However, again, it took another five years before physical activity-specific Government strategy documents emerged (Department of Health, 2004b; 2005b). In the meantime, a series of National Service Framework (NSF) documents were released to implement *Our Healthier Nation's* aims and included references to increasing physical activity in members of the population with coronary heart disease, diabetes, mental health problems and in older people (Department of Health, 1999a; 2000a; 2001a; 2001c). Yet, it could be argued that this was insufficient given the scale of the problem

[17] $\geq 5 \times 30$ min moderate-intensity activity per week (Pate et al., 1995)

of inactivity and known links with CHD, diabetes, mental health (Section 1.1) and old age (Section 2.2.1).

There was a slight indication of an increase in the prominence of physical activity within public health by the differences in status given to physical activity in the NSF for CHD (Department of Health, 2000a) and the Health Survey for England 2003 (Department of Health, 2003b). The earlier NSF document did not include physical activity as an immediate priority, which was secondary in status to smoking cessation. In the HSE 2003, however, equal status was given to physical activity and three other lifestyle behaviours. This represents encouraging progress that was justified by the finding that approximately one-quarter of men (27%) and women (24%) were current smokers, compared with about two-thirds of men (63%) and three-quarters of women (76%) who reported insufficient activity for health. It should, however, be noted that although Government-commissioned, the HSE 2003 was a survey and not a strategy document.

In 2002 the Department of Culture Media and Sport published the *Game Plan* (DCMS, 2002), intended as a 'blueprint' for the structure of sport and physical activity participation. This was a more action orientated release and an indication of joined up thinking; i.e. requiring collaboration between different Government departments. In relation to increasing physical activity participation, several priority groups were identified: young people (<16 yrs), to ensure that physical activity forms part of daily life from an early age; young adults (16-24 yrs) in whom participation rates fall dramatically; women and older people, who tend to be less active than their male and younger counterparts, respectively. In addition, there was an overriding sentiment of the need to target disadvantaged groups through a "package for disadvantaged adults". This comprised three types of initiative: opening up school facilities for community use; subsidisation to overcome cost barriers (e.g. vouchers for use of local facilities; extending PARS); and training to ensure dissemination of consistent advice throughout the system (from local health professionals and community leaders to transport managers). Therefore, by identifying specific measures that should be targeted to specific population groups, the *Game Plan* (DCMS, 2002) showed further progress.

Finally, in 2004-2005 the gradual rise of physical activity in the public health domain culminated in several physical activity-specific documents. *At Least Five a Week*

(Department of Health, 2004a) provided an overview of evidence to make a strong case for the promotion of current physical activity guidelines[18]. The *Choosing Health? Choosing Activity* (Department of Health, 2004b) White Paper released at the same time identified various approaches and settings for physical activity promotion. These included schools, further education facilities, the workplace, methods of transport, the community and the NHS as settings for physical activity promotion. The report specified the need for equal opportunities in community-based physical activity with 'access for all' (Department of Health, 2004b: p.21), in addition to identifying several priority groups (children, people with disabilities and older people). However, in relation to creating an *active health system*, there was no mention of targeting disadvantaged groups through health service based interventions, such as PARS. Nevertheless, on the back of this, *Choosing activity: a physical activity action plan* (Department of Health, 2005b) made specific reference to targeting disadvantaged groups. The action plan advocated physical activity promotion through cross-Government action ("joined up thinking") in a range of settings, including schools and communities. Most pertinent to the present study was the emphasis on the responsibility of the NHS for taking forward the health improvement agenda, including physical activity promotion. Again, reference was made to creating an "active health care system" that takes advantage of the unique access and opportunity to influence people that those working in health and social care have. Moreover, the report specified the intention to provide Primary Care Trusts with 'the means to tackle health inequalities and improve health' (Department of Health, 2005b: p.30). Whether the NHS is an appropriate setting for such preventive and targeted health promotion is addressed later in the thesis (Section 13.2).

Two further points that have arisen from these most recent government policy and strategy documents are particularly pertinent to the present discussion as they can be directly related to PARS. Firstly, there is a recognition that health care-based physical activity promotion can be problematic if dependent upon existing channels for delivery (Section 4.3.3), especially when staff are already under considerable pressure (Department of Health, 2004b). Looking beyond existing processes within the NHS to create new physical activity-specific routes for patients makes a case for the PARS-model as described in Section 5.1. Secondly, the recent physical activity-specific releases make increasing reference to the importance of routinely collecting data to

[18] $\geq$5 x 30 min moderate-intensity activity per week (Pate et al., 1995)

assess need and the effectiveness of interventions; moreover, to develop the evidence base to better understand what works and what does not (DCMS, 2002; Department of Health, 2005b). As will become apparent in Chapter 5, this latter point is particularly relevant to PARS, which have been accused of proliferating in the absence of a sound evidence base (Section 5.2), largely through failure of schemes to collect sufficient data to enable high-quality evaluations (Section 5.5.4).

In summary, it is clear that the Government not only recognises the problem of the increasingly sedentary population, but finally appears willing to act. The aims and objectives set out in Government policy documents are encouraging but there are two issues regarding current health promotion policy. Firstly, promises have not necessarily been followed by resources. New Labour tends to rely on partnerships working and moving money from existing sources. For example, to target physical activity promotion towards the most disadvantaged sections of the population, there has been new investment in some deprived areas; but not the case for places like Somerset (the present study area) where despite being a county of above average affluence (Section 8.6), there exist areas of extreme deprivation (Health and Social Needs Analysis Group, 2004). Consequently, physical activity promotion becomes dependent on alliances between organisations with the same aims, such as the Somerset Physical Activity Group (SPAG).

Secondly, the same criticisms regarding the health promotion approach described previously (Section 2.6) bring into question how well physical activity interventions are able to achieve public health goals, especially in attempting to promote physical activity in lower socio-economic groups as a means of tackling health inequalities in the absence of wider social and environmental change (Guthrie, 2001; Lynch et al., 1997; Shaw et al., 2005; Stronegger et al., 1997).

These are indeed valid criticisms. However, failure to create physical activity opportunities for those with the greatest need might represent a missed chance to try to change attitudes and break the cycle of health-damaging behavioural norms in certain sections of the population. In the context of the present study, there is currently no evidence of socio-economic differences in access to or appropriateness of PARS. Therefore, in order to understand the role for PARS within public health the relative equality of access to and the appropriateness of schemes should be explored. This will enable evidence from a well-run local scheme to be compared with national policy to identify whether policy can be implemented by PCTs to achieve overall public health objectives, especially in relation to health inequalities.

The following section considers different types of physical activity intervention and their respective strengths and weaknesses before focusing on problems associated with primary care-based intervention that contributed towards the development of PARS.

4.3 Physical activity promotion strategies and interventions

4.3.1 Intervention level

Physical activity can be promoted in various ways and in a variety of settings (Kahn, Ramsey, Brownson et al., 2002; Naidoo and Wills, 2000). Several authors have adopted an ecological perspective in an attempt to understand how physical activity should be encouraged (Sallis et al., 1997; Sparling et al., 2000). This views behaviours as a result of interactions between personal attributes (biological and psychological) and environmental factors (social and physical environment). Therefore, as a complex behaviour, physical activity can be influenced through interventions targeted at the individual-, community-, or population-level (King, 1994). Clearly, approaches that reach the largest number of people will have the greatest public health impact but as the scale of intervention increases, the ability to take into account different needs of individuals and population groups is reduced.

A comparison with smoking cessation interventions

An example of a multifaceted large-scale campaign to promote behaviour change in this country is the anti-smoking campaign, which has achieved relative success in altering public attitude (Cavill and Bauman, 2004; Davey, 2003; Department of Health, 1998). At the individual and community-level, trained smoking cessation advisors (e.g. practice nurses) offer advice, guidance and a follow-up service to monitor whether or not patients successfully abstain. In addition, full-time specialist advisors are also in post who not only provide a drop-in service for one-to-one sessions, but can visit the homes of people unable to attend, therefore overcoming potential transport barriers (Kweatowski, 2005). Finally, Nicotine Replacement Therapy has been made available free of charge to benefit claimants, thus overcoming potential financial barriers. These interventions that operate locally and are tailored to the individual, have been implemented nationally throughout the NHS and act as local support for wider initiatives aimed at changing public attitude towards smoking. These include the national media campaigns, tobacco advertising bans, and the introduction of a ban on smoking in public places. So far this approach has been relatively successful in modifying the social climate around tobacco use (Cavill and Bauman, 2004; Department of Health, 1998).

The antismoking campaign has been suggested as a model on which to base physical activity promotion (DCMS, 2002). However, increasing physical activity levels represents a far more complex behaviour change than smoking cessation. Simply abstaining from smoking is an easily understood concept (although potentially difficult in practice). Although the type of approach might vary according to an individual's readiness to quit or the use of aids (e.g. NRT), there is no ambiguity about the intended outcome: to stop smoking. Conversely, to a sedentary individual, becoming physically active represents an unknown with many variables relating to the type, duration, frequency and intensity of activity. On the one hand this gives flexibility and allows tailoring to suit the needs of the individual. On the other hand, the most appropriate approach will depend on numerous factors related to the individual, the influence of their social and physical environment and the constraints imposed on their ability to undertake physical activity. As discussed in the previous chapter, this will depend to some extent on socio-demographic characteristics (Sections 3.3.4-5 and 3.6.3). The following section provides an overview of different types of approach and associated pros and cons to gain some idea of whether different approaches might be more effective in some population groups than others.

4.3.2 Types of intervention

Physical activity promotion strategies can be broadly divided into three categories: educational, behavioural, and environmental and policy interventions (Epstein, 1998; Kahn et al., 2002). Most basic are the educational interventions, such as the aforementioned *ACTIVE* for LIFE campaign (Hillsdon et al., 2001). These generally involve a simple exchange of information to improve awareness and knowledge about physical activity for health, and possible ways to become active or increase activity. These can be delivered at various levels, ranging from the provision of written information to individuals (Chambers, Chambers and Campbell, 2000; Smith, Bauman, Bull et al., 2000), all the way up to national media campaigns, with the potential to reach large numbers of people (Cavill and Bauman, 2004). The effectiveness of disseminating untailored, general messages is likely to depend on the individuals' current beliefs, knowledge and attitude towards physical activity; again this will be related to socio-demographics and associated environmental influences.

Researchers have attempted to measure how effectively educational interventions can engender physical activity behaviour change through the mass media (Cavill and Bauman, 2004; Kahn et al., 2002; Marcus, Owen, Forsyth et al., 1998), printed information and verbally (Kahn et al., 2002). Despite some short-term increases in physical activity, evidence for the effectiveness of written materials is relatively inconclusive (Chambers et al., 2000; Smith et al., 2000). Problems of imposing experimental control and manipulation to such interventions performed on a large-scale makes evaluation difficult (Hillsdon et al., 2001; Kahn et al., 2002; Marcus et al., 1998). As found in the evaluation of the *ACTIVE* for Life campaign (Hillsdon et al., 2001), a review of mass media campaigns aimed at influencing community norms around physical activity concluded that such approaches could increase awareness but not physical activity (Cavill and Bauman, 2004). This type of approach requires sustained promotion of consistent and easily understood messages, and successfully reaching target groups might rely on adequate social marketing techniques (Cavill and Bauman, 2004). The obvious advantages of using media campaigns are the ease of dissemination and the potentially large audience (Kahn et al., 2002; Marcus et al., 1998). Alone they are unlikely to have a substantial impact on public activity levels, but in combination with other types of intervention and operating at different levels, this kind of approach could form an important part of a wider strategy that includes policy and environmental change.

Environmental and policy interventions are based on ecological models of behaviour (used in Sections 3.3.3-5 and 3.4.3 to explain the social patterning of physical activity behaviour) that operate on the premise that the physical and social environment can restrict behaviour by promoting and sometimes demanding certain actions, and by discouraging or prohibiting others (Sallis, Bauman and Pratt, 1998). Thus, environmental and policy approaches aim to create an environment that is conducive to physical activity.

Environmental interventions often refer to changes in the physical environment in terms of infrastructure (e.g. provision of cycle lanes; pedestrianisation to discourage car use), work sites (e.g. installing showers; financial incentives for bicycle commute; attractive stairwells) and creating safe and attractive areas to be active in the community. However, policy-led social interventions are an area of considerable potential. Transport policy has been identified as a primary means through which Government could effect change in public attitude and behaviour, by creating an environment that fosters active transport and discourages car travel (Smith and Bird, 2004). Suggested policies include those that increase the costs associated with car travel, ensure the safety of non-car users, and promote town planning to favour pedestrians and cyclists. This kind of intervention is increasingly recognised as a promising alternative to existing smaller scale behavioural strategies (Bauman, 2005; Trost et al., 2002).

The associated advantages include the ability to influence large numbers of people, that changes tend to be more enduring, and may require minimal maintenance once implemented (King, Jeffrey, Fridinger et al., 1995; Sallis et al., 1998; Trost et al., 2002). Nevertheless, prompting policy makers into action has been identified as a major challenge for several reasons (Sparling et al., 2000). Firstly, the cost of initial implementation can be considerable, especially for physical environmental change (King et al., 1995; Sallis et al., 1998). Secondly, attempting to provide a sound evidence base on which to convince policymakers is hampered by difficulties of applying experimental controls for evaluation (Sallis et al., 1998; Trost et al., 2002). Thirdly, policies might be perceived as politically dangerous; for example, increasing the cost of car travel by through fuel duty and tax increases (Smith and Bird, 2004). Despite these factors, some claim that the conceptual argument is strong enough to warrant immediate action: 'it is timely to prioritise these natural experiments and the opportunistic evaluation of environmental improvements' (Bauman, 2005: p.536).

Behavioural interventions are most direct. Rather than attempting to effect behaviour change indirectly through education or the environment, behavioural approaches usually target the individual's behaviour. They include interventions such as counselling, personal advice and exercise referrals (Section 5.1), and are often based in primary health care (Taylor, 2003). Smaller target groups and the ability to monitor recipients of interventions make this type of intervention easier to evaluate (Schmid et al., 1995). Also unlike educational and environmental interventions, they are relatively versatile and can be selective, targeted, tailored to the individual, and can be easier to implement than altering the physical environment. There are, however, disadvantages such as the requirement for sustained implementation and limited potential public health impact as a result of the smaller target audience (Fox, Biddle, Edmunds et al., 1997). For example, counselling interventions using techniques such as motivational interviewing require a health or exercise professional to deliver them. This is not only time consuming and labour-intensive, but to be effective, requires skills developed through considerable training and feedback. Consequently, the ability and skills of the person delivering intervention becomes hugely influential (Miller and Rollnick, 2002). Although this type of training is available it is not widespread, nor widely recognised in the fitness industry as a required component of health or exercise professionals' competencies.

As a result of the strengths and weaknesses of various approaches, employing several different interventions as part of an overall physical activity promotion programme is preferable: effective mass promotion of consistent messages that are reinforced at individual and community levels, whilst creating environments that are conducive to health behaviour. The desirable outcome is physical activity becoming part of people's daily lives and accepted as a behavioural norm, rather than an activity that requires conscious and deliberate choices, and is in conflict with social and physical environmental influences, as is often the case in modern societies that strongly reinforce sedentary behaviour.

In public health terms, to reduce socio-economic health inequalities, changes to both the physical and social environment are likely to be necessary (as discussed in relation to health, Section 2.6). Tackling the most *upstream* factor of the unequal distribution of material wealth that dictates social structure is the most challenging approach but most likely to achieve long-term success. However, this should be accompanied by interventions to tackle physical and social influences further *downstream*. More feasible changes (although still ambitious) are those at the environmental and policy level. However, it is only relatively recently that much of the focus in this area has turned towards environmental manipulation to foster physical activity. Physical Activity Referral Schemes, which have been developed since the early 1990s provide a good example of small-scale interventions that are widespread and could, therefore, play an important role in the overall public health strategy. The nature of this role, however, is yet to be determined.

Physical Activity Referral Schemes, which are based in primary care, are discussed in detail in Chapter 5. The following section considers some of the pros and cons associated with using the primary care setting, and limitations in associated research to date.

4.3.3 Physical activity promotion in primary health care in Britain

Advantages and disadvantages

Primary health care generally refers to patients' initial point of contact with health care services. In Britain, primary care, particularly general practice, has proved the most popular setting for physical activity promotion (Riddoch, Puig-Ribera and Cooper, 1998). The two main advantages of this setting are the high level of public contact (King, 2000; Mutrie and Woods, 2003; Taylor, 2003) and the esteem often associated with health professionals, especially GPs (King, 2000). It is estimated that over seventy *per* cent of the British population visit their GP at least once a year and ninety-five *per* cent over a three-year period (Taylor 2003). This provides unique access to a large proportion of the public, although certain population groups are more likely to use primary health care services than others (Sections 6.3.1; 6.3.2; 6.4.1). Furthermore, people are more likely to trust and be willing to act on advice from health professionals such as GPs, whom they hold in esteem (Hardcastle and Taylor, 2001; Stathi, McKenna and Fox, 2003).

Despite these advantages, questions have been asked regarding the ability of primary health care professionals to identify patients with most to gain from increasing physical activity, and to promote it in an appropriate and effective manner (Gould, Thorogood, Iliffe et al., 1995; Hillsdon, 1998). This is especially pertinent considering the substantial pressures GPs face from existing primary care workloads (Department of Health, 2004b). As a result there have been calls for better training and education of health professionals to enable more effective delivery of physical activity promotion (McKay, Macdonald, Reed et al., 2003) and for other members of the primary health care teams to become involved (Department of Health, 2001b; 2005b). Indeed, the effectiveness of various strategies in this setting has been the subject of a great deal of research. Unfortunately this has often been inconclusive, reporting at best, short-term increases in physical activity (Chambers et al., 2000; Hillsdon, Thorogood, White et al., 2002; Imperial Cancer Research fund OXCHECK study group, 1995; Lowther, Mutrie and Scott, 2002; Smith et al., 2000). Consequently, how best to encourage primary care patients to be more physically active remains a key question in modern public health (Puska, 2001).

From evidence relating to the effectiveness of primary care-based physical activity interventions in Britain two important points emerge, which are considered subsequently (Section 4.3.3): potential problems associated with health professional-delivered interventions and limitations of experimental research.

Issues of health professionals-delivered physical activity promotion interventions

The concept of health professionals using their relationships with patients to promote physical activity is an attractive one. In practice, this has usually involved GPs and to a lesser extent, practice nurses. In both cases, several barriers to the successful implementation of this model have been identified. Questionnaires and interviews with GPs and practice nurses have revealed generally positive beliefs regarding the benefits of physical activity and the value of physical activity promotion (Gould et al., 1995; McKenna, Naylor and McDowell, 1998; Smith, 1998; Steptoe, Doherty, Kendrick et al., 1999). However, physical activity was perceived by some as the least important CHD lifestyle risk factor, behind smoking, diet and alcohol consumption (Gould et al., 1995), and a general lack of knowledge has emerged (Gould et al., 1995; Smith, 1998). Smith et al (1998) found that the intention to promote physical activity was largely dependent on health professionals' perceptions of control over physical activity promotion. Steptoe et al (1999) similarly found that approximately half of practice nurses and less than a quarter of GPs thought that lifestyle counselling was effective, and few believed in their ability to persuade patients to be more physically active (24.0% of GPs and 34.5% of practice nurses). Using questionnaires, McKenna et al (1998) found that health professionals' personal activity levels and their readiness to be active were important determinants of promotion behaviour. Some practitioners even believe that lifestyle change is a decision for the patient and, therefore, not their responsibility (Taylor, 2003). Overall, GPs most likely to promote physical activity tend to be older, regular exercisers, have positive attitudes towards exercise and confidence in their ability to counsel patients.

Despite wide endorsement of in-service training in this area during the early 1990s (Health Education Authority, 1994), these themes connote a lack of education for health professionals. Indeed, lack of training in appropriate skills has been cited by health professionals (Steptoe et al., 1999). Inconsistency in health professionals' knowledge regarding physical activity promotion means that their confidence and ability to do so becomes dependent on personal characteristics, such as their own physical activity behaviour. The major practical barrier to promoting physical activity to patients appears to be a lack of time, which ultimately reflects limited resources (McKenna et al., 1998; Taylor, 2003). A lack of education in key target groups is also evident from this research. For example, some practitioners failed to see the value in attempting to change lifestyle of an old person (Taylor, 2003). Others were aware of the benefit of physical activity for CHD but few conditions beyond this (Gould et al., 1995).

In summary, despite positive attitudes towards physical activity promotion, inconsistency in knowledge and perceived ability in health professionals, in addition to organisational barriers (e.g. lack of time; training; financial incentives) are likely to increase resistance to physical activity promotion in primary care. The most likely candidates for delivering primary care interventions are GPs. However, because they are already responsible for providing healthcare to most of the population (Eaton and Menard, 1998), it is unlikely that they would welcome further responsibility unless compensated through increases in time and resources. The present section looked only at evidence from British studies, although similar sentiments have been echoed by health professionals elsewhere (Devereaux Melillo, Crocker Houde, Williamson et al., 2000; Gribben, Goodyear-Smith, Grobbelaar et al., 2000; King, 2000; King et al., 1992; Taylor, 2003).

The majority of British studies of primary care-based physical activity interventions[19] have been controlled or randomised controlled trials (Chambers et al., 2000; Hillsdon et al., 2002; Imperial Cancer Research fund OXCHECK study group, 1995; Lowther et al., 2002; Smith et al., 2000) or quasi-experimental (Dowell, Ochera, Hilton et al., 1996). The first limitation of this research relates to common methodological weaknesses despite the experimental rigour expected from the RCT approach. Physical activity measurement (Section 3.2) was almost exclusively self-reported and retrospective, with variation in the level of activity used to discriminate between active and inactive individuals. For example, an otherwise rigorous and well-designed trial used one or more episode(s) of vigorous activity in the last month as the primary outcome (Imperial Cancer Research fund OXCHECK study group, 1995). Clearly, this is a crude distinction, the clinical significance of which has been questioned (Eakin, Glasgow and Riley, 2000). Furthermore, there was apparent control group contamination. Exposing controls to more than simple baseline measurement corresponded with increases in activity levels at follow-up (Chambers et al., 2000; Lowther et al., 2002). Whereas the only study that attempted prospective self-reported and objective physical activity measurement, used different measurements at baseline and follow up, which could explain the observed increases in control group activity (Hillsdon et al., 2002).

In addition to criticisms of study design, there are more fundamental limitations associated with relying on experimental RCT methods to evaluate this kind of human intervention. Recruitment methods in experimental research tend to result in study samples of more highly motivated individuals (Hillsdon, Foster and Thorogood, 2005), in whom a positive response is more likely, especially with knowledge that they are being monitored [the Hawthorne effect (Rowland, 1994)]. This is problematic when trying to learn more about those members of the population who are least active, least motivated to be active and, therefore, least likely to be recruited. It is this population group who are most in need of intervention and yet are most likely to be missed out. Such response bias tends to manifest in over-representation of white, middle-aged, well-educated, more affluent, and to a lesser extent, female participants (Adams and White, 2003; Bock, Marcus, Pinto et al., 2001; Dunn, 1996; Godin and Shephard, 1983; Hillsdon et al., 2005; Hillsdon and Thorogood, 1996; Hillsdon, Thorogood and Foster,

[19] Not including Physical Activity Referral Schemes, which are discussed in Chapter 5.

1999; McKay et al., 2003; Simons-Morton, Hogan, Dunn et al., 2000). However, this is a limitation of physical activity research in general, and not one that only applies to RCTs.

Some argue that the notion of RCTs representing the 'gold-standard' approach to evaluation cannot be extrapolated to public health, as this assumes that public health is merely an extension of medicine (Barreto, 2005). Indeed, there is increasing opposition to relying on RCTs to evaluate human interventions, such as those in physical activity promotion (Barreto, 2005; Dugdill and Graham, 2004; Hammond, Brodie and Bundred, 1997; Puska, 2001; Redman, 1996). The RCT approach is undoubtedly valuable; for example, to compare physiological responses to medications, RCTs would be most appropriate. However, from an ecological perspective physical activity is a complex behaviour that can be influenced by a large number of psychological, social and physical environmental factors (Sallis and Owen, 1999). Attempting to isolate this behaviour to measure change (which is also very difficult to do) within a controlled setting is less reflective of 'real life' and how interventions might operate and their effectiveness in practice (Estabrooks and Gyurcsik, 2003; Puska, 2001). There is no doubt that RCTs make a valuable contribution but, as with any single approach to evaluation, unless accompanied by other types of research the picture will be incomplete. Through applying rigour in an applied research environment, the present study aims to add to existing PARS research in this capacity.

There are other sources of objection to using RCTs in this context. These include ethical concerns about withholding potentially beneficial treatment from control patients (Dugdill and Graham, 2004; Hammond et al., 1997; Riddoch et al., 1998), in addition to more pragmatic concerns about potential consequences of placing greater burden on participants and participating exercise and health professionals (Estabrooks and Gyurcsik, 2003). This burden can increase the likelihood of attrition bias (Hennekens and Buring, 1987; Torgerson and Torgerson, 2003) or promoting differential compliance in the intervention versus control groups (Torgerson and Sibbald, 1998).

The apparent dearth of applied research in this area puts a question mark over the effectiveness in practice, of interventions that might demonstrate limited efficacy in the controlled study environment. More problematic, however, is determining the reach of such interventions in practice; i.e. in the absence of RCT inclusion criteria or recruitment methods. Puska (2001) stated that we should critically ask what kind of evidence we are looking for. Reliance upon RCTs alone can overemphasize simpler interventions and undermines the role of broader complex interventions involving community-based programmes and national policy-led approaches. Therefore, even with the most accurate measurements of adherence and physical activity improvements, unless complemented by other types of research, on their own RCTs will be unable to provide a complete and faithful representation of the response and behaviour of those individuals at whom such interventions should be targeted.

4.4 Summary

A number of general themes have emerged in the present chapter. The PARS-style intervention goes some way to address the limitations of the health professional-delivered physical activity promotion model, such as variable ability of health professionals and lack of time and resources. Although their effectiveness has been called into question, the types of intervention described in this section make a good case for the PARS approach. However, there is a need for more applied research in this area to give an impression of how interventions will operate in practice and how best to increase physical activity in the population groups with most to gain. Unless these kinds of questions can be answered, the true public health value of different interventions such as those based in primary care, will be based on ecologically invalid experimental research.

*

Chapter 5

The majority of Chapter 5 is devoted to a systematic review of British PARS, with a focus on scheme attendance of schemes and who PARS have proved most successful for. The review features some examples of applied physical activity research, which is compared with experimental evidence in an attempt to learn more about schemes in practice and identify gaps in the evidence base.

Chapter 5: Physical Activity Referral Schemes in Britain[20]

5.1 The Physical Activity Referral Scheme model

As described in Section 1.2, PARS involve referral of patients from primary care into a recognised system with appropriately qualified exercise professionals, to undertake a programme of physical activity aimed at increasing activity levels (Department of Health, 2001b). Figure 5.1 illustrates the referral process as defined in the national guidelines (Department of Health, 2001b). Most PARS participants are referred from general practice, to attend a participating leisure facility (Fox et al., 1997).

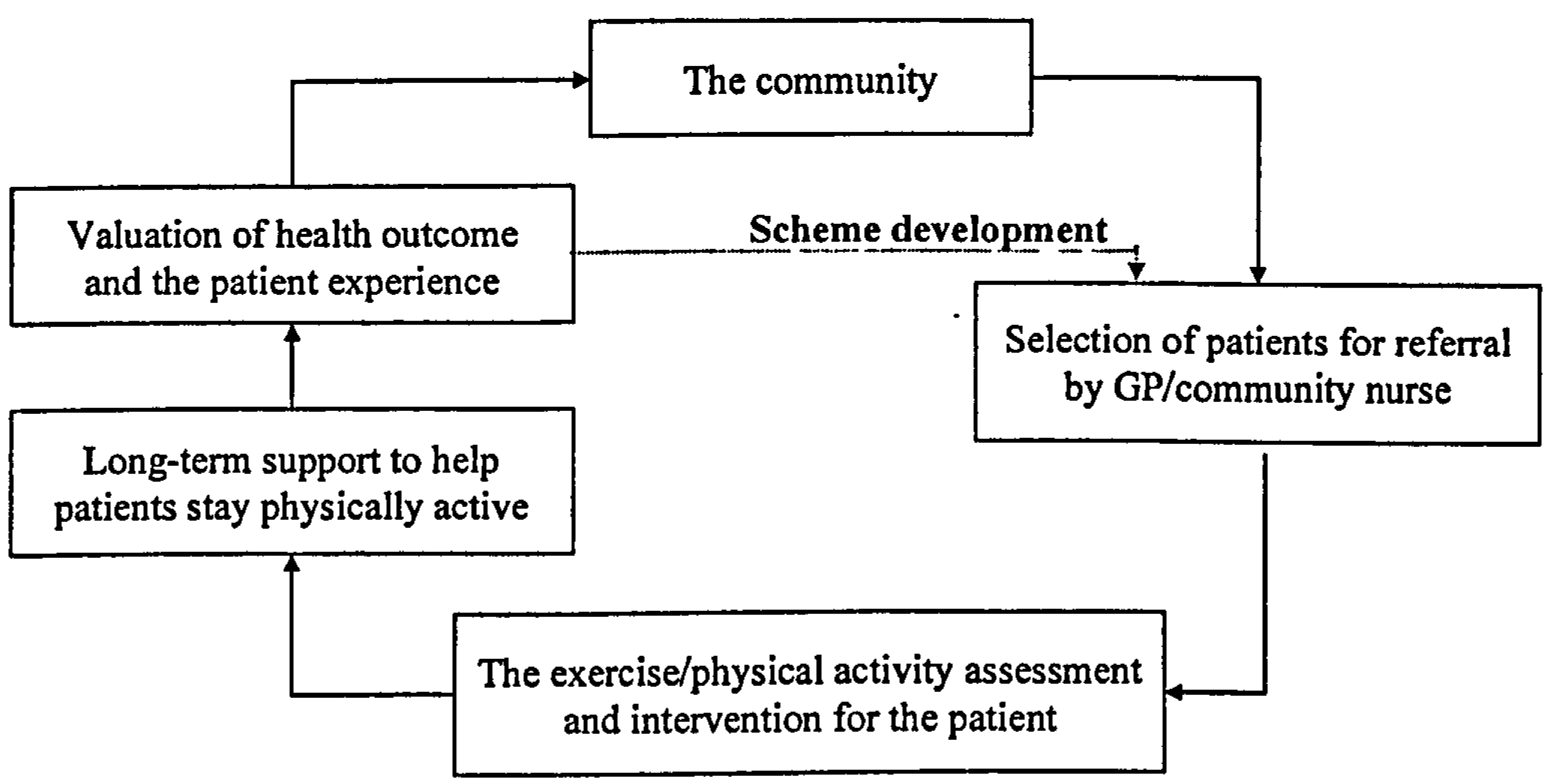

Figure 5.1 Physical activity referral process [taken from The National Quality Assurance Framework for exercise referral schemes (Department of Health, 2001b: p.17)

A primary advantage of this model is that health professionals are not required to deliver the intervention, which can be problematic (Section 4.3.3). Instead it becomes the responsibility of the exercise professional with the necessary exercise expertise. Other advantages include popularity of schemes with referred patients and the motivational effect of group exercise (Fox et al., 1997). Indeed, in Britain PARS have become the most prevalent primary care-based physical activity interventions (Crone et al., 2004). They have featured in several Government health and physical activity

[20]The information that forms the basis for much of this chapter has been published as a systematic review (Gidlow et al., 2005)

promotion strategy documents (DCMS, 2002; Department of Health, 1999b; 2004b; 2005b). Their rise in this country prompted the release of the National Quality Assurance Framework (NQAF) for exercise referral schemes (Department of Health, 2001b); PARS were also included in the recent NICE consultation on public health interventions, although this advised against further pursing this intervention model (NICE, 2006). Nevertheless, the NQAF sets out that PARS have a part to play in the overall public health programme. Indeed, given their prevalence, this is plausible. Yet the exact nature of this role is unclear. To date, evaluations have failed to determine whether PARS are effectively reaching those with the greatest need, and who face the greatest barriers to physical activity participation.

Depending on the scheme in question, referrals might be made by any primary health care professional, although it is predominantly GPs and to a lesser extent, practice nurses (Crone et al., 2004; Fox et al., 1997). Physical Activity Referral Schemes have taken the practical and medico-legal responsibility of intervention delivery away from primary health care professionals, but they retain responsibility for *who* gets referred. Therefore, questions remain over their ability to identify patients with most to gain from physical activity promotion (Section 4.3.3). Few British studies have explored the perceptions of referring health professionals in this context, with the exception of Graham et al (2005) and Smith et al (1996). Nevertheless, researchers' findings suggest that although health professionals generally recognise the potential benefits of PARS, they tend to consider them as therapeutic rather than preventive, which could result in inappropriate targeting (Johnston, Warwick, De Ste Croix et al., 2005).

5.2 The proliferation of PARS

Over the last decade the number of PARS in the Britain has risen dramatically from an estimated two hundred in 1994 (Fox et al., 1997) to approaching seven hundred in 2001 (Squire, 2001). More recently it was estimated that PARS are operating in eighty-nine *per* cent of Primary Care Trusts (Department of Health, 2005b). It is thought that this proliferation has been largely driven by the leisure industry and a lack of time and expertise available for health professional-delivered interventions (Section 4.3.3), rather than a sound evidence base. In the past, schemes have generally failed to put in place the necessary processes for quality evaluations. Despite their popularity, the dearth of robust evidence of their effectiveness continues to be a source of contention (Fox et al., 1997; Health Development Agency, 2004; Hillsdon et al., 1999; NICE, 2006; Riddoch et al., 1998).

In 2001, the NQAF (Department of Health, 2001b) set out guidelines to ensure consistency and quality in the service provided across Britain. It also stated that schemes should be widely available. Physical Activity Referral Schemes, are therefore, intended as a non-discriminatory service that is equally available to all population groups; yet to have the greatest impact on public health it could be argued that they should be targeted at the least active population groups and those at risk of future health problems (e.g. lower socio-economic groups). At present little is known about which sections of the population PARS reach, and who are most appropriate for. These are both questions that need to be answered in order to determine their role within public health.

5.3 Problems with existing evidence

In the present climate of evidence-based practice, decisions about policy, and the design and the funding of health promotion interventions are increasingly guided by research (NICE, 2006; Webb, 1999). Systematic reviews are therefore used to guide clinicians, managers and policy makers on the effectiveness of such interventions (Blamey and Mutrie, 2004; Webb, 1999) and thus directly influence both policy and practice. To date, a lack of rigour in evaluations of PARS has resulted in many studies failing to meet the strict inclusion criteria of systematic reviews, which often preclude studies that deviate from the RCT model (Blamey and Mutrie, 2004; Morgan, 2005; Riddoch et al., 1998). Although a certain level of rigour and methodological coherence is necessary to obtain meaningful results, it is recognised that the imposition of strict inclusion criteria has the potential to miss out valuable information (Blamey and Mutrie, 2004).

Moreover, as described in Section 4.3.3, there are problems when trying to make generalisations about the practice setting on the basis of experimental research alone. For example, in the PARS context the types of people who volunteer for physical activity research interventions are likely to differ from those referred to existing PARS from primary care. Further, health professionals' behaviour and their influence on participants will be different from that of a researcher; not only would patients' health concern and possible esteem associated with health professionals promote a different response, but researchers' vested interest in recruitment could result in recruitment methods that do not reflect practice. Therefore, rigorous research in a 'real-world' context is invaluable. The need to create a holistic evidence base to inform practice was recognised several years ago in the national PARS guidelines (Department of Health, 2001b). Despite the need for more controlled research in this area, recommendations to pursue only this approach (NICE, 2006) ignore the need for, and value of, other kinds of research when evaluating human interventions such as PARS (Barreto, 2005; Dugdill and Graham, 2004; Hammond et al., 1997; Puska, 2001; Redman, 1996).

5.4 Importance of measuring attendance

This chapter is concerned with attendance in PARS, which is central to the present thesis. Rather than attempting to demonstrate change in habitual physical activity or other related variables, in the case of PARS it is more pertinent to measure attendance for several reasons (Godin and Shephard, 1983). Firstly, most PARS make some attempt to monitor attendance and the relatively limited number of ways in which to do so should enable between-scheme comparisons. Secondly, attendance can be monitored by exercise professionals thus potentially avoiding a reliance on participants self-reporting attendance or physical activity retrospectively, the problems with which were described in Section 3.2. Thirdly, where attendance and physiological changes have been monitored, beneficial changes have been shown to occur if attendance is adequate (Taylor, Doust and Webborn, 1998). Finally, some researchers measure physiological changes to reflect physical fitness, even though the public health focus has shifted and now places greater emphasis on health benefits from regular physical activity rather than fitness *per se* (Blair, Cheng and Holder, 2001a).

The primary focus is, therefore, how well PARS are attended, in addition to *who* attends, reasons for attrition, and how schemes are perceived by participants. Much of the remainder of the chapter has been published as a systematic review (Gidlow et al., 2005).

5.5 A review of attendance in British PARS

5.5.1 Introduction and review methods

The present discussion was limited to British studies of PARS that reported attendance-related outcomes. This avoided international differences in health care systems (Lawlor and Hanratty, 2001). Furthermore, the exclusion of unpublished studies imposed a degree of quality assurance. Nevertheless, both experimental studies of PARS interventions and evaluations of 'real life' schemes were included to enable comparisons between them, both in terms of design and findings, and allow a discussion of possible implications of any differences. This approach was aimed at redressing the emphasis in previous reviews on experimental, RCT-based studies.

A search of literature using the terms listed in Figure 5.2 revealed ten original studies that met the necessary criteria: six were evaluations of existing schemes (Dugdill and Graham, 2004; Hammond et al., 1997; Harrison, McNair and Dugdill, 2005a; Jackson, Bell, Smith et al., 1998; Lord and Green, 1995; Martin and Woolf-May, 1999) and four were experimental RCTs involving PARS interventions. An additional study by Fielder, Shorney and Wright (1995) that applied the RCT model to an existing scheme was aborted due to insufficient numbers. Finally, two further studies were published but not in peer-reviewed journals (Day and Nettleton, 2001; Hope, Lewis, Bird et al., 2002).

Pub Med, Sports Discuss and Psych Info:

1. Exercise OR physical activity
2. refer OR referral OR referred OR referrer
3. 1 AND 2
4. health promotion
5. primary care
6. GP OR physician OR doctor OR general practitioner
7. 4 OR 5 OR 6
8. 7 AND 4

Results = 2031

Embase:

1. Exercise.ti,ab
2. Physical activity.ti,ab
3. 1 OR 2
4. health promotion.ti,ab,kw
5. primary care.ti,ab,kw
6. GP.ti,ab,kw
7. 4 OR 5 OR 6
8. refer$.ti.ab
9. 3 AND 7 AND 8

Figure 5.2 Search strategy for review of British PARS

For consistency, throughout this discussion evaluations of existing schemes are referred to as *evaluations*, whereas RCTs are referred to as *RCTs* or *trials*. Attendance, adherence, and compliance were all used, somewhat interchangeably by authors, to describe what is essentially participant attendance of PARS. This will be referred to as *attendance*. *Uptake* of referral will be used to refer to attendance at the initial consultation or first exercise session.

Table 5.1 presents details of existing scheme evaluations, RCT design, and sample demographics. Table 5.2 summarises attendance outcomes and findings, all of which are discussed in the following sections.

5.5.2 Evidence from related reviews

Physical activity referral schemes have already been the focus of three reviews (Fox et al., 1997; Morgan, 2005; Riddoch et al., 1998). Riddoch et al (1998) concentrated on changes in physical activity-related outcomes. Researchers found small but positive short-term changes that became less marked as experimental rigour increased and called for more methodologically robust evaluation. In 1994, near the beginning of the PARS proliferation, Fox et al (1997) identified and obtained data (mostly unpublished) from approximately two hundred schemes that were running in Britain at the time. Their aim: to investigate the extent and nature of schemes using routinely collected data. The authors concluded that attendance of inductions (equivalent to 'uptake') was high (60-70%) and that schemes were rated favourably by patients. However, they criticised the quality of the 'in house' evaluations and questioned the potential public health impact of PARS.

More recently, Morgan (2005) reviewed controlled experimental or quasi-experimental PARS studies. Nine were identified of which four were British (4 American, 1 New Zealand). Three of these are included in the following review. The fourth, a trial of free access to walking groups (Lamb, Bartlett, Ashley et al., 2002), was not included as it did not involve attendance at a leisure facility and relied solely on self-reported physical activity outcomes. The review raised several interesting issues. Firstly, non-British interventions tended to be more intensive with considerably more participant contact time. This might have contributed to the generally more positive results but the associated costs and labour-intensiveness meant that interventions were less feasible in practice than British interventions. Secondly, self-reported physical activity measurement was a common weakness in all cases. Only one study attempted to validate self-reports but with little success. Thirdly, British studies reported generally low uptake. Finally, the likelihood of response bias in many studies was increased by recruitment through media, advertising and telephone surveys, rather than by health professionals for health reasons (preventive or therapeutic). However, collection of socio-demographic information by very few studies meant that it was not possible to determine the extent and implications of such bias and the need for further studies of PARS in a range of populations was identified.

The following section focuses on how well British PARS are attended, who attends them, and reasons for dropout. Similar to reviews by Riddoch et al. (1998) and Morgan (2005) this discussion includes experimental studies using PARS-style interventions; however, because evaluations of 'real life' schemes are also included, findings are discussed in the context of study design.

Table 5.1 Study details and sample demographics for evaluations and RCTs of British PARS

Authors	Type of study	Sample characteristics	Recruitment method	Exercise programme/ treatment groups	Duration/program follow-up	Type/Location	Other info
EVALUATIONS							
Lord and Green 1995	Existing scheme evaluation	419 adults Age 18-65 yrs (~75% aged <55 yrs)	By GP at voluntary health screening visit	3 x 1-hr sessions/wk	10 wks	Local leisure facilities Various aerobic activities at	Cost £4.75
Hammond et al. 1997	Existing scheme evaluation (retrospective)	200 adults: Age ≥18 yrs	GP referral	3 sessions/wk	12 wks	2 x LC-based sessions 1x home- or club-based session	1 LC session free of charge for first 6 wks
Martin and Woolf-May, 1997	Existing scheme evaluation (retrospective)	77 adults: 64% female Mean age 53 yrs 35 'finishers' 42 'non-finishers'	GP referral	20 sessions	10 wks	Gym-based	
Jackson et al. 1998	Existing scheme evaluation (retrospective)	686 adults	GP referral		10 wks	Gym-based	Cost £1.50 - £2.00 per session
Dugdill and Graham (2004)	Existing scheme evaluation	667 adults: 62% female Largest age category 46-60 yrs	GP referral	Dependent on consultation	14 wks	LC or gym-based	
Harrison et al. 2005	Existing scheme evaluation	6610 adults 60.8% female Mean age 51.3 yrs	Referral from general practice (by GP and other health professionals)	1-hr consultation with exercise officer: tailored advice and information, 12-wk leisure pass for subsidised use of any council facilities, ≥2 facility-based sessions/wk encouraged	12 wks	LC-based and other exercise encourage	Subsidised use of local authority leisure facilities

Authors	Type of study	Sample characteristics	Recruitment method	Exercise programme/ treatment groups	Duration of program / follow-up	Type/Location	Other info
RANDOMISED CONTROLLED TRIALS							
Taylor et al. 1998	RCT (existing scheme)	142 adults with modifiable CHD risk factors: 63% women Mean age 54 yrs (40-70 yrs) 97 intervention 45 control (randomised 7:3)	Identified from practice register – mailed by GP/ research team	i. Intervention - $\leq$20 x 1-hr sessions (+ lifestyle assessment, exercise prescription, goals setting, advice on equipment) ii. Control - No further intervention	10 wks	Gym-based	All patients received an assessment, and CHD prevention leaflets Exercise sessions: - half price (£1.30) - supervised
Munro, 1997	RCT (experimental)	Age 65-99 yrs (least active 20% from baseline survey) 530/2301 responded	Contacted by researchers	i. Intervention - 2 x 1.5 hr exercise classes/ wk. Encouraged activities outside of the classes ii. Control - classes not offered	2 yrs	Church halls, community centres, and residential homes	Free of charge
Stevens et al. 1998	RCT (experimental)	714 adults: Mean age 59 yrs (45-74 yrs) 58% women 363 intervention 351 control	Contacted by researchers	i. Intervention – personalised exercise programme following consultation ii. Control –info on local facilities, physical activity and health	10-wk	LC and home-based activities	No provision of structured sessions – program designed to increase current activity
Harland et al. 1999	RCT (experimental)	523 adults: 59% women Age 40-64 yrs	Identified by GP in routine appt, contacted by researchers	i. 1 x 40 min motivational interview ii. 1 interview + 30 vouchers for free use of facilities iii. Up to 6 interviews iv. Up to 6 interviews + 30 vouchers v. Control – no further intervention	12 wks	Local leisure facilities	All participants received baseline assessment, info on physical activity, local facilities, and advice

LC, leisure centre

Table 5.2 Main attendance-related and perception outcomes of evaluations and RCTs

Authors	Measurement of attendance	Response rate	Attendance Outcomes	Participant comments relating to schemes	Authors comments	Comments
EVALUATIONS						
Lord and Green 1995	Attendance of assessments at 10 wks	N/A	60% up take (252/419) 18.4% attended at 10 wks Women vs. men: 69% vs. 51% uptake 21.3 vs. 13.3% at 10 wks 18.1 vs. 11.4% at 6 months Characteristics of attenders: female, part-time workers, retired (aged >55 yrs), already active	Reasons for dropout: illness, injury, holiday, and sessions stopping for school holidays	Disappointing attendance rates Dropout rate at 10 wk may be partially attributable to high deprivation in the area	Class attendance was not monitored Significance levels when comparing groups not given, just percentages No data on dropouts and no control group - cannot attribute outcomes to the scheme
Hammond et al. 1997	Attendance of assessments 12 wks	N/A	20% attendance at 12 wks (two yrs after scheme est.) 56% attendance at 12 wks (3 after scheme est. following changes to scheme)	Reasons for referral: weight reduction (43%), improve fitness (14%), anxiety/depression (11%), arthritis (10%), and reduce BP (7%)	Recommendations for GPERS, including: - tailor to population demographics - identify non-adherers early - variety and flexibility of exercise session	Much of the report reviews previous research Changes made after 2 yrs address commonly cited reasons for non-attendance (see text)
Martin and Woolf-May, 1997	Attendance of 20 sessions over 10 wks and/or attended final assessment at 10 wks	N/A	60 (12%) classed as 'finishers' No significant differences between groups (age, sex, CVD/CHD risk factors)	Reasons for non-completion: illness and injury, work pressures and time, wanting to go with someone, and transport problems Positive and negative experiences of the gym reported by all participants	Evaluation process not part of the scheme – resulted in incomplete information Methodology too crude to measure determinants of attendance	Method of assessing attendance not specified Small sample Study highlights importance of data routine collection
Jackson et al. 1998	Attendance of exercise sessions from LC records Attendance of assessment at 10 wks	N/A	Attenders n=466 Non-attenders n=220 (responded to questionnaire)	Experiences of attenders vs. non-attenders: - 92% vs. 70% enjoyed the scheme - 96% vs. 70% reported benefiting - 96% vs. 85% would recommend scheme - 55% vs. 31% thought scheme affected current activity levels	Importance of studying non-attenders	Brief conference report - lacks detail Response bias - greater proportion of attenders returned questionnaires Objective measurement of attendance but rates not given Non-attenders were excluded as LC records were not available No baseline assessment – cannot measure changes

Authors	Measurement of attendance	Response rate	Attendance Outcomes	Participant comments relating to schemes	Authors comments	Comments
Dugdill and Graham 2004	Attendance of assessments at 0, 7 and 14 wks	N/A	43% at 0 wks only (n=287) 15% at 0 + 7 wks only (n=100) 42% at 0, 7 + 14 wks (n=280) Attendance of all assessments: 49% in men vs. 37% in women Increased with age Dependent on reason for referral		14-wk too short to expect significant physiological change Importance of monitoring non-attenders Importance of targeting those most in need of physical activity	Non-attenders not recorded – no true control group
Harrison et al. 2004	Uptake of referral: attendance of first session	N/A	Uptake: - 79% overall (5225/6610) - Highest in ages 25-74 yrs - higher in referrals for mental health, fitness - not affected by deprivation or health professional characteristics		Few sedentary people referred Indicates a failure to meet the needs of younger and older adults The majority of patients referred by a small number of general practices	Strengths: - large sample - data from point of referral - efforts to socio-economic the profile participants Weaknesses: - ward level socio-economic measurement - attendance of first consultation only reported
RANDOMISED CONTROLLED TRIALS						
Taylor et al. 1998	Attendance of exercise sessions from LC records	345 contacted 240 responded (70%) 142 participated (41%) 83 attended ≥1 session (out of intervention group n=97)	Mean = 9.1 sessions 13% attended 0 sessions 68% attended ≥5 sessions 41% attended ≥10 sessions 28% attended ≥15 sessions 17% attended all 20 sessions Intervention group: 63% women at baseline (n=97) 53% women at 10 wks (n=40) Not related to age, sex, employment status, occupation type, education level, housing type, marital and family status Greater attrition in intervention group	Feelings towards scheme at 8 wks: 50% positive 35% mixed 15% negative Criticisms: lack of staff support, crowded/noisy exercise room, inconvenient times	Selection of appropriate patients and strategies to improve attendance will maximize benefits Well-perceived but poor attendance Those with most to benefit were less likely to enter and remain in the study	Strengths: - Measured effectiveness of existing scheme - Objective measurement of attendance - Regular follow-up - Controls had no contact with researchers/exercise professionals - Some socio-economic profiling of participants Weaknesses: - Recruitment by researchers Complete data only available for 50% (n=71) - Exclusion of people that might be targeted by other schemes (diabetes, MI, angina)

Authors	Measurement of attendance	Response rate	Attendance Outcomes	Participant comments relating to schemes	Authors comments	Comments
Munro, 1997	Not specified	2307 contacted Response not given	23% uptake (n=530): Higher in women cf. men (26% vs. 18%) Higher in most cf. least active at baseline (50% vs. 10%) Sessions attended in 10 months: Mean = 25 sessions (men and women) Fell sharply with age Least and most active at baseline attended fewest sessions	Barriers to attendance: - Pre-existing illness/disability (arthritis, etc). - Emotional barriers (lack of confidence, etc) - Self-perception (too old, etc) - Practical issues (time, transport, etc)	1 in 4 old people might attend exercise sessions Important barriers must be overcome Local health professionals need to promote schemes Most and least active participants less likely to continue attending	Strengths: One of few studies to focus on issues of recruitment and barriers Weaknesses: Preliminary report of ongoing RCT and lacks detail on: - Participant numbers - Method of monitoring attendance - Significance of outcomes and corresponding data Selection bias – better uptake in most active Recruitment by researchers
Stevens et al. 1998	Attendance of assessments at 0 and 10 wks	2253 contacted 1288 responded (57%) 714 participated	35% at 0 wks (n=126) 25% at 10-wk (n=91) 57% response to recruitment questionnaire: Higher in women cf. men (63 vs. 46%) Increased with age	LC use increased in least active participants Participants reported exercising more away from LC	Process of recruitment is most important variable – cost could be halved with a better recruitment strategy	Strengths: - Randomisation method described - ITT analysis (dropouts assumed to have unchanged activity levels) Weaknesses: - Recruitment by researchers Attendance of sessions not monitored - Poor response rate - Control group received some info More exercising away from facilities - demonstrates independent exercising
Harland et al. 1999	Attendance of interviews after 12 wks Use of vouchers at facilities after 12 wks	2497 eligible patients contacted 734 agreed to participate (28.6%) 523 participated (21%)	Attendance of interviews: 82% of intervention groups attended ≥ 1 Median attended = 3 (in group offered 6) Higher in groups given vouchers (86 vs. 77%) Voucher use: 670 vouchers used 69% at LC, 31% at swimming pool 41% participants used at least 1 voucher Use was higher in participants offered 6 interviews (44% vs. 27%)		Most intensive intervention was most effective but did not affect long-term activity change Need to reconsider the use of scarce resources to fund exercise prescription schemes	Strengths: - Good quality RCT, single blinded with clearly described method of randomisation Weaknesses: - Socio-economic and demographics at baseline but data not related to attendance - No true control group received substantial intervention - Exercise not prescribed – not representative of ERS - Unrealistic intervention for primary care - Recruitment by researchers

5.5.3 Discussion of review findings

Intervention design

Table 5.1 presents details relating to the design of PARS and RCT exercise interventions. There were no marked or consistent differences between the interventions in RCTs or existing schemes, which is not surprising considering that RCTs effectively try to simulate 'real life' schemes. They generally began with an assessment or consultation with an exercise professional (Dugdill and Graham, 2004; Hammond et al., 1997; Hardman, 1999; Harland, White, Drinkwater et al., 1999; Harrison et al., 2005a; Lord and Green, 1995; Stevens, Hillsdon, Thorogood et al., 1998; Taylor et al., 1998), although not specified in some cases (Martin and Woolf-May, 1999; Munro, 1997). Where frequency was specified, participants were encouraged to attend two (Harrison et al., 2005a; Martin and Woolf-May, 1999; Taylor et al., 1998) or three (Hammond et al., 1997; Lord and Green, 1995) exercise sessions per week. The duration of interventions was ten weeks (Jackson, 1997; Lord and Green, 1995; Martin and Woolf-May, 1999; Stevens et al., 1998; Taylor et al., 1998), twelve (Hammond et al., 1997; Harland et al., 1999; Harrison et al., 2005a) or fourteen weeks (Dugdill and Graham, 2004). One RCT lasted two years (Munro, 1997), despite reporting ten-month outcomes.

All interventions were primarily facility-based. Only two evaluations (Hammond et al., 1997; Harrison et al., 2005a) and one RCT (Stevens et al., 1998) reported the inclusion of additional activities. Financial incentives were offered in some evaluations and trials, in which exercise sessions were either free of charge (Harland et al., 1999; Munro, 1997) or available at a reduced rate (Hammond et al., 1997; Harrison et al., 2005a; Lord and Green, 1995; Taylor et al., 1998). Stevens et al. (1998) did not specify whether or not participants had to pay.

The degree of individualisation and flexibility in programmes was only made clear in three of the six evaluations (Hammond et al., 1997; Harrison et al., 2005a; Lord and Green, 1995); in the remainder, exercise professionals recommended the most appropriate types of activity. The requirement to attend specific sessions was not apparent in any evaluations. Two RCTs offered individualised exercise programmes to intervention participants, both using initial consultations to advise individuals on increasing activity levels through attending the leisure facilities (Stevens et al., 1998; Taylor et al., 1998). In contrast, the Munro (1997) intervention was more rigid, comprising exercise classes for older adults. Despite less flexibility in terms of the format, classes were held at a variety of less formal venues such as community centres and church halls. Finally, Harland et al. (1999) offered motivational interviews (single or multiple), with or without vouchers for free access to leisure facilities. The use of vouchers gave participants flexibility in terms of activity type, times, and facility. Implications of intervention design in relation to attendance are discussed subsequently.

Recruitment

In the evaluations, recruitment tended to be through GP referral during routine appointments (Dugdill and Graham, 2004; Hammond et al., 1997; Harrison et al., 2005a; Jackson et al., 1998; Martin and Woolf-May, 1999). Lord and Green (1995) used voluntary health screening visits at GP practices, whereas Hammond et al. (1997) performed additional recruitment through community screening and patient self-selection. In contrast, it was the researchers not health professionals who recruited participants in RCTs (Harland et al., 1999; Munro, 1997; Stevens et al., 1998; Taylor et al., 1998). Eligible patients were identified using practice registers (Munro, 1997; Stevens et al., 1998; Taylor et al., 1998) with one exception in which individuals were approached during routine appointments, and subsequent postal recruitment (Harland et al., 1999).

The differences between these recruitment strategies could have implications for recruitment response. As discussed in Section 4.4.4, it is unlikely that people would respond to researchers and GPs in the same way. On the one hand, some hold GPs in esteem, especially older adults (Hardcastle and Taylor, 2001; Stathi et al., 2003), which often comprise a substantial proportion of PARS participants. As a result, a recommendation from a GP might improve or even be necessary for uptake and attendance (Stathi et al., 2003). On the other hand, some health professionals perceive barriers to referral (Graham et al., 2005; McKenna et al., 1998) and do not prioritise physical activity promotion (Section 4.3.3). Therefore, many health professionals will be more reluctant to promote schemes than researchers who have a vested interest in recruitment. Fielder et al (1995) learned this lesson. Researchers were forced to abort the study as their sole reliance on GP referrals resulted in just thirty-eight participants being recruited after four months.

Sample characteristics

The range in sample size was similar in evaluations and RCTs (Table 5.1). Generally, characteristics of participants were not well reported and tended to be limited to age and gender, with SEP reported in only two studies (Harrison et al., 2005a; Taylor et al., 1998). Participants were exclusively adults (≥18 yrs) in both evaluations and RCTs (Table 5.1). Age and gender distributions were in keeping with previous findings (Fox et al., 1997; Hillsdon, 1998). Men tend to be under-represented in PARS, with women accounting for approximately sixty *per* cent of participants in three evaluations (Dugdill and Graham, 2004; Harrison et al., 2005a; Martin and Woolf-May, 1999) and three trials (Harland et al., 1999; Stevens et al., 1998; Taylor et al., 1998). Participants were mostly middle-aged and older (Harland et al., 1999; Martin and Woolf-May, 1999; Stevens et al., 1998; Taylor et al., 1998). In RCTs this was the result of employing specific inclusion criteria. Aside from targeting age groups, two RCTs performed baseline surveys to identify less active individuals (Munro, 1997; Stevens et al., 1998), and one targeted individuals with modifiable CHD risk factors (Taylor et al., 1998). Specific patient targeting was not evident in any of the existing schemes. Few studies reported the condition for which participants were referred. Commonly reported reasons for referral were weight reduction (Dugdill and Graham, 2004; Hammond et al., 1997), hypertension (Taylor et al., 1998), musculoskeletal conditions and cardiovascular risk factors (Harrison et al., 2005a).

Unfortunately data were not available in any of the five evaluations to establish how many people were offered but refused a referral by their GP. Therefore, RCT response rates to invitations to participate were the only source of insight into the proportion of people who, if offered, would accept an exercise referral. There was a broad range of response rates: 70% (Taylor et al., 1998), 57%, (Stevens et al., 1998), 28.6% (Harland et al., 1999), and 15-20% (Munro, 1997). Indeed, researchers in the latter two studies with poor responses were those that resorted to additional recruitment measures to boost numbers; postal recruitment in one (Harland et al., 1999) and further letters, invitations to social events, and encouragement from primary health care professionals in the other

(Munro, 1997). However, probable differences in patient/participant responses to researchers and health professionals are a limitation.

In practice, referral is the gateway to PARS. Therefore, several points should be considered. First of all, over-referral of women suggests that generally lower physical activity levels in women compared with men (Section 3.3.1) might be addressed through PARS, in accordance with priority group targeting outlined in public health policy (Section 4.2). However, this may simply reflect gender differences in GP consultation rates (Section 6.3.1). Secondly, the high average age of participants demonstrates a need to target younger sections of the sedentary population. This is especially important in order to avoid the consequences of an ageing population which is living longer but increasingly suffering from lifestyle related diseases (Section 1.1). A qualitative investigation of referring health professionals revealed that none of the twenty-three interviewees thought of PARS in terms of prevention, only for reducing medication (Smith et al., 1996). Thirdly, more thorough patient profiling is necessary at the point of referral. The stage between referral by the health professional and uptake of referral is the first point at which potential participants may be lost. Only two published studies to date have reported characteristics of patients lost at this stage (Harrison et al., 2005a; Johnston et al., 2005). In order to better understand whether PARS are indeed 'widely available to the public' as intended (Department of Health, 2001b: p.6), more participant information is required from the point of referral. This could have several benefits: enable the development of strategies to maximise the efficiency of the referral process; to determine which sections of the population are likely to be neglected (e.g. lower socio-economic groups); and potentially, to modify schemes to target these groups.

Uptake of Referral

Following referral, the next step in the process is referral uptake, defined as attending the initial consultation or first exercise session. Rates of uptake varied widely in both RCTs and evaluations, with no consistent differences between them. Overall they were markedly lower than the sixty-seventy *per* cent reported by Fox et al (1997). This could be attributable to differences in rigour between published studies featured here and unpublished 'in house' evaluations that provided the bulk of data in the earlier review.

Three evaluations were retrospective with researchers recontacting previous participants (Hammond et al., 1997; Jackson et al., 1998; Martin and Woolf-May, 1999). Consequently, only those who had already taken up referral were included in analysis. Differences in data reported in the remaining evaluations and RCTs complicates what can be defined as 'uptake'. Three evaluations (Dugdill and Graham, 2004; Harrison et al., 2005a; Lord and Green, 1995) and one RCT (Stevens et al., 1998) reported attendance of initial consultations with exercise officers, and rates varied (35% to 79%). The scheme evaluation by Harrison et al. (2005) found that over three quarters of those referred from general practice attended the first consultation with the exercise officer (79%). The RCTs by Taylor et al. (1998) and Munro (1997) reported the proportion of participants that attended one or more exercise sessions. Uptake in the Taylor et al (1998) trial appeared even higher (86%); but as a proportion of the total number of people who responded to initial invitations (including those who dropped out prior to randomisation), approximately half of potential participants took up referral (n=83, 49%). Uptake was lowest in the trial that offered exercise classes to older adults (23%), possibly a result of the relative inflexibility of the intervention or the specific target population (Munro, 1997). Finally, Harland et al. (1999) found that most of the intervention group attended one or more interview (82%), whereas a far smaller proportion of participants who were given vouchers, used them (41%). Again, these figures are less encouraging when calculated as proportions of respondents who would have been offered interviews (approx. 58%) and vouchers (approx. 29%) before dropouts.

Attendance

Levels of attendance in evaluations were generally poor; three evaluations reported that between twelve and eighteen *per* cent of participants attended final assessments (Dugdill and Graham, 2004; Lord and Green, 1995; Martin and Woolf-May, 1999). Harrison et al. (2005a) did not report attendance following the initial consultation. Twelve-week interviews were conducted but attendance at leisure facilities was apparently not monitored and success or otherwise was judged on the basis of self-reported activity levels reported elsewhere (Harrison, Roberts and Elton, 2005b). In RCTs, Taylor et al. (1998) reported that twenty-eight *per* cent of intervention participants were considered to have 'high' attendance (15 out of 20 sessions) and Stevens et al. (1998) reported similar attendance at final assessment (25%). However, in the former trial, 'high attenders' (n=27) represented just sixteen *per* cent of the potential intervention group (n=168) before dropouts, which is more comparable with evaluations of existing schemes. Attendance was apparently lowest in the remaining two trials (Harland et al., 1999; Munro, 1997). Harland et al (1999) recorded a total number of vouchers for leisure facilities that were used (n=670), which equated to between three and four activity sessions per person (out of 30) over a three-month period. Finally, Munro (1997) reported that on average twenty-five exercise classes were attended by each person over ten months, equivalent to less than three sessions per month. The most encouraging attendance was reported in the PARS evaluated by Hammond et al (1997). The authors observed substantial improvements (increasing from 20 to 56%) one year after implementing several changes to the PARS programme (described subsequently).

When discussing attendance, it is worth considering how it was measured. Given the relative ease with which this could be achieved, it is somewhat disappointing that only one trial (Taylor et al., 1998) and one evaluation (Jackson et al., 1998) used leisure centre records to monitor the number of exercise sessions attended. Moreover, latter failed to report the outcome adequately. It should not be necessary to rely on simply recording the presence of participants at final assessments to determine successful attendance; yet this was the case in four studies [3 evaluations (Dugdill and Graham, 2004; Hammond et al., 1997; Lord and Green, 1995), 1 RCT (Stevens et al., 1998)]. This not only fails to discriminate between participants according to attendance levels but assumes that all those present at final assessment have attended regularly and equally throughout. Furthermore, there were no notable differences in quality of attendance measurement between evaluations of existing schemes and RCTs, which adds further weight to the argument against excluding from reviews studies that do not adhere to RCT methods (Blamey and Mutrie, 2004).

Characteristics of participants who took up referral and/or attended

Characteristics of participants who attended were even less well reported than at baseline and were provided in just four evaluations (Dugdill and Graham, 2004;

Harrison et al., 2005b; Lord and Green, 1995; Martin and Woolf-May, 1999) and two RCTs (Munro, 1997; Taylor et al., 1998). Harrison et al. (2005a) found no difference between uptake in men and women (78.9 *vs.* 79.2%). Despite better uptake in women in several studies (Dugdill and Graham, 2004; Munro, 1997; Taylor, 1999), subsequent attendance in men was higher (than women) in one study (Dugdill and Graham, 2004). Neither RCT found a relationship for gender (Munro, 1997; Taylor et al., 1998). One evaluation reported higher attendance in women (Lord and Green, 1995), although this was based on a relatively small final sample following eighty two *per* cent attrition (n=77 out of 419). Further, it is possible that the size of the study population (n=77) in the evaluation by Martin and Woolf-May (1999) could have masked a potential gender- (and age-) attendance association.

The relationship between age and attendance was generally inconsistent. Evaluations found that increasing age (Dugdill and Graham, 2004) and being retired (Lord and Green, 1995) were associated with better attendance. Conversely, the RCT of older adults reported a negative association (Munro, 1997), whereas Taylor et al (1998) reported no association. In a review of primary care-based health promotion, increasing age was found to reduce participation (Hillsdon et al., 1999) but being older was found to increase attendance in the more recent review of PARS-style interventions (Morgan, 2005). In the present review, age of attenders and non-attenders were not sufficiently well reported to determine the nature and direction of an age-attendance relationship (if one exists at all).

Other factors associated with increasing attendance included higher baseline activity levels thus reiterating the importance of response bias (Munro, 1997; Taylor et al., 1998), being in part-time work (Lord and Green, 1995) and the condition for which people were referred (Dugdill and Graham, 2004; Taylor et al., 1998). However, none were demonstrated consistently. In terms of SEP, Taylor et al (1998) found that participant employment status, occupation type, education and housing type were all unrelated to attendance. Similarly, Harrison et al (2005a) found that deprivation of participants areas of residence lived was unrelated to referral uptake, with the exception of those referred for respiratory conditions. Despite conducting a rigorous RCT, Taylor et al (1998) did not apply such rigour to socio-economic measurement. The authors not only failed to justify the selection of socio-economic variables but failed to present data and made no reference to socio-economic outcomes or variables in either the methods or discussion sections. They even failed to specify whether data were obtained at the individual or area-level. Harrison et al (2005a) provided more detail and some discussion relating to their use of the Index of Multiple Deprivation (DETR, 2000) to reflect deprivation. Although open to criticism, such as using ward level analysis, this represented the first attempt to monitor participants of different SEP from the point of referral. A more detailed critique of this approach is provided in Section 12.3.2.

The content and quality of information available on participant characteristics raises some important issues. Firstly, despite being less likely to be referred for physical activity, there is some indication that men are at least as likely (if not more) than women to successfully attend schemes (Dugdill and Graham, 2004) and possibly to take up the referral. Further data are required to confirm this but if so, greater attrition in women who have been identified as a priority group, could be a concern. Secondly, lack of data in many studies highlights a clear need to routinely collect more detailed participant information and to track individuals' progress through schemes. From the evidence discussed it is not possible to draw any conclusions regarding which population groups are most likely to attend. Participant profiling at the point of referral, attempted in just one study (Harrison et al., 2005a), would enable monitoring of participant progress in order to determine which population groups are most prone to drop out, and at which stage of the referral process. This would allow programme modifications to reduce attrition.

Thirdly, a matter of particular concern arising from this review is the failure of all but two studies (Harrison et al., 2005b; Taylor et al., 1998) to report socio-economic characteristics in relation to attendance; although neither found an overall relationship. There is consistent evidence of a positive association between SEP and physical activity and general participation (Baum, Bush, Modra et al., 2000; Coggins et al., 1999; Lindstrom et al., 2001; Office of National Statistics, 2004; Owen, Leslie, Salmon et al., 2000). There is further evidence that physical activity interventions tend to attract the white, middle-class, well-educated members of the population (Adams and White, 2003; Bock et al., 2001; Godin and Shephard, 1983; Hillsdon and Thorogood, 1996; Hillsdon et al., 1999; McKay et al., 2003; Simons-Morton et al., 2000). Therefore, it is necessary to determine whether or not substantial numbers of the British population who live in deprived areas are also deprived of the opportunity to participate in schemes like PARS. Some suggest that this is the case and that lower socio-economic groups would respond well if appropriately targeted (Lowther et al., 2002).

Characteristics of successful schemes

In the present review, success of schemes was judged on the basis of participant attendance. Due to generally high attrition and variable study design, as reported elsewhere (Morgan, 2005), it was difficult to relate intervention design to attendance. With the exception of Munro (1997), whose two-year intervention had the lowest rate of uptake (and poor subsequent attendance), there was little variation in the duration of interventions. All involved attending facilities and only two studies included home-based activities (Munro, 1997; Stevens et al., 1998). The level of tailoring, supervision, and contact with staff were on the whole inadequately described. Half of the studies offered some kind of financial incentive (Hammond et al., 1997; Harland et al., 1999; Lord and Green, 1995; Munro, 1997; Taylor et al., 1998), two of which were conducted in deprived areas (Harland et al., 1999; Lord and Green, 1995). Again, the extent to which this influenced uptake and attendance is unclear. This further emphasises the need for improvements in the measurement and reporting of attendance outcomes in order to identify desirable scheme characteristics. However, the extremely high rate of uptake (79%) in the scheme evaluated by Harrison et al (2005a) might be attributable to the role of the 'exercise officers' who were responsible for contacting participants following the primary-care referral to initiate consultations.

Reasons given by participants for dropping out and how they perceived schemes can provide some insight into aspects of PARS that promote or discourage attendance. Two evaluations reported such reasons, which mostly related to practical barriers to attending a leisure facility. They included illness and injury (Lord and Green, 1995; Martin and Woolf-May, 1999), lack of time, work pressure, wanting to attend with someone, transport problems (Martin and Woolf-May, 1999), and sessions being interrupted during school holidays (Lord and Green, 1995). Comments from participants in two evaluations indicated that schemes were generally perceived favourably, even by those who did not complete programmes (Jackson et al., 1998; Lord and Green, 1995). Specific positive comments related to the appropriateness of programmes and supportiveness of staff (Martin and Woolf-May, 1999). Negative comments corresponded with the reasons cited for attrition and were common to themes that have emerged from qualitative investigations of PARS (Hardcastle and Taylor, 2001; Stathi et al., 2003). They included to inappropriate level of programmes (Martin and Woolf-May, 1999), lack of staff support (Martin and Woolf-May, 1999; Taylor et al., 1998), disliking the gym environment (Taylor et al., 1998), and inconvenient session times (Taylor et al., 1998). Barriers cited by participants in the Munro (1997) trial included the desire to attend with someone and practical barriers, such as transport. Therefore, despite general positive and negative comments regarding specific scheme aspects, reasons for dropouts were mostly related to the participants and the constraints of their personal circumstances (e.g. lack of time; work commitments; social support). Indeed, these atone with environmental influences posited as explanations for lower physical activity in certain population groups (Sections 3.3.4; 3.3.4; 3.4.3)

The evaluation by Hammond et al (1997), a rare example of a scheme in which regular evaluation and modification were integral components, further emphasised the importance of these points. Scheme modifications addressed the types of issues described and substantial corresponding increases in attendance were reported. Changes included the provision of classes specifically for PARS participants and specific groups (e.g. obese individuals), provision of transport, additional sessions for those who worked, sessions for close others, and increased appreciation of client needs by leisure centre staff.

5.5.4 Conclusions from systematic review

The present review has raised several important issues from a relatively small number of studies. Firstly, attrition in British PARS is high; approximately eighty *per* cent of participants who take up referral drop out before the programme ends. This suggests that many participants are inappropriately referred as previously noted in relation to PARS (Johnston et al., 2005; Riddoch et al., 1998), thus emphasising the importance of effective patient targeting. Some participants might be dissatisfied with the service they receive but their perceptions of schemes are generally positive. It is more likely that regular attendance at leisure facilities might simply present too many barriers for many people, which could be reduced by scheme modifications or for some groups, require diversification away from the facility attendance model.

Second, the lack of attention given to obtaining attendance data, even in RCTs, was disappointing. Unlike physical activity measurement, accurate measurement of attendance should be achievable with relative ease. It does not require use of expensive electronic devices but simple processes put in place to record attendance of participants at facilities. The importance of collecting reliable data to enable the evaluation of physical activity interventions generally (DCMS, 2002; Department of Health, 2005b) and specifically in relation to PARS (NICE, 2006), has been recognised. This would enable the identification of existing associations between attendance and other factors, such as participant characteristics and scheme components, which were not evident in the present review. Moreover, attendance arguably represents the most important outcome [although this is disputed (McNair, Graham, Dugdill et al., 2005)] upon which most others depend. It is difficult to make inferences regarding potential benefits of participation if attendance is unknown. It could be argued that the offer of a physical activity referral might be beneficial through moving a person one stage closer to behaviour change. However, other far less costly and labour-intensive interventions could achieve this (e.g. brief GP negotiation). The purpose of PARS is to provide an opportunity for sedentary or insufficiently active individuals to become more active in a safe and supervised environment. Ideally, those who are simply not ready to undertake such an activity would not be referred, which would reduce the substantial dropout.

Thirdly, as recognised elsewhere (Dugdill and Graham, 2004; Estabrooks and Gyurcsik, 2003) we cannot continue to ignore those who fail to take up referral or dropout of schemes as they are probably the least active and least motivated members of the population who would benefit most from increasing physical activity. To avoid this requires collection of data on participants from the point of referral to compare those who fail to progress past this stage, dropout at subsequent stages, and successfully complete programmes. Only two published studies have reported data from this initial stage in the referral process. Johnston et al (2005) analysed data only from those who dropped out prior to taking up referral (refer to Section 12.3.1, *post-hoc analysis*), whereas Harrison et al (2005a) only reported data for uptake. Subsequent attendance was not monitored. Ideally data would be available on those who refuse referral but in practice this may not be feasible. However, by routinely collecting data at initial referral and exploring differential progression in relation to socio-demographic characteristics, we might move a step closer to understanding factors that influence which participants schemes are most appropriate for. These themes are developed in the context of findings from the present study in Sections 12.3.1 and 12.3.2.

The fourth point is related to this idea and specifically, the inadequacy of participant profiling to date. More data must be collected on participants. Physical activity and participation is known to be lower in certain population groups including women (Section 3.3.1), older people (Section 3.3.2) and lower socio-economic groups (Section 3.4.2). Yet, the groups that appear most likely to volunteer for physical activity-related research and interventions do not necessarily correspond, often being middle-aged and more educated or affluent (Adams and White, 2003; Bock et al., 2001; Dunn, 1996; Godin and Shephard, 1983; Hillsdon et al., 2005; Hillsdon and Thorogood, 1996; Hillsdon et al., 1999; McKay et al., 2003; Simons-Morton et al., 2000). It might, therefore, be expected that differences between population groups exist in accepting the health professionals referral, referral uptake, and subsequent attendance or dropout. Moreover, it is unlikely that such differences would be in favour of those with the greatest need to whom such interventions should be targeted. Clearly, the existing data presented in this review provide an incomplete picture regarding these issues.

In addition to this, it is important to consider socio-demographic differences in access to and use of primary health care services (Sections 6.3.1 and 6.4.1) because both are necessary in order to be given the opportunity to participate in PARS. Indeed, depending on the relative access to the primary care services and leisure facilities, an individual's area of residence could increase or decrease their chances of obtaining a referral and of attending exercise sessions (respectively). It is imperative that such possibilities are further explored but possibly even go a step further than in the NICE consultation (NICE, 2006) by considering the role of PARS in public health, in terms of their relevance to important public health issues, such as tackling socio-economic inequalities in health. Failure to collect sufficient data on all referrals could result in the continued exclusion of certain population groups, probably those with most to gain.

Finally, the potential implications of differences between RCTs and 'real life' schemes are increasingly recognised. More energy should be directed towards high quality applied research involving 'real life' PARS. For this to be successful, those involved in schemes must recognise the importance of routinely collecting accurate and complete data to (Department of Health, 2001b; Martin and Woolf-May, 1999). Relying on retrospective evaluations is not satisfactory and processes should be implemented at the design stage to avoid this compromise.

*

Chapter 6

Chapter 3 described some of the evidence for lower physical activity participation in lower socio-economic groups, women, older people and rural dwellers. Chapter 4 described the development of current physical activity related public health policy in Britain, of which PARS are a feature as the most widespread physical activity intervention. It is clear from Chapter 5 that there is a distinct lack of information relating to possible bias in access to PARS. One way to further explore relative accessibility in different population groups is through differential access to and use of primary care, in particular, general practice. This is the focus of Chapter 6.

Chapter 6:

Socio-demographic patterning of 'access to' and 'use of' healthcare

6.1 Introduction

The review in the previous chapter (Section 5.5) demonstrated a deficiency in evidence regarding the existence of systematic bias in *who* gets referred, and *who* is most likely to attend PARS in Britain. The present chapter helps to address the first point by exploring differential access to, and use of health services in Britain according to socio-demographic group and area of residence. First of all, access to and use of primary care services are considered as both are necessary in order to obtain a physical activity referral. Secondly, bias in referrals to secondary care is discussed, to identify any existing general trends that could be applicable to physical activity referrals. Finally, because the PARS that is the focus of the present thesis was originally intended for disease prevention (Section 8.2), the final section considers use of preventive health services.

6.2 'Access to' and 'use of' primary health care

The concept of equity in access to health care has been a central objective of the NHS since its inception in 1948 and has again been prioritised in recent years through public health policy (Gulliford, Morgan, Hughes et al., 2001). Over thirty years ago, the Inverse Care Law proposed that the availability of *good* medical care varied inversely with the need of the population (Tudor Hart, 1971). According to this, people most likely to experience ill-health, such as those living in deprived areas, have their greater health need compounded by poorer access to good health care. There is no shortage of investigations into healthcare provision and use but the evidence remains somewhat patchy and difficult to interpret (Goddard and Smith, 2001; Gulliford et al., 2001). Moreover, a review of studies into healthcare access revealed some confusion surrounding the concepts and subsequent measurement of *access to* and *use of* health services (Goddard and Smith, 2001). Therefore, before discussing socio-demographic patterning of these variables it is important that they are defined.

Different definitions of variable in complexity have been used to describe *access* to healthcare (Goddard and Smith, 2001; Gulliford et al., 2001; Tudor Hart, 1971). Throughout this chapter (and thesis) access will refer to *physical access*; i.e. the availability of services, usually in terms of proximity. *Use of* services on the other hand, will refer to *realised access*, primarily in the form of primary health care consultation. This simple distinction was chosen for several reasons. Firstly, the present study focuses on whether individuals' socio-economic context or urban-rural location were factors in determining access to a physical activity referral. Clearly this is related to physical access. Secondly, different socio-demographic population groups exhibit different behaviour regarding health service use. Therefore, the propensity of population groups to visit primary care will provide insight into the likelihood of obtaining a physical activity referral. Thirdly, this circumvented conceptual problems that can arise from relying on *use* of health care services as a proxy measure for *access* (Goddard and Smith, 2001), which assumes equality across the population in peoples' propensity to use available services.

Theoretically, *access* is an objective construct that is under the control of the healthcare service providers rather than the users. Conversely, *use* of services is potentially subject to the influence, not only of access, but numerous other factors related to the individual, such as their values, beliefs, and social and cultural norms associated with health and health behaviour (Campbell and Roland, 1996). As discussed in relation to physical activity (Section 3.3.4; 3.3.5; 3.4.3), these kinds of influences relate to social and physical environmental influences that act differentially on different socio-demographic groups.

Physical access to health care services is considered in relation to the characteristics of patients' area of residence (in terms of deprivation and urban-rural location). Conversely, in addition to health status and accessibility, gender and age characteristics are more likely to be associated with an individual's propensity to use services. Therefore, in relation to *use*, age and gender were also considered.

6.3 Gender and age

6.3.1 Gender, age and use of primary health care services

As discussed in Section 2.2.2, gender differences in health vary according to age, demonstrating an interrelationship linking gender, age and health. As a result of this and the inherent association between health status and use of health services (Campbell and Roland, 1996), it was logical to consider health service use in relation to both gender and age simultaneously.

General practitioners act as 'gate keepers' to the NHS, providing the first point of contact for the majority of the British population. Over a three-year period approximately ninety-five *per* cent of the British population visit their GP at least once (Taylor, 2003). Campbell and Roland (1996) recognised that, "the decision to consult a general practitioner is based on a complex mix of physical, psychological and social factors" (Campbell and Roland, 1996: p.79). Therefore, marked gender differences in GP consultation rates are the result of both health and non-health factors, including different social roles and cultural norms linked with gender (Galdas et al., 2005; Malterud and Okkes, 1998).

Qualitatively different healthcare needs in men and women are thought to be responsible for quantitative gender differences in health care utilisation, with women generally being the more frequent users (Campbell and Roland, 1996; Gulliford et al., 2001). Figure 6.1 presents data from the General Household Survey 1998-1999 comparing GP consultation rates in men and women. When the data are averaged to compare consultations in men and women of all ages, it emerged that the proportion of British women who consulted their GP during the two weeks prior to the survey was thirty-three *per* cent higher than in men (18 *vs.* 12%). However, Figure 6.1 clearly demonstrates that in the female excess in GP consultations reduces with increasing age; the twofold difference in the youngest age group (16-24 yrs) becomes markedly reduced by late-middle-age (55-64 yrs), disappearing altogether in those aged seventy-five and older.

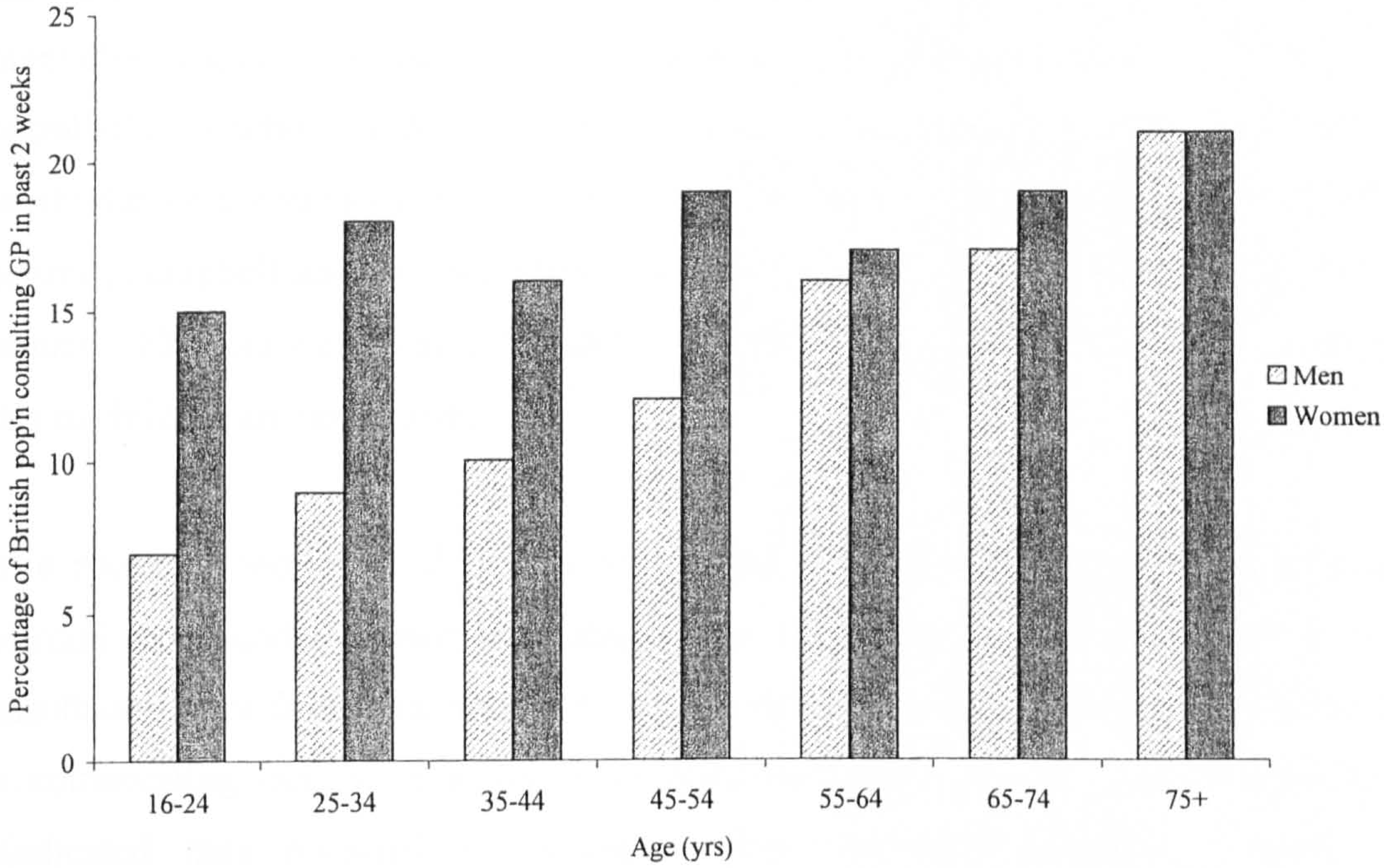

Figure 6.1 Proportion of British population visiting the GP in past two weeks

This difference between consultation behaviour of British men and women that reduces over the life course is broadly supported in the literature. Not only is the presence of a gender difference consistent but the magnitude of this discrepancy is often found to be of a similar order. Approximately sixty *per* cent of consultations in general practice appear to be made by women (Kapur, Hunt, Lunt et al., 2005; Ronalds, Kapur, Stone et al., 2002), and gender distributions in the use of some other types of healthcare service, including mental health care and community health care, are reportedly similar (Keene and Li, 2005). Interestingly, before general rates of referral from primary care are even considered, the overall direction and magnitude of this gender difference concurs with gender distributions commonly reported in PARS (Section 5.5.3).

Age variation in gender differences (Carr-Hill, Rice and Roland, 1996; Morris, Sutton and Gravelle, 2005) prevents generalisations across the population. A study of patients from sixty GP practices (n=502,493) in England reported that changes in GP consultation rates across three groups of increasing age (0-14, 15-64, >65 years) were generally U-shaped in men, whereas in women a more linear increase was observed. Being in the middle age group (15-64 years) was associated with a greater likelihood of consultation in women and these relative differences were fairly consistent across different socio-economic groups (Carr-Hill et al., 1996). However, interpretation is made difficult by the broad age bands and despite controlling for numerous other potentially confounding variables, it is unlikely that health status was sufficiently controlled for (authors used a 'permanent sickness' variable). Nevertheless, a U-shaped distribution of consultation rates across the age range in men is consistent with earlier surveys (Campbell and Roland, 1996). This is not replicated in Figure 6.1; probably because GHS data were limited to adults ($\geq$16 yrs) and, therefore, greater consultation rates in children are not shown.

More recently, Morris et al (2005) demonstrated the importance of controlling for potential confounders when examining this relationship. Age distributions for consultation rates from men and women were reported both before and after adjusting for confounding factors, of which morbidity was singled out as the most important. Unadjusted data revealed a relatively linear age-related increase in women's consultation rate. In men the pattern was U-shaped, with a decline from childhood until the age of thirty years, that steadily increased to old age. When morbidity and other confounders were included in the model, the same U-shaped pattern in men's consultation rate persisted, albeit less marked. In women, however, the direction of the relationship was reversed, with a gradual decrease in GP consultations from childhood to old age. Clearly, patterns from these few studies provide some support for the over-representation of women in PARS. Age-related patterns are less easily compared due to inadequate information from PARS research (Section 5.5.3).

It is possible to gain some insight into the reasons behind differences in health help-seeking behaviour in men and women by comparing the nature of consultations. In addition to using outpatient medical services more frequently than men, women are also more likely to consult for preventive purposes (Malterud and Okkes, 1998). This could explain why the gender difference is far greater in younger adults, who tend to be more physically healthy (Section 2.2.1). Women have also been reported to consult more readily with matters relating to psychological distress or psychiatric problems, whereas men tend to present with somatic symptoms (Briscoe, 1987; Kapur et al., 2005; Zatinge, Verhaak and Bensing, 2005). In keeping with this trend, Briscoe (1987) identified health status and social role factors as important determinants of men seeking help, whereas in women, psychological predisposition was more important (Briscoe, 1987). Thus the weight of evidence seems to suggest that women are more likely than men to consult prior to the onset of physical symptoms (i.e. during young adulthood), and this difference will reduce as the prevalence of physical ill-health increases with age (Section 2.2.1).

Male socialisation of health help-seeking behaviour

Qualitative studies have taken this idea further by interviewing both patients and healthcare professionals. Focus groups have reported that American GPs perceive that men seek help through more indirect routes, using friends or partners, whereas women are more likely to consult health professionals directly (Tudiver and Talbot, 1999). This corresponds with the notion that women can act as *gatekeepers* of family demand for health care, often providing the primary source of informal advice for the rest of the family (including men), prior to seeking professional help (Campbell and Roland, 1996). Moreover, this corresponds with the earlier discussion about greater domestic responsibilities in women, which can have adverse consequences for psychological health (Section 2.2.3) and physical activity levels (Section 3.3.5).

However, gender differences in consultation are not simply a reflection of poorer psychological health in women. There is a growing literature that recognises the adverse effects of male socialisation on men's health through a reluctance to seek help (Aoun et al., 2003; Doyal, 2001; Galdas et al., 2005; Tudiver and Talbot, 1999). A recent review of qualitative and quantitative research identified a recurrent theme of men delaying before seeking medical help. Authors generally attributed this to men conforming to masculine behavioural stereotypes by not expressing health concern and displaying a lack of willing to admit a need for help. Indeed, it is thought that men perceive such behaviour as a sign of weakness and feel it inappropriate to expose vulnerabilities or to disclose intimacies with others, sometimes even the GP (Huggins, Somerford and Rouse, 1996; Tudiver and Talbot, 1999)[21]. When symptoms are manageable, it is preferable to simply tolerate them. Yet, increasing severity of symptoms increases the acceptability of seeking help, especially when encouraged to do so by one's partner (Huggins et al., 1996).[21] In Britain, this not only presents a challenge to health professionals who need to recognise the psychological difficulties of male patients who do consult, but to health promoters whose messages relating to

[21] Huggins et al cited in Aoun et al (2003)

preventive measures are less likely to be heard or acted upon by men (Doyal, 2001). The latter point is discussed further in Section 6.5.3.

In summary, apparent gender differences in social influences provide a plausible explanation for the large discrepancy between consultation rates in young men and women. In women, the conflict between home and work responsibilities and a lack of reciprocal social support from their family/spouse is thought to be detrimental to psychological health, increasing the frequency of consultation. In men, conforming to masculine stereotypes often delays help seeking until physical symptoms are perceived as serious enough. Moreover, men are more likely to seek initial support and advice from their female partner. The reduction in this difference with increasing age is a likely reflection of the rising frequency and severity of ill-health becoming the dominant factor for both men and women.

6.3.2 Gender, age and referrals from primary care

At the primary-secondary care interface, the primary care team regulates access to secondary care services (i.e. hospitals and specialist services) through referrals (Gulliford et al., 2001). The aforementioned *gatekeeper* role of the GP is not only important in ensuring efficient utilisation of secondary care services but also equality in access (Gulliford et al., 2001). In the context of the present study, accessing primary care presents the first possible discriminatory barrier that could prevent certain population groups from receiving care, including physical activity referrals. For those who visit primary care, the referral represents the second potential source of discrimination and the point at which health professionals become influential.

There is considerable variation in hospital referrals rates between GP practices, previously reported to be as high as twenty-five-fold (Acheson, 1990). The reasons behind this have been the subject of a great deal of research (Gulliford et al., 2001). Suggested determinants include doctor and patient concerns about diagnoses, concerns about the treatment, patient requests, and fear of litigation from health professionals. However, these fail to explain much of the variation and patient characteristics often account for more. Previous studies and reviews of related research have found that important patient characteristics tend to be linked with deprivation (discussed in Section

6.4.3), rather than age or gender (O'Donnell, 2000; Reid, Cook and Majeed, 1999). Similarly, an earlier study found that the magnitude and direction of gender differences in consultations for six different conditions were similar to the patterns for surgery (Chaturvedi and Ben-Shlomo, 1995). More women consulted GPs for five out of six conditions, and more women subsequently were referred for surgery.

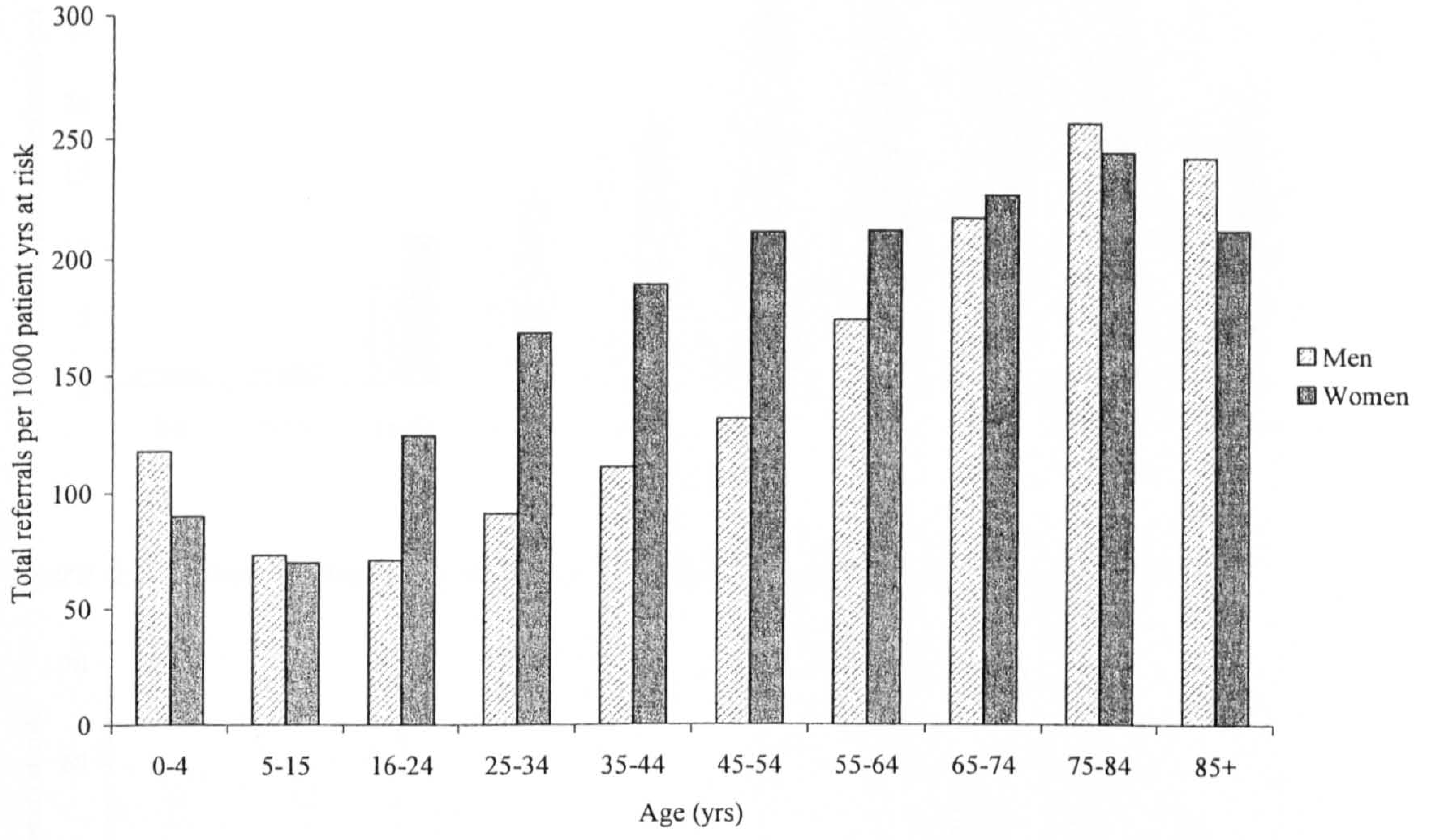

Figure 6.2 Total referrals from primary care (Office for National Statistics, 2005d)

There is, however, a cautionary note. There has been some inconsistency in how referral rates were calculated. Most studies in the aforementioned review did so as a proportion of the number of consultations (O'Donnell, 2000). Others calculated referral rates from the number of patients registered at each GP practice (Reid et al., 1999), which fails to consider differences in consultation rates between different population groups as described in Section 6.3.1 (and 6.4.2).

Nonetheless, the literature provided little evidence for an independent influence of gender on the likelihood of referral from primary care. Official statistics were obtained to verify this. Figures 6.2-6.6 illustrate some of the main trends in terms of referrals per one thousand patient years at risk (Office for National Statistics, 2005d: data presented in Appendix 5). A marked female excess in *total* referrals was evident in adults aged between sixteen and fifty-five years (Figure 6.2), which demonstrates a similar pattern to consultation rates.

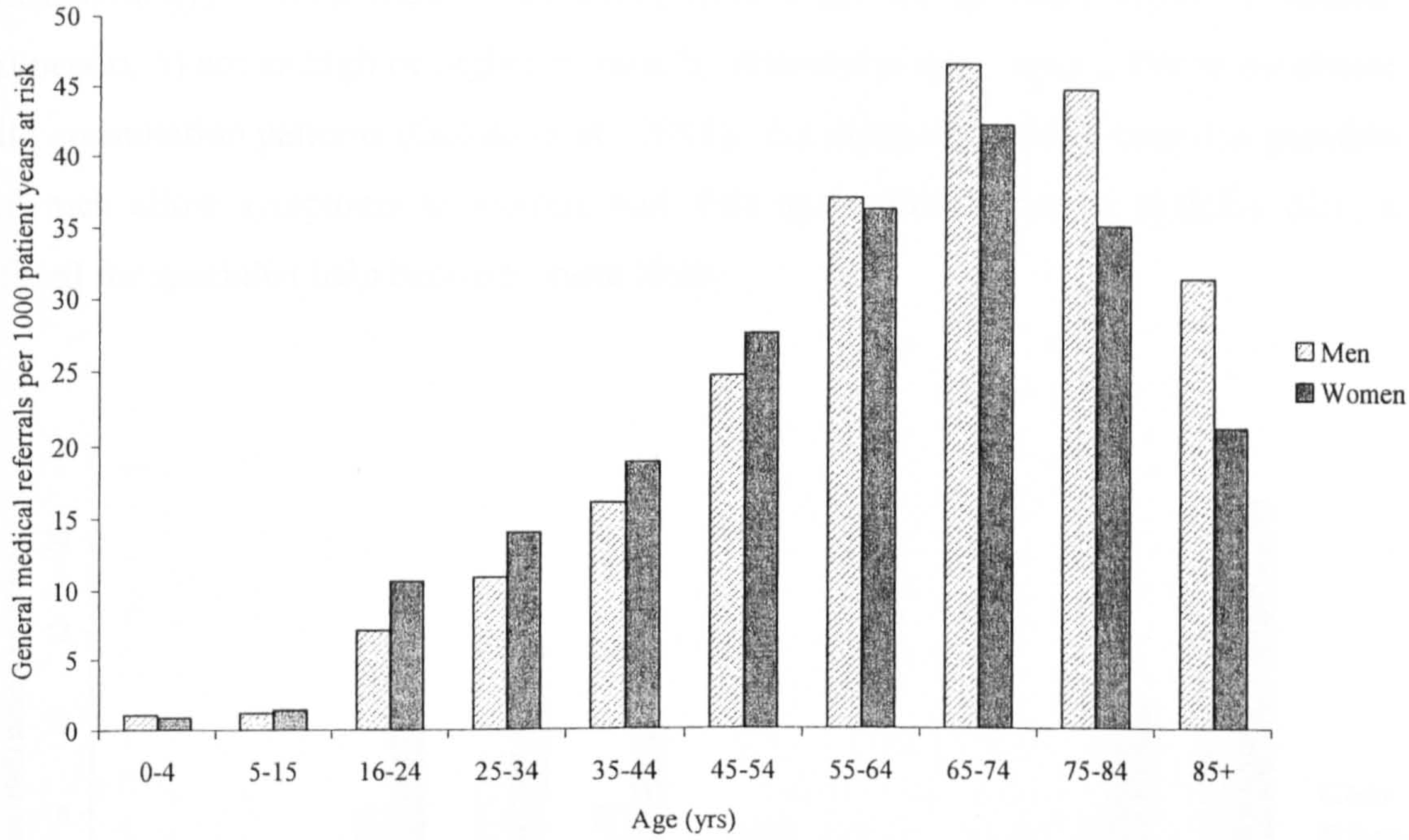

Figure 6.3 General medicine referrals (Office for National Statistics, 2005d)

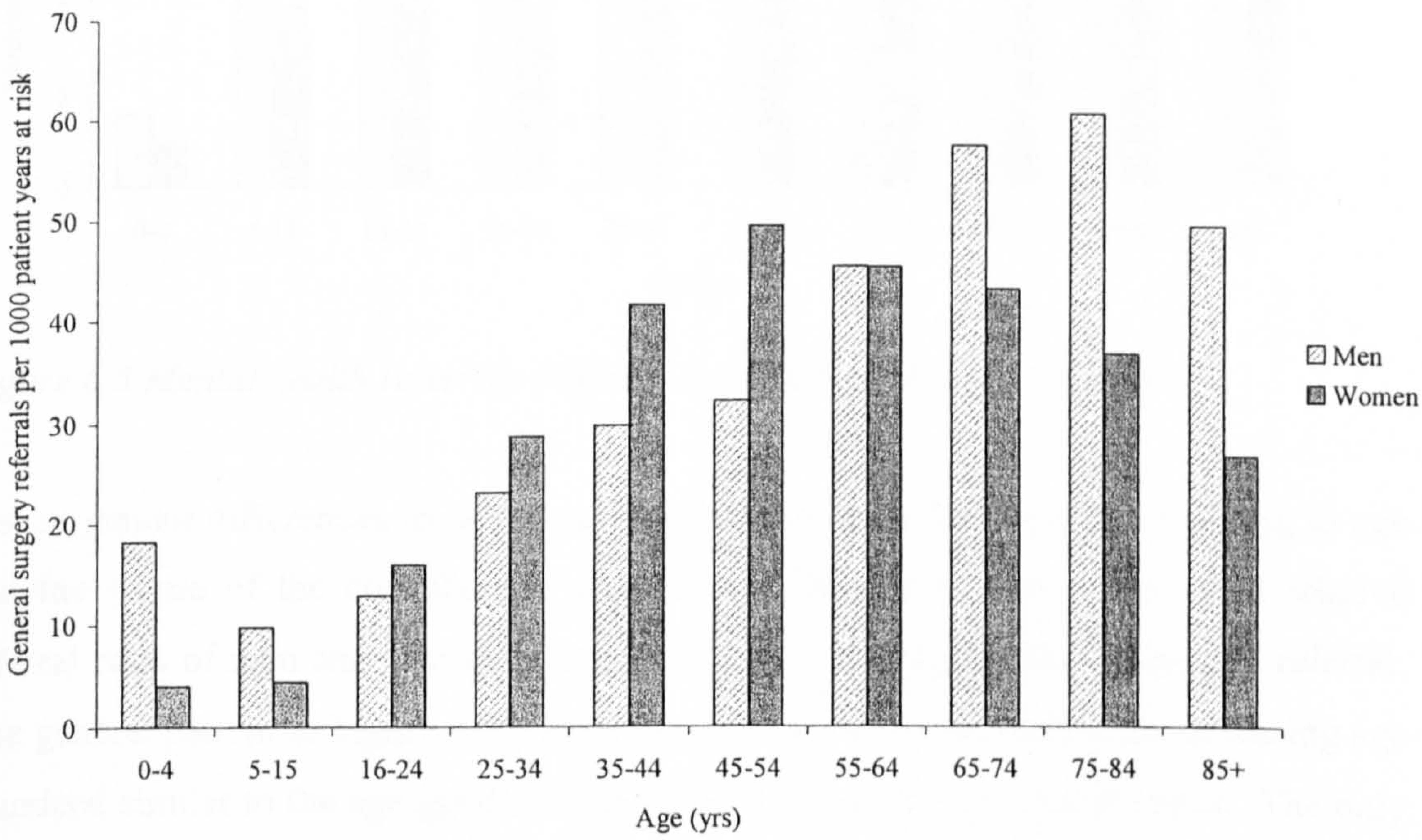

Figure 6.4 General surgery referrals (Office for National Statistics, 2005d)

When different types of referral were examined, the pattern for total referrals appeared to reflect higher mental health referrals in women of all ages (Figure 6.5), rheumatology (Figure 6.6), and gynaecology (not shown). This can be linked to known sex differences in health. Clearly gynaecology referrals are gender specific. Women are known to consult primary care more frequently for psychological reasons (mental health) and are more predisposed to osteoporosis, especially around menopausal age (rheumatology). With these three exceptions, rates for all other types of referral (Appendix 5) are as high or higher in men by retirement age. Again, this is consistent with consultation patterns (Galdas et al., 2005). By delaying seeking help it is possible that men allow symptoms to worsen such that upon presentation in primary care, a referral for specialist help becomes more likely.

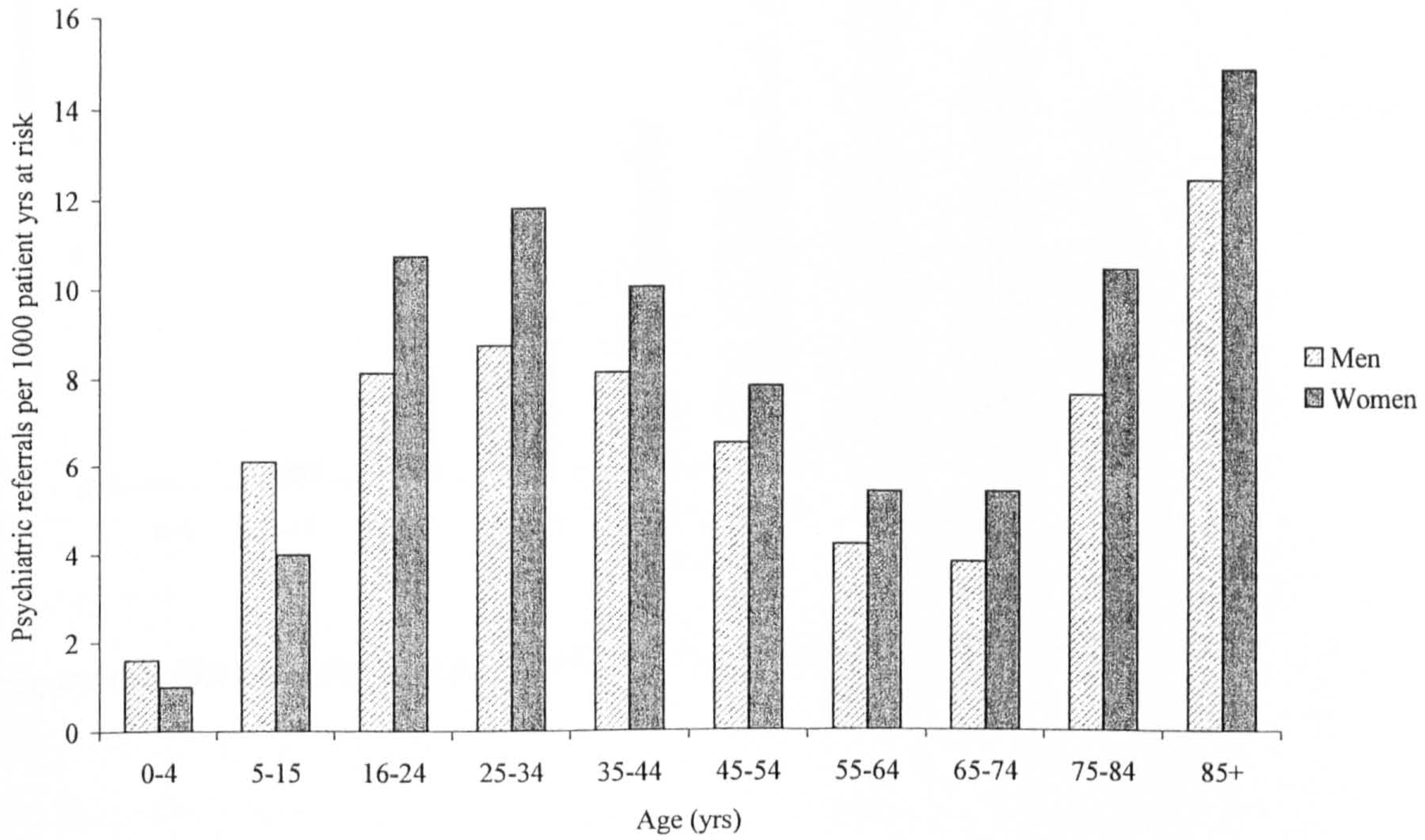

Figure 6.5 Mental health referrals (Office for National Statistics, 2005d)

Just as gender differences in health and rates of GP consultation vary according to age and the nature of the consultation respectively, Figures 6.2-6.6 suggest that relative referral rates of men and women are dependent on patient age and the type of referral. The general pattern of higher referral rates in women that attenuates with increasing age is indeed similar to the age-gender distribution of primary care consultations. The only notable differences are in old age, when most referral rates begin to decline despite continued rises in consultation rates. The age of the patient in relation to the nature of the specialist service is likely to be a major consideration on which referral decisions are made. For example, the risks associated with surgery could explain the reduction in referrals for surgery in older adults (Figure 6.4). In many cases it may be that the referrals follow onset of physical symptoms. For many diseases this might occur between middle-age and early old age (Boreham and Riddoch, 2003), thus reducing the possibility of referrals later on.

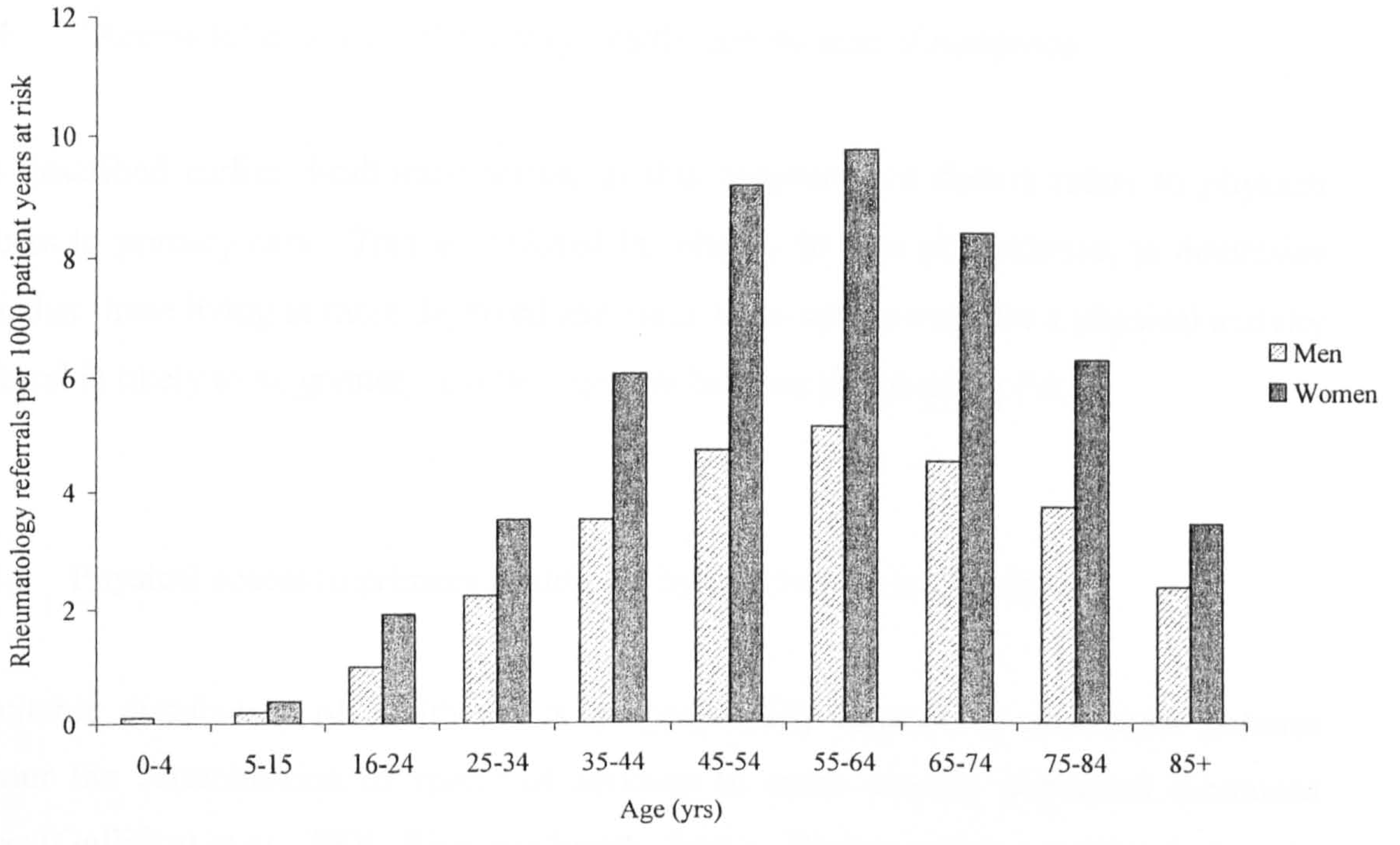

Figure 6.6 Rheumatology referrals (Office for National Statistics, 2005d)

6.3.3 Summary

In summary, women are more likely to consult their GP than men (especially for psychological reasons) but this female excess reduces as age increases and the onset of physical symptoms prompts more men to seek help. Different social influences are likely contributors to these patterns. Similarly, the age-gender distributions of referrals from primary to secondary care appear to reflect those for primary care consultations, but again vary according to the type of referral. The exception is older adults. Those at the top of the age range who visit primary care most frequently tend to receive referrals less frequently than those in the age group(s) below. However, once the type of referral is considered in relation to age there is no indication of systematic gender bias in referrals. Those who consult more appear to be referred more. In the context of PARS, this would again suggest that GP consultation patterns might be an important factor in determining access to physical activity referrals. Yet, to ascertain which age-gender groups are most likely to be referred out of those in primary care, the nature of the referral must be considered.

6.4 'Access to' and 'use of' primary health care by area of residence

As described earlier, healthcare access in this chapter (and thesis) refers to physical access to primary care. This is explored in relation to area of residence, to determine whether those living in more deprived and rural areas whose need for a physical activity referral is likely to be greater, also face greater barriers to accessing PARS.

6.4.1 Physical access to primary healthcare by deprivation and health

Equitable distribution of healthcare is geographically impossible as current policies favour the centralisation of specialist services in more densely populated urbanised areas (Gulliford et al., 2001; Rice and Smith, 2001). Distance from a service is thought to be inversely associated with utilisation (Goddard and Smith, 2001; Rice and Smith, 2001) and factors such as travel time and cost, and availability of reliable transport, represent other potential predictors of use (Goddard and Smith, 2001). Physical access to health care services is difficult to measure accurately and no single measure is accepted as the 'gold standard' (Higgs and White, 1997). Consequently, researchers attempting to capture physical accessibility are often limited by measurement. A review of related literature set out to review studies of access but was restricted to those that measured utilisation rates as proxy measures for access because the vast majority of researchers took this approach (Goddard and Smith, 2001). In recent years the increasing use of Geographical Information Systems (GIS) in health research has increased the scope for measurement of the physical environment in relation to health services (Jordan et al., 2004a; Lovett, Haynes, Sunnenburg et al., 2002). The nature of GIS and their use in health research is described in more detail elsewhere (Briggs and Elliott, 1995). Briefly, they allow mapping of physical attributes of areas such as roads and hills, enable accurate measurement of distance by road between two points, and even average journey time.

Two recent studies have used GIS in this context, in a largely rural areas of England (Jordan et al., 2004a; Lovett et al., 2002), where many residents will face greater barriers to accessing healthcare services (Adams and White, 2004). Both found that access to GP practices was generally good. Most people lived within a five or six-minute drive, even those in rural areas. Both studies also measured deprivation using the Townsend score of material deprivation (Section 7.7.2) and reported a U-shaped association between distance from services and deprivation. Therefore, deprivation decreased with increasing distance from health services, but increased in the most remote and inaccessible areas. However, this is only significant for secondary care services in one of the studies (Jordan et al., 2004a). Therefore, both studies found that in the most remote rural areas in which residents experience the poorest access to services, deprivation and health need are high, providing some support for the Inverse Care Law (Tudor Hart, 1971).

Some researchers have made claims to the contrary, stating that the Inverse Care Law may never have existed and was merely the result of misinterpreted information on health service use (Adams and White, 2004). The researchers followed this up with an investigation into the relationship between deprivation and proximity to general practice (Adams and White, 2005). Significant correlations reported between ward deprivation and proximity in all areas, and in urban and rural wards (analysed separately) were used to argue that deprivation, not proximity, was the important determinant. Nevertheless, this latter study conducted in the Northeast of England was methodologically weak compared with those just described (Jordan et al., 2004a; Lovett et al., 2002). Firstly, proximity to GP practices was measured using the access domain of a composite deprivation index (IMD: DETR, 2000) calculated from average straight line distances between households and four services, including GP practices. As discussed in Section 7.7.3, evidence for this domain capturing access deprivation in rural areas is unconvincing (Jordan, Roderick and Martin, 2004b) and it was removed in the revised IMD 2004 (ODPM, 2004). Secondly, the researchers used employment, education and income domains of the IMD to reflect deprivation. Again from the research discussed in Chapter 7 (Section 7.7.1), by combining a broad range of indicators of both material and social deprivation, this lacks the conceptual clarity of the Townsend score (Section 7.7.2). Finally, the researchers reported overall correlations but presented insufficient data to speculate about the presence or absence of the U-shaped relationship between deprivation and access reported elsewhere (Jordan et al., 2004a; Lovett et al., 2002). This cannot, therefore, be ruled out.

In summary, area of residence in terms of both deprivation and rural-urban context is related to physical accessibility of healthcare, but more so for secondary care than GP practices. It is not surprising that people living in urban centres experience the best physical access. However, the relationship between physical access and deprivation appears to be U-shaped. The most urban and most remote areas are most materially deprived (and experience highest morbidity), yet have the best and worst physical access respectively. Therefore, taking into consideration rural-urban location is important, not only in relation to deprivation and health, but also access deprivation in healthcare. Although any effects of rural location are far more marked for accessing secondary care (compared with primary), the studies discussed used ward-level data. Analysis at a smaller area level should be more sensitive (i.e. Output Area-level: refer to Section 7.4.2). To relate this back to the present study of PARS, area of residence in terms of both socio-economic and urban-rural context could influence the level of access to primary care. However, access to the leisure facilities (equivalent to secondary care) might pose a greater barrier to participation. The following section discusses the same factors in relation to health care use.

6.4.2 Use of primary healthcare services by deprivation and urban-rural location

Substantial inequalities in health and health care utilisation in Britain are widely acknowledged (Gilthorpe and Wilson, 2003). This combined with the health-deprivation relationship (Section 2.4), and some evidence of differences in physical accessibility of services by urban-rural location (Section 6.4.1), provides reasonable grounds to speculate that socio-economic and urban-rural characteristics of an area will influence residents' use of healthcare services.

There is consistent evidence that primary care consultation rates are higher in more deprived areas (Campbell and Roland, 1996; Goddard and Smith, 2001). An earlier study demonstrated that several deprivation indices could predict general practice workload across England and Wales, with the highest consultation rates in the most deprived areas (Ben-Shlomo, White and McKeigue, 1992). Indeed, out of all of the deprivation indices included, the Townsend score exhibited strongest association. Similar patterns have been reported more recently at county level (Carlisle, Avery and Marsh, 2002). Again, high Townsend deprivation scores were associated with increases in surgery consultation (18%) and in same-day (urgent) consultations (28%).

There is also evidence of socio-economic variation in consultation rates at the individual-level (Carr-Hill et al., 1996; Morris et al., 2005). In fact, Carr-Hill et al (1996) analysed survey data from a very large sample (n=502,493) and concluded that individual SEP was a more powerful predictor of GP consultation frequency than area deprivation. The socio-economic effect was indeed more powerful at the individual-level, but researchers did not dismiss the importance of area. Moreover, the authors acknowledged the complexity of analyses that involved many possible explanatory variables and made interpretation difficult. It is possible that inclusion of such a large number of variables attenuated or even masked some genuine effects, despite the considerable sample size. They also reported a positive effect on GP consultation rate, of urban residency and proximity to practices; although this was only significant in certain subgroups (girls and elderly men living near to GP practices consulted more) and the influence of proximity was greater in urban dwellers (compared with rural). This inconsistency in the association between access and consultation rate might reflect the reality. Alternatively, it is possible that the strength of the relationship was underestimated as a result of measurement methods or the complexity of analyses.

Finally, recent analysis of data from three consecutive years of the Health Survey for England (1998-2000) demonstrated that a higher frequency of GP consultations was associated (although not always significantly) with lower income, lower education, being retired, being a homemaker, and having better access services in general (Morris et al., 2005). Social class had little independent influence once the other socio-economic variables were accounted for, which highlights the implications of using different socio-economic indicators that essentially reflect different things (Section 7.9).

It is entirely plausible that the relative deprivation level of an area (urban or rural), and issues of access to services (related to urban-rural location) are likely to impact on use. This is supported by the literature discussed here and the aforementioned review by Goddard and Smith (2001). Use tends to be higher in more deprived areas and is also influenced by geographical location and associated access. The only exception noted by the authors was use of preventive services, which tends to be lower in more deprived areas. This is discussed further in Section 6.5.4.

Strength and consistency of relationships appear to depend on the type of measurement and analysis. Data on urban-rural characteristics are reported less frequently than socio-economic data; yet for both there is variation in type and scale of the area measurement. The complex analysis of Carr-Hill et al (1996) failed to show strong area-level effects on GP consultations. More simple analyses involving fewer variables showed stronger effects for similar GP consultation outcomes (Ben-Shlomo et al., 1992; Carlisle et al., 2002). Morris et al (2005) on the other hand, who performed complex analyses involving a large number of variables, but used different measures of access, reported strong significant associations linking access to both GP consultations and use of secondary care. A limitation of most area-level analyses was the use of ward-level data. As described in Section 7.4.2, the large size of wards and resultant heterogeneity of the composite population is likely to mask more subtle socio-economic and urban-rural variation (Sections 7.4.2 and 7.8 respectively), potentially underestimating the effects. With the advent of Output Areas, such problems should be greatly reduced.

In the context of the present study, evidence from this section suggests that relative deprivation and rurality of the area in which a personal lives and could influence their propensity to use health services, in turn affecting the likelihood of them and being offered a physical activity referral. This would be expected to increase the opportunity for residents of deprived and urban areas. However, access to primary care appears to be relatively good, even in rural areas. Secondary care services, on the other hand, tend to be more concentrated in urban centres. Therefore, for PARS, accessing primary care might be less important than accessibility of leisure facilities, which could potentially result in more rural dwellers refusing a physical activity referral or removing themselves from schemes following referral. The same might not be said for the people living in affluent areas because participation in physical activity interventions and facility use tends to be more likely in higher socio-economic groups (Hillsdon et al., 1999), even though proximity of facilities might be poorer (Giles-Corti and Donovan, 2002b).

Simply visiting primary care does not necessarily ensure a referral. Therefore, the following section explores evidence of variation in rates of referral from primary to secondary care in relation to area of residence.

6.4.3 Referral rates by deprivation and urban-rural location

The purpose of examining evidence for general systematic bias in primary care referral rates in general is to identify population groups that might be similarly excluded from accessing physical activity referrals.

Evidence from the previous section indicated that neither factors related to the referring health professional, nor patient gender or age explained much of the observed variation in referral rates. Rather, it appeared that differences in consultation behaviour by gender and age, combined with the specific nature of the referral were likely contributors. In addition, there was some suggestion that patients' area of residence might be more influential. The present section provides an overview of relatively recent evidence of primary care referral rates in relation to the socio-economic or urban-rural environment.

Chaturvedi and Ben-Shlomo (1995) investigated potential socio-economic bias in the relationship between rates of first consultation and surgical referrals for conditions for which surgery is a common treatment. The findings demonstrated the importance of both deprivation level and type of referral in relation to both consultation and referral rate. The authors found concordance between the patterns of consultation rates and operation rates across the respective socio-economic groups for only two of the conditions. Varicose vein-related consultation and operation rates were both higher in poorer social classes and more deprived areas respectively, whereas an inverted U-shaped relationship was observed for cataract-related consultations and operations (highest rates in intermediate socio-economic groups). For the remaining conditions, the socio-economic distribution of consultation rates was not replicated in operation rates. However, for reasons not made clear, consultation and operation rates were not socio-economically stratified in the same way; the former by individual social class, and the latter, by ward-level deprivation (using the Townsend score). This could have been important as individual-level social class and area-level deprivation scores do not necessarily represent the same construct and there are conceptual difficulties in treating them as such (Section 7.7.1). Yet, the possible implications of this were not addressed by authors. Nevertheless, the findings indicate that any area-level socio-economic or urban-rural effects in referrals to PARS might be specific to this type of referral.

Hippisley-Cox et al (1997b) found significant positive associations between ward deprivation and practice referral rates for total and medical referrals, and a negative association for surgical referrals. Indeed, researchers reported that deprivation accounted for twenty-nine and thirty-five *per* cent of variation in total and medical referrals, respectively. Also, these associations were independent of practice-related characteristics and the proportion of older men and women within each ward (≥65 years). Despite criticism for using the Jarman deprivation score (Williams, Jackson, Turbitt et al., 1997), which was originally developed to reflect GP workload (Section 7.7.2), repeated analyses using the Townsend score produced similar results (Hippisley-Cox, Hardy, Pringle et al., 1997a). There is one further important consideration common to that raised in Section 6.3.2. Rates of referral were calculated per one thousand registered patients, not as a proportion of consultations. Therefore, it is possible that the apparent bias *in favour* of residents of deprived areas is simply a reflection of higher rates of GP consultation as a result of poorer health. If so, a socio-economic effect might not have existed and bias against those in deprived areas receiving a referral for surgery would have been greatly underestimated.

The same can be said for a similar study reporting similar findings in a sample of socio-economically diverse patients (Worrall, Rea and Ben-Shlomo, 1997). All measures of GP workload and referrals increased linearly with the percentage of ward populations in sequentially higher social classes. But again, this suggestion of socio-economic bias in favour of residence of more disadvantaged areas is a likely consequence of failing to control for differential consultation rates. It seems more likely that more frequent GP consultations rather than systematic bias *against* residence of more affluent areas explains the pattern observed. This was confirmed by the review of Goddard and Smith (2001). Despite several studies indicating that total referrals from general practice were higher in deprived areas (except for surgical referrals), the reviewers noted that controlling for health need or morbidity (linked to consultation rate) negated or reversed the positive effect of socio-economic disadvantage, in favour of the more affluent. These patterns are confirmed by national data from the General Household Survey (Office for National Statistics, 2005d: Appendix 6).

From the literature examined, a review by O'Donnell (2000) was the only evidence of authors questioning the impact of urban-rural location on referral rate. The authors commented only briefly but indicated that higher referral rates were associated with urban residency. Whether this took into account greater deprivation and morbidity was unclear.

To summarise, although a positive association emerged between referral rate and deprivation, this appears to reflect differential consultation rates. If any socio-economic bias exists at the point of referral, it is likely to benefit those in the least deprived areas. There remains some variation depending on the specific morbidity or associated type of referral. In the context of the present study, the evidence indicates that although dependent on the nature of referral (i.e. physical activity referral), if the socio-economic environment were to have an impact, it would be likely to favour the affluent. The impact of urban-rural location was largely ignored. It is therefore, not possible to infer how urban-rural residence might affect the likelihood of a physical activity referral for primary care patients.

Given the possible influence of referral type and the notion of physical activity as preventive health action, the final section of this chapter was devoted to exploring differential use of preventive health care services, thought to have different socio-demographic patterns for use, compared with therapeutic services.

6.5 Differential use of preventive health services

6.5.1 Introduction

Social patterning in the use of preventive health services was considered a necessary inclusion in this review because in order to maximise the public health gain, physical activity referrals must be employed in a preventive (as well as therapeutic) capacity. Further, the particular scheme under evaluation was originally intended for CHD prevention (Section 8.2) and it might be expected that the same patient groups who would consent to a physical activity referral would be more inclined to take up preventive health care services when offered.

6.5.2 Age

Specific age profiles of people who use preventive health services, such as health checks or disease screening programmes, are relatively uninformative. In order to be considered preventive, they must precede the onset of disease, the likelihood of which reduces with increasing age (Section 2.2.1). Therefore, by definition the possibility of any health-related action being preventive decreases with increasing age. Moreover, specific risk profiles for certain diseases for which screening is available, can mean that subsequent programme targeting determines the age of participants, rather than age *per se* being a useful predicator. For example, the NHS Breast Cancer Screening Programme in Britain has covered women aged between fifty and sixty-four years. Therefore, a significant reduction in uptake with increasing age in older women is not surprising as they fall outside of the target group (Harris, Cook, Shah et al., 2002). Indeed, studies of uptake in screening programmes for specific diseases often focus on relatively narrow age groups considered most at risk, such as screening for breast cancer screening in women aged fifty to sixty-four (Gatrell, Garnett, Rigby et al., 1998) and for colorectal cancer in fifty-five to sixty-four year old adults (Wardle, Miles and Atkin, 2005).

This said, there is some evidence that increasing age can increase the likelihood of taking preventive health action, possibly as a result of age-related health deterioration. For example, age has been positively associated with the intention to participate in cancer screening (Watts, Vernon, Myers et al., 2003) and 'turning forty' or 'turning fifty' have been linked with men becoming motivated to act as a result of close others (of a similar age) succumbing to disease (Aoun et al., 2003). Aside from this, age is not particularly useful for making generalisations about the characteristics of preventive health services users. In contrast, low utilisation of such services has been consistently linked with being male (Doyal, 2001; Wardle et al., 2005) and socio-economic disadvantage, measured at either the area- or individual-level (Goddard and Smith, 2001).

6.5.3 Gender

As discussed in Section 6.3.1, men are less likely to consult GPs for preventive reasons. Researchers have also found that men tend to be less interested in their health (Aoun et al., 2003) and possibly more sceptical about the value of preventive health behaviour (Courtenay, McCreary and Merighi, 2002; Furnham and Kirkcaldy, 1997). Furthermore, men are thought to have lower levels of health knowledge than women (Beier and Ackerman, 2003) and even among men who are aware of the benefits of preventive health behaviour, their understanding may be insufficient to prompt a practical response (Aoun et al., 2003). As a result of these general patterns and the aforementioned delaying behaviour in men to seeking health help (Section 6.3.1), it is not surprising that men are less likely than women to use preventive health services (Munley, McLoughlin and Foster, 1999; Thorogood, Coulter, Jones et al., 1993).

There are, however, exceptions to the general pattern. Existing literature on participation in screening programmes is limited by the sex-specific nature of most diseases that can be screened for; namely breast cancer, prostate cancer and cervical cancer (Wardle et al., 2005). Therefore, colorectal cancer screening, which is recommended to both men and women, provides a rare opportunity to make gender comparisons for participation. A British trial of faecal occult blood test screening for colorectal cancer conducted several years ago reported that uptake in the first round of screening was slightly higher in women than men (55 *vs.* 51%) (Hardcastle, Chamberlain, Robinson et al., 1996), a pattern echoed elsewhere (Jorgensen, Kronberg and Fenger, 2002; Tazi, Faivre, Daissonville et al., 1997). Yet a gender difference of similar magnitude, but in the opposite direction was reported for uptake of more a invasive screening procedure involving endoscopy (UK Flexible Sigmoidoscopy Trial Investigators, 2002; Wardle et al., 2005). It transpired that independent determinants of screening intention were related to worry and expectations about the procedure itself (Wardle et al., 2004), and that women were more likely than men to express a preference for the alternative method. Again this implicates the nature of the procedure as an important factor. From this study and others (Lewis and Jensen, 1996), it is apparent that the commonly observed female excess in preventive health service use can be altered by the nature of the preventive service.

6.5.4 Socio-economic position

An inverse relationship has been observed between SEP and responses to invitations to attend health check clinics (Thorogood et al., 1993), attendance of checks for cardiovascular disease and immunisation rates (Goddard and Smith, 2001), and for uptake of screening for various diseases including colorectal cancer (Wardle et al., 2004; Wardle et al., 2005), breast cancer (Gatrell et al., 1998; Harris et al., 2002), and cervical screening (Bentham, Hinton, Haynes et al., 1995; Majeed, Cook, Anderson et al., 1994). Indeed, the association of preventive service use with SEP is more marked and pervasive than for gender.

Again, socio-economic variation in peoples' intention to take up colorectal cancer screening provides a recent example that highlights important predictors. Wardle et al (2004) reported a graded inverse socio-economic gradient of screening intention. Analysis revealed that all of the variables that reflected patients' beliefs and expectations about the disease and screening service, were strongly associated with screening intention, and attenuated the socio-economic effect beyond significance. This suggests that the socio-economic environment can shape peoples' beliefs and attitudes towards preventive health care, thus dictating their propensity to use them. This point is similar to that raised in the discussion of social patterning in physical activity behaviour (Section 3.4.3); i.e. socio-economic differences in behaviour can be explained in terms of differences in the socio-economic environment that shapes beliefs, attitudes and subsequent behaviour.

In summary, the nature of the specific preventive health service, and peoples' beliefs and attitudes regarding preventive health care, are likely to differ by gender and SEP. The evidence again confirms the potential importance of environmental influences that act differentially on different socio-demographic groups, in turn shaping health-related behaviour. Socialisation of the stereotypical masculine behaviour means that men are less likely to use services in the absence of somatic symptoms. A disadvantaged environment can engender negative attitudes and beliefs regarding the importance of preventive action, for example, through social modelling such that preventive health behaviour conflicts with accepted behavioural norms. In the context of the present study, it could be argued that if the nature of the service can determine which socio-demographic groups use them, trends cannot be extrapolated to PARS. However, the same underlying environmental influences are likely to be at work and although some differences are inevitable, it would be expected that out of those offered a physical activity referral, men and people in relative disadvantage would be most likely to refuse.

6.6 Conclusion

The evidence discussed in the present chapter highlighted numerous factors that can influence use of health services. This has enabled further speculation regarding potential determinants of a physical activity referral. Firstly, potential participants must first consult their GP. This is likely to depend on patient age and gender, perceived health and health help-seeking behaviour, access to services (depending on urban-rural location), and area-level deprivation. Secondly, once individuals seek help in primary care, the major determinant of whether or not they receive a referral appears to be the type of referral in relation to patient socio-demographics. Unless targeted by health professionals, similar social and physical environmental influences described in relation to preventive health care, physical activity, and health behaviour in general, are likely determinants of whether or not patients would consent.

Although this confirms the likelihood that PARS have an associated socio-demographic profile, there is little existing evidence of this beyond a female excess and above average age distribution (Section 5.5). Therefore, further research is required to determine how PARS participants might differ from the population as a whole, and how differences between participants might determine their likelihood of success within schemes.

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The importance of SEP in relation to health (2.4), physical activity (3.4), health care services access (6.4.1), use (6.4.2) and the use of preventive health care is evident, strengthening the case for thorough profiling of PARS participants (Gidlow et al., 2005). Chapter 7 provides a detailed critique of socio-economic measurement. This enables critical consideration of different approaches and informs the decision regarding the approach to socio-economic measurement used in the present study (Section 8.4).

Chapter 7: Socio-economic Measurement

The present chapter outlines some of the history of socio-economic measurement, the variety of methods used, and the associated difficulties to enable an informed decision to be made on how best to measure SEP in the present study and to support the earlier critique of physical activity in relation to SEP (Section 3.4).

7.1 Introduction

Socio-economic measurement refers to the empirical methods used to stratify populations in order to demonstrate relative disadvantage or position in society and is one of the most established, complex and disputed areas in the social sciences (Berkman and MacIntyre, 1997; Jones and Cameron, 1984; Murray, Gakidou and Frenk, 1999; Wagstaff, Paci and Van Doorslaer, 1991). The associated terminology can be inconsistent depending on the views of different researchers (Berkman and MacIntyre, 1997; Carr-Hill and Chalmers-Dixon, 2002; Liberatos et al., 1988). There has been a tendency for researchers to use the terms social class, socio-economic status, and social status interchangeably (Galobardes, Shaw, Lawlor et al., 2006; Goldman, 2001). Yet according to the Weberian class-status components, 'status' infers a measure of lifestyle, attitudes and knowledge, whereas 'class' reflects material circumstances (Liberatos et al., 1988). To avoid such issues, throughout this discussion (and thesis), socio-economic (SEP) is be used as the generic term for all socio-economic variables. Such generic terms are useful as a shorthand reference to a range of possibilities, but beyond this researchers must be more specific in order for data to be meaningful (Deaton, 2002). Therefore, within SEP, the various different measures, such as income, education, and social class will be referred to as socio-economic indicators or measures. Social class will be used only to refer to social class based on occupation.

To date, there is no agreed 'gold-standard' socio-economic measure with which others can be compared to demonstrate validity (Carr-Hill and Chalmers-Dixon, 2002; Jones and Cameron, 1984; Liberatos et al., 1988). Socio-economic measurement began in Britain with publication of higher mortality rates in sequentially lower social classes and there has since been a tendency in epidemiology to assume that the best measure of SEP is that which produces the steepest gradient in health or mortality for the population under study (Berkman and MacIntyre, 1997). However, the debate about how best to capture SEP and what various socio-economic measures actually tell us, remains unresolved.

7.2 Economic and social position

The inherent multi-dimensionality of SEP is reflected in the variety of approaches researchers have used to reflect it (Kaplan and Keil, 1993; Liberatos et al., 1988). Various socio-economic indicators are used either individually, several used simultaneously, or in combination as composite measures. In practice, the choice of measure is often dictated by the available data (Acheson, 1998; Martin et al., 2000) and most epidemiological studies use indicators as proxies for material wealth. Despite the difficulty of disentangling the influence of material and psychosocial circumstance, they should not be confused (Carr-Hill and Chalmers-Dixon, 2002; Wilkinson, 1997). A distinction can be made between indicators of *economic status* such as income, car ownership and housing tenure, and indicators of *social position* such as social class and education (Carr-Hill and Chalmers-Dixon, 2002). Traditionally, epidemiological research in Europe and Latin America has focused on the concept of social position, whereas North American epidemiologists have looked at various socio-economic indicators. Although the economic-social distinction is somewhat simplistic, it provides a good starting point to discuss commonly used indicators and their respective meanings, merits and shortcomings. First, however, it is important to identify some fundamental issues that have provoked debate in this area; how to demonstrate validity and whether to use measurements at the individual or area-level (and implications for validity).

7.3 Validity of socio-economic measures

Validity of socio-economic measurement can be broadly divided into *criterion* validity, which involves comparison with accepted measures and *construct* validity. The latter refers to the relationship between the indicator and a phenomenon presumed to be associated with SEP, most commonly health (Carr-Hill and Chalmers-Dixon, 2002). In the absence of a 'gold-standard' measure, tests of criterion validity are limited to measuring relationships between different indicators. Construct validity is far more easily tested (Lee, 1995; Morris and Carstairs, 1991), but is based on the assumption that most valid socio-economic measures produce the smoothest and steepest social gradients in mortality and health. Thus, health or mortality data are effectively used to define SEP. This is a fundamental weakness of socio-economic measurement (Jones and Cameron, 1984) and is discussed further in Section 7.6.2 in relation to measures of occupational social class.

7.4 Individual and area-level measurement

7.4.1 Introduction

There are advantages and disadvantages associated with both individual and area-level socio-economic measurement. These are distinct approaches which should not be confused (MacIntyre et al., 1993). Clearly, with individual data, the individual is the unit of analysis, enabling researchers to make inferences about people with certain levels of income, education, and so on. Area-level data on the other hand, refer to aggregated individual-level data within geographically defined areas (e.g. electoral wards). Therefore, the area becomes the unit of analysis. Practical disadvantages of individual-level data include the greater time, cost and laboriousness associated with data collection (Liberatos et al., 1988). It has further been recognised that using the individual as the unit of analysis does not take into account the potential influence that people living together can have on each other; the notion that they can share SEP in ways not reflected by individual characteristics (Berkman and MacIntyre, 1997; MacIntyre et al., 1993). Moreover, the effect of the environment itself on the residents cannot be reflected by individual data. For this reason and because of greater data availability, and the low-cost and ease of data collection (Liberatos et al., 1988), area-level data are often favoured or used in conjunction with individual-level data to add explanatory power (Ben-Shlomo, 1999; Berkman and MacIntyre, 1997; Liberatos et al., 1988).

It is argued that the practical advantages associated with area-level data combined with poor availability of individual-level data have led some researchers to become over reliant on area-based measures (Martin et al., 2000). The principal argument against using this approach is the implied assumption of population homogeneity within a particular geographical area, known as the *ecological fallacy* (Carr-Hill and Rice, 1995; Farmer et al., 2001; Martin et al., 2000). This assumption that all people living in deprived areas are deprived can only truly be overcome by using individual-level data (Martin et al., 2000). Nevertheless, this is only a limiting factor when using area data to make inferences about individuals; for example, predicting that an individual's life expectancy will be seventy-five years because that is the mean life expectancy within their particular area of residence. Using them as genuine ecological measures does not rely on such assumption. These kinds of implications associated with area-level data must be taken into account, but before doing so it is important to consider exactly what some of the different types of measurements represent.

7.4.2 Area-level socio-economic measurement

The concept of area effects

Section 2.4.1 outlined some of the evidence for the existence of an independent socio-economic area effect on health; i.e. that the socio-economic environment confers an independent health risk. However, interpretation of what this means requires careful consideration and conceptual clarity in measurement.

Research into health inequalities has identified three types of area-level socio-economic influence on health and mortality (Ecob and Jones, 1998). *Compositional* effects relate to the notion that area differences are explicable purely in terms of the socio-demographic composition of the residents. *Collective* effects refer to some form of social miasma in which individuals conform to the behaviour of the dominant group living in an area. *Contextual* effects, also referred to as 'environmental' effects (ODPM, 2004), imply that the characteristics of the area have a direct impact,. There is some inconsistency in how these definitions are used (Ecob and Jones, 1998; Jones and Cameron, 1984; Shouls et al., 1996) but according to those definitions described, most area-level socio-economic data in epidemiological studies are included for compositional reasons. This includes most socio-economic census variables, which are area aggregates of the socio-economic characteristics of residents. In the absence of individual-level data it is not possible to distinguish compositional from collective effects, i.e. to determine whether it is individuals' personal socio-economic characteristics or the characteristics of those around them that influence the outcome of interest such as health or behaviour. Contextual' effects are of particular interest to geographers and epidemiologists as they suggest that areas may be germane in some way to the processes which affect health (Shouls et al., 1996). Although measurements of physical aspects of areas are less common, urban-rural differences have been highlighted as one of three fundamental areas that should be considered in relation to health inequalities: urban-rural, rich-poor, and North-South disparities (Shouls et al., 1996). Indeed, it is the latter construct that is of interest in the present study

As with all socio-economic measurement, the conceptual rationale underpinning the decision to use data at the individual or area-level must be clear in order to draw meaningful conclusions. A further complication of using data at the area-level is how the geographical units of analysis are defined. This has proved to be a limiting factor. However recently, and with the release of census 2001 data, associated problems are being resolved. The following section outlines the recent evolution of area-level measurement in Britain before discussing different types of socio-economic indicators.

Scale of measurement: Wards and Enumeration Districts

When using area-level data (e.g. census data), researchers are faced with a choice regarding the level of output, or the size of the geographical area at which data are provided. The electoral ward has been the most commonly used geographical unit for census and other government and local/district authority data, from which decisions regarding allocation of resources have traditionally been made (Haynes and Gale, 2000; Martin et al., 2000). The advantages of ward-level analysis are mainly practical and policy-related. They are relevant to local authorities and district health authorities (now PCTs), and until 1991, wards were the smallest area for which it was possible to match census and postcode data (Townsend, Phillimore and Beattie, 1988). However, several considerable disadvantages arguably outweigh these benefits (Mackenzie, Nelder, Maconachie et al., 1998; Townsend et al., 1988). Firstly, electoral ward boundaries were not drawn to identify natural communities but created to contain appropriate numbers of voters. This not only resulted in substantial social heterogeneity within wards but meant that they were frequently redrawn to accommodate changes in the voting population (Townsend et al., 1988). Secondly, they have never corresponded to postcode boundaries (ESRC, 2000), which has been problematic when trying to assign socio-economic data to individuals on the basis of postcode. Finally, the constituent populations were simply too large. Each ward typically contains five-to-six thousand residents (Martin et al., 2000) but this can range from anything between five hundred and fifteen thousand. The problems associated with ward size made a case for the development of alternative smaller areal units, resulting in enumeration districts (EDs).

It was hoped that EDs would address the shortcomings of wards. Yet their primary function was to equalise the workloads of census enumerators and because they were derived from wards, it is not surprising that they failed to provide a satisfactory alternative (ESRC, 2000). As simple subdivisions of existing wards the constituent populations (approx. 500) were assumed to be more homogeneous (Martin et al., 2000). However, the ability of wards and EDs to predict individual characteristics was similar (Carr-Hill and Rice, 1995; Haynes and Gale, 2000). Like wards, EDs did not correspond with postcode boundaries, such that a single postcode could belong to more than one ED. Furthermore, data for a substantial number of people (n=3890) and households (n=4990) had to be excluded from the 1991 census (Martin, 2004b) for reasons of confidentiality; in some rural EDs the size of the constituent populations fell below the confidentiality threshold of at least fifty residents or sixteen households (ESRC, 2000; Majeed, Cook, Poloniecki et al., 1995; Martin et al., 2000). Overall, EDs did not solve the problems of wards and by the release of census 2001 the preferred areal unit was the Output Area (OA).

Scale of measurement: Output Areas and Super Output Areas

Geographical Information Systems were used to develop an automated zoning technique that used residence-specific grid references to define areal units; all of which were above the confidentiality threshold, whilst maximising uniformity of population size, homogeneity, and compactness of geographical shape (ESRC, 2000). Each OA contains a minimum of one hundred residents (>125 recommended) or forty households (Martin, 2004b; Office for National Statistics, 2005e). The creation of OAs represented a substantial improvement. They relate to postcode areas, avoid exclusions for reasons of confidentiality, and have markedly improved within-unit homogeneity (Martin, 2004b). As a result, the validity of using area-level data to represent the constituent populations has increased. More recently OAs have been aggregated into Super Output Areas (SOA). Although three layers of SOA are proposed (lower, middle, higher), the lower layer is the only one to be put into operation to date. They are made up from between four and six OAs and contain at least one thousand residents (mean of 1500) (Office for National Statistics, 2005g). As aggregations of OAs, a level of within-area, homogeneity is inevitably lost in SOAs, although the other advantages are conferred.

These issues of validity and level of measurement should be kept in mind when considering evidence from individual and area-level socio-economic effects on health (Section 2.4.1), the advantages and disadvantages of using deprivation indices (Section 7.7), and in relation to the physical activity-SEP relationship (Section 3.4). The following sections introduce the ways in which SEP is most commonly captured to provide insight into the respective strengths and weaknesses of different approaches.

7.5 Measures of economic position

7.5.1 Income

Income is considered the most direct marker of material well-being (Galobardes et al., 2006; Kaplan and Keil, 1993) and gradients of increasing morbidity and mortality with decreasing income have been consistently demonstrated (Wilkinson, 2006). Like education, income measures are not dependent on working status. Nevertheless, there are several problems associated with the collection and use of income data. Firstly, such information is considered sensitive, which has connotations for the accuracy of information and the level of detail willingly disclosed (Berkman and MacIntyre, 1997; Galobardes et al., 2006; Liberatos et al., 1988). For example, people are more likely to place themselves in an income category (e.g. £20–25,000) than disclose their annual earnings. Consequently, it has never been routinely collected in Britain where indirect measures (e.g. benefit claiming) or asset-based measures have been favoured (Berkman and MacIntyre, 1997). Secondly, income fails to account for other assets such as savings or earning power, benefits, or ownership (Berkman and MacIntyre, 1997; Kaplan and Keil, 1993; MacIntyre, Ellaway, Der et al., 1998). Thirdly, income is relatively unstable over time and current income may not reflect lifetime income

(Liberatos et al., 1988; MacIntyre et al., 1998), potentially giving a false impression of material wealth. Fourth, it does not account for household expenditure or distribution within households (Berkman and MacIntyre, 1997; MacIntyre et al., 1998). Consequently, unless adjusted for household size, two households with the same total annual income would be classed in the same income category even if, for example, one supported an unmarried couple and the other a family of six. Finally, there is great regional variation in the cost of living, which is problematic in studies covering large geographical areas (Liberatos et al., 1988).

Despite these shortcomings, income is commonly used in American epidemiology and some European countries (as demonstrated in Section 3.4.2). As previously detailed, in Britain, the sensitivity and resultant dearth of information on income has led many to look towards asset-based socio-economic indicators to reflect material wealth, which can provide a more in-depth picture of the various dimensions of SEP.

7.5.2 Asset-based measures

Asset-based measures, primarily car ownership and housing tenure, have been increasingly used in Britain either as alternatives or in conjunction with other indicators (MacIntyre, 1997); often this is a means of circumventing the absence of income data (Berkman and MacIntyre, 1997; MacIntyre et al., 1998). In Britain and elsewhere, whether or not a household is owner-occupied and/or the residents have access to private transport, are predictors of the life expectancy and the health of its members (Berkman and MacIntyre, 1997; Filakti and Fox, 1995; MacIntyre et al., 1998; MacIntyre, Hiscock, Kearns et al., 2001). Some suggest that increased ownership of homes and cars (and other demographic changes) over the last twenty years, have reduced their validity as proxy measures of wealth or income (Carr-Hill and Chalmers-Dixon, 2002). However, others argue that based on data from the 1991 census a substantial proportion of the population still lived in rented properties and that rises in car ownership from 1981 were mainly caused by additional cars in households that already own them (MacIntyre et al., 1998). Moreover, asset-based measures are thought to provide a more refined picture of material wealth thus creating a more finely grained hierarchy of SEP (Berkman and MacIntyre, 1997; Davey Smith and Egger, 1992). To a certain extent, both measures can be used to discriminate between most and least disadvantaged members of society, although recent changes might problematise discriminating between those in the middle of the social strata.

Car ownership is one of the major asset-based measures, featuring in several composite deprivation indices (Section 7.7.2). However, its use in rural areas has been brought into question. Given the largely rural nature of the study area in the present study, this is considered in more detail.

Car ownership/access and rural/urban interaction

In Britain access to private transport has indeed increased in recent years (Acheson, 1998; Filakti and Fox, 1995) with the proportion of households that have access to a car or van rising from just over fifty *per* cent in 1972 to seventy *per* cent in 1996 (Acheson, 1998). Indeed, compared with people born in 1952, the proportion of those born in 1932 who had never owned a car was far higher (23 *vs*. 8%), as was the mean age of acquiring a car (32.3 *vs*. 24.7 years) (Ellaway, MacIntyre and McKay, 2003). However, most socio-economic measures are similarly limited by temporal changes as a result of changes in education, the labour market, levels of earnings, and so on. As the present study is not longitudinal and data collection lasted three years, this was not an important issue. Moreover, access to, or ownership of cars or vans can be effective socio-economic discriminators as demonstrated by relationships with other socio-economic indicators and health outcomes; i.e. criterion and construct validity (Acheson, 1998; Berkman and MacIntyre, 1997; MacIntyre et al., 2001). Another potential problem relates to the assumption of equal access to cars of all members of households that own a car. However, when using car ownership as a marker for material wealth, this issue is avoided.

In terms of the criterion validity of using car ownership as a proxy for wealth, it is known to correlate strongly with income, and vary according to social class (Ellaway et al., 2003) and economic activity in the expected directions (Acheson, 1998). Construct validity has been more commonly investigated (Ellaway, Anderson and MacIntyre, 1997; MacIntyre, 1997; MacIntyre et al., 1998; Saul and Payne, 1999). Car access has been shown to predict health independent of social class but is not income, suggesting that it can act as a marker for income (MacIntyre, 1997). Elsewhere, researchers have found that car access (and housing tenure) were significantly associated with most health measures independent of income, age, and gender (MacIntyre et al., 1998), and that they are among the three socio-economic census variables most strongly correlated with health outcomes (Saul and Payne, 1999).

The controversy regarding use of car ownership in rural populations arises from the notion that private transport is considered more as a necessity, than a luxury, for rural residents. Therefore, some argue that far from representing relative wealth, owning a car might exacerbate material deprivation by draining valuable resources that could be spent on other essentials, such as food and housing (Christie and Fone, 2003; Farmer et al., 2001). Analysis of socio-economic data from the 1991 census in the most sparsely populated parts of Wales (Christie and Fone, 2003) revealed that twice as many households in urban areas did not have access to a car compared with rural areas (35 *vs.* 17%). Furthermore, car ownership was more strongly correlated with other socio-economic variables in urban areas and when it was removed from a composite measure of deprivation (Townsend score), the rank of relative deprivation of areas (EDs) was altered. In contrast, an English study in the West Midlands recently found that car ownership was relatively stable across rural and urban areas and did not have the same deleterious effect on the same composite deprivation index (Gilthorpe and Wilson, 2003). The only major difference between studies was that analyses were performed at ward and not enumeration district level.

Opposing data from these two studies highlight two potential issues. Firstly, the size of geographical units of analysis has implications and must be considered when interpreting data. Secondly, it appears necessary to exercise caution before excluding specific socio-economic indicators as inappropriate, especially in this case when there is potential for diversity in how rural-urban areas are defined (Section 7.8), and potentially geographical differences.

Housing tenure

Housing tenure is not associated with the same controversy in relation to rurality as car ownership and is, therefore, not considered in the same detail. Overall, it is accepted that tenure relates strongly to income (Howden-Chapman, 2004) and can reflect accumulated wealth (Townsend et al., 1988) because paying off a mortgage is effectively "forced" saving that provides future security (Howden-Chapman, 2004). Conversely, it could also be argued that the financial strain of meeting mortgage repayments has potentially damaging consequences. Independent influences on health do not bring into question the relationship with income (Carr-Hill et al., 1996; Dunn, 2002; Howden-Chapman, 2004; MacIntyre et al., 1998; MacIntyre et al., 2001; Saul and Payne, 1999; White, Blane, Morris et al., 1999). They indicate that housing tenure might impact on health through additional or alternative mechanisms than income and, therefore, reflect an additional dimension of material wealth aside from current income.

7.6 Measures of social position

7.6.1 Education

Education is perhaps the most commonly used socio-economic indicator in American epidemiology (Kaplan and Keil, 1993; Pocock et al., 2004). Indeed, this was confirmed in Section 3.4.2. Similar to asset-based measures, education is often used as a proxy for income and wealth. It is thought to be a powerful predictor of labour market position during working life and therefore, a determinant of material well-being (Galobardes et al., 2006; White et al., 1999). The advantages of measuring education include its relative stability after a certain age, ease of data collection and relevance to people regardless of age or working circumstance (Berkman and MacIntyre, 1997; Galobardes et al., 2006; Kaplan and Keil, 1993; Liberatos et al., 1988).

However there are several disadvantages when using education as a generic measure of social or economic well-being. This involves an implicit assumption that better education will lead to more highly paid occupations and subsequently higher SEP, which may not always be the case. Furthermore, although changes in educational outcomes are unlikely after a certain age, change in the value of educational achievement over time and for different generations is an issue (Galobardes et al., 2006; Liberatos et al., 1988). For example, a university degree thirty years ago had quite different implications in terms of subsequent employment opportunities and income compared with today. In this respect, age is an important consideration. In addition, there is regional variation. Despite the wide reporting of education in American studies, education is rarely used in Britain (and other European countries); the large proportion of the population who complete the minimum sixteen years of compulsory education reduce its effectiveness as a socio-economic discriminator (Berkman and MacIntyre, 1997). Rather, in British epidemiologists have traditionally favoured occupational social class as the primary socio-economic variable.

7.6.2 Occupational social class

Ever since social gradients of increasing mortality in sequentially poorer social classes were first reported in Britain, social class based on occupation has remained the dominant socio-economic variable in British epidemiology (Berkman and MacIntyre, 1997; Liberatos et al., 1988; Rose and O'Reilly, 1997). Early in the twentieth century the British Registrar General's (BRG) classification schema was developed to stratify the population into five broad classes according to occupational skill: I-professional; II-intermediate; III-skilled; IV-partly skilled; V-unskilled (Jones and Cameron, 1984; Liberatos et al., 1988). The creators wanted a scale that accounted for social status linked to occupation, which they assumed would in turn reflect education and culture. In a highly critical review describing the evolution of the BRG, Jones and Cameron (1984) claim that initially imperfect mortality gradients from the 1911 census led the researchers to arbitrarily modify class boundaries to smooth gradients. Apparent statistical manipulation in the absence of a sound theoretical base led to accusations that the resultant social gradients in health did not contribute to our knowledge regarding 'if and why' such gradients exist. This undermines not only the original scale but all subsequent derivations, the most recent being the Social Class scale (Rose and O'Reilly, 1997).

A description of different types of occupational classification is provided in Appendix 7. For the purposes of this discussion, there are several noteworthy general issues. A major limitation of using occupation is the changing nature of the employment market. When the concept of occupational social class was developed, it was assumed that sons followed their father's work, and were likely to remain in the same job for most of their working life. Such inheritance of work and job security has all but disappeared and it is argued that jobs now change with such frequency and so radically that they can no longer be considered a significant indicator (Jones and Cameron, 1984). A major shortcoming of this approach is the problem of within-class heterogeneity that results from trying to place thousands of different occupations into a handful of representative categories. Although researchers can attempt to minimise mis-classification, it is to a certain extent, unavoidable (Berkman and MacIntyre, 1997). Variation between regions and the societies within America socio-economic social class is again important, both nationally and internationally. In Britain a traditionally defined class structure justified and made possible the original classifications. In America, however, epidemiologists have tended to use various alternatives, mostly commonly education and income (Murray et al., 1999). Although not an issue in the present study, this type of inconsistency becomes especially important when comparing populations, or studies from different countries/societies that use different socio-economic variables as was the case in Section 3.4 (Murray et al., 1999). A final limitation of many schemas is failure to classify non-working groups, such as students, retired people, homemakers and unpaid carers, which can result in the exclusion of potentially large numbers of people (Galobardes et al., 2006; Rose and O'Reilly, 1997).

Despite these issues, occupation can provide useful information about, individuals' social and economic position. As with socio-economic measurement in general, it is how much researchers try to infer on the basis of a single socio-economic outcome, like occupation, that can lead to oversimplification of a complex construct. As classification schemas have been created and evolved to overcome problems and criticisms such as those described, the types of classification have diversified (Bergman and Joye, 2001; Liberatos et al., 1988). There are two distinct approaches: the *prestige perspective* that uses level of esteem associated with occupation, and the *socio-economic approach* that bases classification on constructs such as educational requirements and monetary payoffs. Most fall into the latter category (Appendix 7).

The most recent occupational classification schema is the National Statistics Socio-economic Classification (NS-SEC) (Rose and O'Reilly, 1998). Its purpose was to replace the existing indices used official statistics and academic research in Britain, most of which were derived from the BRG (Office for National Statistics, 2002). The main aims of the creators of the NS-SEC were to employ a clear conceptual rationale, enable classification of non-working individuals (by previous occupation), and to avoid outdated distinctions such as 'manual' versus 'non-manual' and references to skill. The Goldthorpe schema (1997) was chosen as the theoretical base. This widely used and accepted approach focuses on how individuals fit into the labour market relative to each other and has been reasonably well-validated in terms of both criterion and construct validity (Rose and O'Reilly, 1998). Moreover, the NS-SEC only requires information on type of occupation, employment relations and company size, which simplifies the process of data collection and coding.

In summary, by its very nature, occupational social classification will always be limited by the need to group large numbers of people into a manageable number of meaningful categories. The implicit assumptions of within-class homogeneity and that work has primacy in defining a person's social standing, are somewhat unavoidable. Other shortcomings can be addressed. They include under-theorising, omission of non-working groups that comprise a substantial proportion of society, and short-cuts and substitutions, often made for reasons of data availability that tend to weaken predictive power of schemas and the link between theory and empirical application. Few areas in social science can claim to have been so thoroughly analysed as occupational social classification, yet many theoretical, conceptual and methodological problems remain (Bergman and Joye, 2001). As the number of people finding themselves without a single stable occupation increased, using social class alone is becoming a less satisfactory means of socio-economic measurement and the value of using additional measures in an attempt to reflect the multi-dimensionality of SEP has been recognised (Bartley and Blane, 1994; Berkman and MacIntyre, 1997).

7.7 Deprivation

7.7.1 Definition and measurement

In contrast to the socio-economic indicators described, which can be measured at either the individual or area-level, deprivation operates at area-level only. It relates to a combination of circumstances that describe relative disadvantage of areas, usually based on the characteristics of the resident population. There has been some confusion regarding measurement of deprivation and the related concept of poverty (Martin et al., 2000), which represent distinct constructs. Deprivation is, 'a state of observable and demonstrable disadvantage relative to the local community or the wider society or nation to which an individual, family or group belongs' (Townsend, 1987: p.16).

Poverty on the other hand, has been defined as, 'the situation in which resources are so seriously below those demanded by the average individual or family that the poor are, in effect excluded from ordinary patterns, customs, and activities' (Gordon, 1995: S40). Put simply, people can experience one or more forms of deprivation but are not considered to be in poverty until this falls below a certain threshold that marks a state of objective poverty (Townsend, 1987). For example, in America the Federal poverty line defines poverty and non-poverty areas (e.g. in Ford et al 1991, Section 3.4.3), whereas in Britain this kind of nationally recognised definition of poverty does not exist.

The ease of measuring (and defining) deprivation has meant that researchers tend to favour it over poverty. This has been achieved through developing deprivation indices, which combine area-level data on several socio-economic outcomes to identify geographical areas with a combination of circumstances indicating low living standards, a high need for services, or both (Bartley and Blane, 1994). Their aim is to reflect the multi-dimensionality of deprivation in a single composite variable (Morris and Carstairs, 1991), thus allowing simple comparisons (Martin et al., 2000). As all deprivation indices are calculated using area-level data, the aforementioned advantages and disadvantages of such data apply (Section 7.4).

In public health research, deprivation indices are used to rank areas (such as wards or OAs) to highlight priority areas for resource allocation. Therefore, composition of indices and their appropriateness for use in different areas and populations can have serious implications in terms of government funding; this has provoked some debate (Mackenzie et al., 1998; Martin et al., 2000). Researchers have been accused of using available data through convenience and simply 'trawling' for indicators to include (Townsend et al., 1988). Consequently, the importance of providing a coherent sociological rationale has been emphasised. Townsend et al (1987) identified two important considerations when composing indices. First of all, the authors distinguished between indicators of *material* deprivation, characterised by material apparatus, goods, services, resources, amenities, physical environment and location of life; and *social* deprivation, relating to participation, social support and integration, recreation and education. The latter is more difficult to establish and measure. Secondly, the authors distinguished between *direct* and *indirect* indicators. Direct indicators refer to outcomes such as lack of car access or unemployment, whereas indirect measures refer to demographic population subgroups that tend to experience deprivation, such as single parents or lone pensioners. Indirect indicators, therefore, assume that all members of certain groups are equally deprived and effectively use these groups who often experience deprivation as part of its definition. However, Townsend et al (1987) argued that even if many people in such population groups experience deprivation, this is wrong in principle as it is no longer a measure of deprivation.

Once again, there is no 'gold-standard' approach to measuring deprivation and a history of poor conceptualisation (Carr-Hill and Chalmers-Dixon, 2002; Morris and Carstairs, 1991) has resulted in considerable diversity in index composition. Choice of indicators to be included in each deprivation index has largely been determined by the specific purpose (Martin et al., 2000). Because deprived status can be a gateway to funding, certain indices will be selected on the basis of their performance in certain areas. Moreover, particular organisations have tended to favour different indices. For example, until recently Health Authorities (now PCTs) favoured the Townsend Score (Townsend et al., 1988), whereas the Department of Health often used the Jarman Underprivileged Area Score (Jarman, 1983; Jarman, 1984), primarily because they reflect different things as will become apparent in the next section.

Before some of the main indices are discussed, methods of index construction are outlined. Although there is variation in the statistical method of combining individual indicators, a commonly used approach is to standardise each indicator (to a mean of 0 and a standard deviation of 1) to ensure they contribute equal weight within the index. Following standardisation, often indicators are simply summed to produce a composite score. Alternatively, researchers might differentially weight items to reflect their relative importance prior to summing (Bartley and Blane, 1994); whether or not to weight indicators and how to determine their relative importance is yet another potential source of controversy. Gordon (1995) argues that because some groups are more likely to suffer from multiple deprivation than others, that to weight them equally would yield inaccurate results. However, this argument only applies to indices composed of indirect measures (e.g. proportion of single parent households). The same author also argues in favour of weighting to make interpretation easier by allowing outcomes to be given in percentages of deprivation rather than Zscores or χ^2 scores. However, such problems are easily overcome by conversion of scores into more meaningful forms. The use, or otherwise, of weighting should only influence how the final score is calculated; the form in which results are reported is secondary. Use of weighting introduces the issue of how relative weights should be determined. Some researchers have done so through statistical analysis of large-scale survey data (Gordon, 1995), whereas others have used more subjective methods (Jarman, 1983; Jarman, 1984). To avoid this issue, simplify interpretation, and potentially broaden applicability of indices beyond the specific population group in which they are developed, using equal weighting appears preferable where possible.

Since the first index of deprivation was developed by the Department of Environment in 1971 (Bartley and Blane, 1994) many more have followed (Mackenzie et al., 1998). Some of the more commonly used deprivation indices summarised in Table 7.1 will be discussed. This not only provides insight into the diversity of composition and construction in relation to their underlying purpose, but also highlights strengths and weaknesses associated with each.

7.7.2 Types of deprivation indices

Townsend Material Deprivation Score

Townsend and colleagues are considered by some to have pioneered deprivation measurement (Sloggett and Joshi, 1994). The Townsend score was developed in mostly urban areas of North East England (Townsend et al., 1988), primarily as a reaction to the fact that its predecessors, developed in the South East, consistently identified that the most deprived areas of England were in London (Jarman, 1983; Jarman, 1984; Mackenzie et al., 1998). It is calculated from four unweighted census indicators (Table 7.1) selected on the basis of authors' expertise and experience and the current literature (Martin et al., 2000; Townsend et al., 1988). As the name suggests, the score's purpose was to reflect only material deprivation and is constructed from only *direct* indicators of material deprivation, which are less problematic to define and measure and avoid unwittingly discriminating against population subgroups (Townsend, 1987).

Unlike the creators of some indices, Townsend et al (1988) first adopted a concept (i.e. measurement of material deprivation), and then sought a method. As a result, researchers were able to provide a conceptual rationale to justify their choice of indicator (Morris and Carstairs, 1991). Unemployment was included as a harbinger of other misfortune reflecting more than lack of access to a job and income, with implications for a lack of material resources. Not owning a home reflects lack of wealth in addition to current income. Non-car ownership was defended as being a good surrogate for current income due to the substantial costs associated with running a car beyond the initial purchase cost. Finally, household overcrowding provided a more general guide to living circumstances and housing conditions. Construction of the score is simple. All four variables are standardised and the unemployment and overcrowding variables are log transformed to reduce skewness (Carr-Hill and Chalmers-Dixon, 2002). The sum of the resulting four variables (Zscores) produces the final score in which a high value indicates that an area is highly deprived. The component scores are not weighted. For more detail refer to Section 9.2.2.

Table 7.1 Indicators comprising five census-based deprivation indices

	Jarman	Townsend	Carstairs	DoE 91	Breadline
Direct indicators					
Unemployment	✓	✓	✓ (male)	✓	✓
Overcrowding	✓	✓	✓		✓
No car		✓	✓	✓	✓
Not homeowner		✓			✓
Low social class	✓		✓		✓
Lacking amenities				✓	
Residential mobility	✓				
Indirect indicators					
Children living in flats				✓	
Children in poor households				✓	
Long-term limiting illness				✓	
Single pensioner	✓				✓
Children aged under five	✓				
Lone parents	✓				✓
Born in new Commonwealth	✓				

(Modified from Carr-Hill and Chalmers-Dixon 2002)

The Townsend score has been widely-used in British epidemiology and is considered one of the best available measures of deprivation (Hoare, 2003). It has consistently demonstrated construct validity through gradients of increasing morbidity (Eachus, Williams, Chan et al., 1996; Hoare, 2003; Morris and Carstairs, 1991; Saul and Payne, 1999) and mortality (Morris and Carstairs, 1991; Phillimore, Beattie and Townsend, 1994) in areas of increasing deprivation. Indeed, some have used derivations of the index and similarly found consistent health and mortality gradients (Sloggett and Joshi, 1994; White et al., 1999). Despite its popularity, the Townsend score has been criticised for the inclusion of the car non-ownership variable and the implications for use in rural areas (Haynes and Gale, 2000) as discussed previously (Section 7.5.2). However, positive relationships between most morbidities and deprivation at ED-level has been reported in large-scale analysis of a largely rural region of England (Eachus et al., 1996). Moreover, there is evidence that the Townsend score performs similarly in urban and rural areas (Gilthorpe and Wilson, 2003; Martin et al., 2000).

Carstairs Index

Carstairs and Morris (1989) constructed a similar index to analyse Scottish health data (whereas Townsend was developed for use in England). The Carstairs index comprises four unweighted census indicators, also avoids inclusion of indirect measures and is similarly constructed (Carr-Hill and Chalmers-Dixon, 2002). The primary difference from the Townsend score is the replacement of housing tenure with the proportion of households with head of household in Social Class IV or V. Housing tenure was thought less relevant in Scotland because of the large proportion of public sector housing and because it has shown a weaker association with health in Scotland (Morris and Carstairs, 1991).

Not surprisingly, the Townsend and Carstairs indices exhibit similar relationships with health outcomes, mortality (Morris and Carstairs, 1991), and GP workload (Ben-Shlomo et al., 1992). Although the Scottish index is open to the same criticisms for including car non-ownership (Farmer et al., 2001), its robustness in analyses of health data in Scotland, which comprises a substantial proportion of rural land, goes some way to defend against this.

Jarman Underprivileged Area (UPA) Score

The Jarman score was originally constructed to identify geographical inequalities in primary care workload through a survey of GPs (Jarman, 1983; Jarman, 1984). The most commonly used variant of the score (UPA8) comprises eight individually weighted variables identified by GPs as being major contributors to their workload (Thunhurst, 1985). As a result, the method of development and construction were markedly different from those just described. The Jarman score combines an approximately equal number of direct and indirect indicators in addition to indicators of both material and social deprivation (Table 7.1). Furthermore, component variables are weighted. Thirteen factors were identified by GPs as main contributors to workload. These were divided into 'social' and 'service' factors. Eight of the social factors were included in the UPA8 following transformation to reduce skewness, and weighting on the basis of GP opinion (Thunhurst, 1985).

Jarman and colleagues were criticised for excluding indicators, the process of indicator selection, and the representativeness of the GP sample (Thunhurst, 1985). Nevertheless, the purpose of the index and subsequent method for selection of the indicators was consistent and justified. The problems arise when it is treated as a direct measure of deprivation. It is not. The creators adopted the concept of measuring influences on GP workload and proceeded to develop this on the basis of GP opinion. An unrepresentative GP sample is a weakness but combining social-material and direct-indirect factors is not, unless the score is interpreted as anything other than a GP perspective of workload contributors.

Indices of Multiple Deprivation (IMD)

In 1998 the Department for Environment, Transport and the Regions (DETR) commissioned a review of the existing Index of Local Deprivation, which resulted in the development of the Index of Multiple Deprivation (IMD) in 2000 (DETR, 2000). This has since been updated to the IMD 2004 (ODPM, 2004). This is broadly constructed from seven domains of deprivation (Table 7.2), each containing a number of indicators, totalling thirty-seven overall (Appendix 8).

Table 7.2 Domains of the Index of Multiple Deprivation 2004

Domain	Weight
Income	22.5%
Employment	22.5%
Health Deprivation and Disability	13.5%
Education, Skills and Training	13.5%
Barriers to Housing and Services Domain	9.3%
Living environment deprivation	9.3%
Crime and disorder	9.3%

The statistical methods used to calculate the IMD are described in more detail elsewhere (ODPM, 2004). Briefly, standardisation and transformation were performed to ensure that each domain had a common distribution before they were combined with appropriate weightings (Table 7.2). Weights were selected through research and consultation. The Income and Employment domains were given the greatest weights because they were regarded as the most important contributors to the concept of multiple deprivation and the indicators comprising these domains were judged to be robust.

The underlying conceptual aim of this approach was to create an aggregate measure to reflect different dimensions of deprivation. Although the IMD was born out of research and consultation, there are some conceptual and practical pitfalls associated with the approach taken. For example, in order to capture many different types of deprivation, the IMD 2000 and the revised IMD 2004 used previously untapped data sources and geographical access information rather than relying on census variables as do the indices listed in Table 7.1. Consequently, the index contains a broad range of indicators of both social and material deprivation (Townsend et al., 1988). Therefore, despite a clear conceptual base that preceded its development, the combination of indicators of material and social deprivation in the IMD complicates interpretation of exactly what the index represents. As detailed previously, the most appropriate approach to socio-economic measurement depends on the population; yet in attempting to be an index that considers all different types of deprivation, and therefore be appropriate for all population groups, the complexity of the index arguably results in some loss of conceptual clarity.

Furthermore, the concept of an index that could be frequently updated and was not reliant on decennial census data has strength in its dynamism but equally, such instability reduces longer-term comparability. Different indicators reflect data collected at different times, ranging from 1997 to 2003. Therefore, although the 10-year time lag associated with using this decennial census data is a potential issue, census data do reflect a cross-section at one particular time. It is also thought that interest in using such dynamic measures to determine resource allocation might diminish if they prove too variable to maintain (Carr-Hill and Chalmers-Dixon, 2002). Further, in terms of reflecting health inequalities, older data (i.e. from last census) might be a better proxy for health by representing life time exposure. Finally, deprivation data measured using the IMD 2004 have been released at SOA-level. Again these are preferable to the traditionally used ward-level data but less sensitive than OA-level data. Conversely, census 2001 variables necessary to construct the Townsend score are available at this smaller area level.

Being so recent,[22] there is little empirical research to inform on the performance of the IMD 2004. The following section discusses the few studies that have reviewed the performance of the IMD 2000.

7.7.3 Comparisons of deprivation indices

Most studies that compare performance of indices do so through exploring their associations with health outcomes (construct validity). Morris and Carstairs (1991) however, explored correlations between the Townsend, Carstairs, and Jarman scores in addition to their relationships with health outcomes in Scotland. As expected, the similarly constructed Carstairs and Townsend indices were most highly correlated. Both were also found to explain most variation in health indicators (mortality and morbidity). The same has been reported in England. Without exception the Townsend score has been found to correlate more closely with morbidity than the Jarman score (Saul and Payne, 1999). Perhaps more surprising were the findings that the Townsend score was a better predictor of GP workload than the Scotdep and Jarman indices (Ben-Shlomo et al., 1992), with the car ownership and housing tenure components explaining most variation. As the Jarman score was designed for this very purpose, regional differences and the London bias associated with the Jarman (Mackenzie et al., 1998) could explain why the index underperformed in other areas.

A recent comparison between the IMD 2000 and the Townsend score was conducted in the Southwest of England, a largely rural region (Jordan et al., 2004b). It was expected that the geographical access to services domain would enable the IMD 2000 to out-perform the Townsend score. Yet, the authors found that at ward-level the IMD and Townsend scores were comparable in their relationship to mortality and morbidity overall, although in rural areas the correlation between the Townsend score and morbidity was attenuated. However, this did not necessarily represent a weakness in detecting material deprivation. Analysis revealed that in rural areas the Health Deprivation and Disability and Education domains were most important, whereas the Geographical Access domain did not contribute to variation in health outcome, providing no evidence that the accessibility domain successfully overcomes problems of

[22] At the time of writing and planning of the present study.

capturing rural deprivation. Indeed, the access domain was modified and replaced in the IMD 2004.

Elsewhere, gradients of increasing prevalence of ten morbidities and the same two deprivation indices (at ward-level) have been demonstrated, without notable differences (Hoare, 2003). The authors concluded that the relevance of the Townsend index to health data remained and recommended investigation of the updated IMD 2004 in relation to census 2001 data to determine whether subsequent refinements had improved its performance. This had not been undertaken at the time of the present study.

In relation to health data, those indices that include health or disability indicators are likely to correlate better than indices of material deprivation. Again, it is a matter of being clear what the index is attempting to measure. If this is material well-being, the inclusion of health outcomes would seem inappropriate introducing an unnecessary assumption that all those in deprived areas experience poor health. Overall, the choice of index, (and method of socio-economic measurement in general) must be driven by the purpose of the research, and interpretation of findings must be based on the conceptual rationale behind the index construction (Galobardes et al., 2006). Overall, composition of deprivation indices is fundamental in determining their appropriateness in different areas and populations. Researchers need to understand them in terms of the purpose for which they were developed and the validity of the assumptions upon which they rely (Bartley and Blane, 1994). The application of deprivation indices which has provoked much debate is that in rural areas. The following section aims to provide insight into why measuring SEP in rural areas, particularly deprivation, has proved so controversial.

7.8 Socio-economic measurement in rural areas

7.8.1 Problems of socio-economic measurement in rural areas

The source of debate surrounding socio-economic measurement in rural areas relates primarily to socio-economic classification at the area-level (Martin et al., 2000). Rural areas are more sparsely populated, often with more heterogeneous populations. This reduces the representativeness of, and exacerbates the problems associated with aggregated area-level data. This becomes more problematic with increasingly large areas such as wards, which until relatively recently, were the most commonly used areal unit. In addition to population heterogeneity, the aforementioned collective socio-economic influences are likely to be reduced in increasingly sparse populations. As a result, using mean socio-economic characteristics to compare deprivation levels of large geographical areas such as wards, is likely to underestimate the socio-economic range and mask more subtle socio-economic variation at the smaller area-level (Farmer et al., 2001; Haynes and Gale, 2000; Martin et al., 2000). In addition, there is the problem of measuring rurality (Farmer et al., 2001; Martin et al., 2000).

7.8.2 Defining rurality

The concept of rurality as, 'non-urban space characterized by population sparsity' (Hoggart, Buller and Black, 1995) is widely accepted. Yet, the methodological problems encountered when defining and measuring rurality are similar to those of deprivation (Martin et al., 2000). The absence of an absolute agreed definition of rurality has created diversity in how it has been defined: on the basis of description, socio-cultural characteristics, structural features (such as industry type and population density), and personal constructions of rurality (Farmer et al., 2001; Martin et al., 2000).

Population or settlement size is the most basic measure that takes no account of geographical area. The most widely used indicator is population density, favoured for its transparency and ease of calculation. As a continuous variable it can be ranked to simplify comparisons with other areas (Martin et al. 2000). There is, however, no consistently used threshold value of population density used to define rurality (Farmer et al., 2001; Martin et al., 2000). Aside from population-related measures, other definitions involve measurement of distance to the nearest neighbourhood (i.e. geographical isolation) and access to facilities or services. Further, some multivariate classification schemes, equivalent to deprivation indices, attempt to capture the multidimensional nature of rurality (Martin et al., 2000).

The most recent official classification used in Britain was developed through the collaboration of five bodies (Bibby and Shepherd, 2004). The overall aim was to create a schema that considers several aspects of rurality; population settlement size, settlement type and the surrounding geography. This is discussed further in Section 8.4.

7.8.3 Rural deprivation

Problems associated with area-level socio-economic measurement, particularly deprivation, combined with limitations of previous areal units of analysis have led to claims that rural deprivation is misrepresented (Martin et al., 2000). Some argue that the reality of rural life is not adequately reflected through current measures of deprivation (Farmer et al., 2001; Haynes and Gale, 2000), describing them as 'meaningless' area averages (Farmer et al., 2001).

In addition to the problems of area-level data, there are some general differences between urban and rural areas such that certain indicators are thought to have different implications for those living in the different area types. There are differences in employment opportunities and types of industry. Average incomes are lower in rural populations despite higher employment, and there are more restrictions in the choice of work and opportunities for career advancement. The recent decline in the traditionally rural agricultural and extractive industries has exacerbated rural deprivation. Furthermore, declining services, poor accessibility and infrastructures have implications beyond material well-being, in terms of social exclusion (Farmer et al., 2001; Martin et al., 2000). Clearly such differences would have an impact on making urban-rural comparisons on the basis of occupational social class or income.

Furthermore, as described earlier (Section 7.5.2), the relevance of car ownership as a socio-economic outcome in rural populations has been a major source of contention because of rural dwellers' greater dependence on private transport (Farmer et al., 2001; Gilthorpe and Wilson, 2003). Its inclusion in deprivation indices (Carstairs and Morris, 1989; Townsend et al., 1988) has been condemned (Farmer et al., 2001). However, not only is there evidence to the contrary (Gilthorpe and Wilson, 2003) but comparisons between the Townsend score (includes the car ownership) and the IMD 2000 (that included the access domain thought more relevant to rural areas) have failed to show marked differences in performance (Hoare, 2003; Jordan et al., 2004b).

Heterogeneity of rural populations certainly means that measurement at a more local level than the traditionally used ward or district is required (Farmer et al., 2001). A study exploring the construct validity of measures of rural deprivation, found that by combining rural wards to make their populations comparable in size with those of urban wards, almost all correlations between deprivation and health outcomes were increased such that the marked pattern of weaker associations in rural areas practically disappeared (Haynes and Gale, 2000). The authors then combined rural wards to increase social homogeneity within geographical units. The result was an increase in three out of four associations in rural areas, removing any remaining differences between the strength of the relationships in urban and rural areas. They concluded that apparent differences in health-deprivation associations between rural and urban areas were not due to choice of deprivation index or census areas. Rather they were identified as artefacts of the greater internal variability, smaller average deprivation range and smaller population size of rural small areas. Therefore, the recent evolution of census geography resulting in smaller Output Areas should address some of the previous problems by increasing the homogeneity within areas and imposing a minimum OA population size.

7.9 Conclusion

Some have questioned the value of socio-economic measurements originally developed to define gradients in health outcomes. However, socio-economic measurement has evolved since the early social class schemas were defined. Moreover, there is substantial inequity in the distribution of wealth with numerous adverse consequences and, therefore, attempting to measure how and to what extent this impacts on factors such as health and behaviour, is by no means a futile academic exercise. All measures of SEP or deprivation are open to criticism because of the difficulty in demonstrating their validity and differential applicability in different populations, societies, and types of area. Deprivation indices provide a useful and easily interpreted way to assess more than one dimension of SEP. Moreover, with recent developments in the geography of area-level measurement, previous problems associated with measuring area deprivation have been greatly reduced.

Much of the controversy regarding socio-economic measurement and debate over the implications of different measurement methods stems from conceptual confusion and inadequate theorising. In this discussion a distinction between material and social measures was used. However, such clear cut distinctions become less defined when making inferences about the effects of SEP on health or behaviour. Different aspects of SEP interact and it can be argued that material wealth influences health or behaviour through psychosocial mechanisms (Section 2.4.3). Nevertheless, regardless of the specific socio-economic indicator(s) or use of individual or area-level data, researchers must provide a clear conceptual rationale underpinning the chosen approach to socio-economic measurement. Even if data availability imposes limitations on the socio-economic outcomes variables included, which in practice is often the case, an understanding of their theoretical basis is important to ensure that interpretation and inferences are appropriate and defendable (Galobardes et al., 2006) and not based on spurious assumptions.

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Chapter 8

Following the review of literature in Chapters 2 to 7 that aimed to provide the broader context for the present study, the next chapter describes the immediate setting of the research. The purpose Chapter 8 is to provide understanding of the PARS under evaluation and the source of data, which will enable a discussion of findings from this scheme within the broader context.

Chapter 8: Contextualisation and background to research

8.1 The ProActive Physical Activity Referral Scheme

The present chapter provides background contextualisation, and includes a brief history of the ProActive scheme, its organisation, participants' journeys through the scheme, the role of the ProActive Project Worker and finally, the type of data used. For further detail regarding the workings of the ProActive scheme, the reader is referred to Crone et al (2004).

8.1.1 Background

The Proactive PARS is a collaborative, countywide scheme for Somerset run by the Somerset Physical Activity Group (SPAG), Taunton Deane PCT (formerly Somerset Health Authority), Sheffield Hallam University from (2005-2006), and the University of Gloucestershire (2000-2004). True to the PARS model (Figure 5.1), ProActive involves the referral of primary care patients by health professionals to attend a programme of supervised exercise sessions with local leisure providers, most commonly leisure centres or health clubs. In addition to operating countywide with an annual turnover of approximately 1500 referrals, the scheme has been cited as a model of good practice (Biddle et al., 2000).

The scheme was first established in 1994 with the initial remit of CHD prevention. This was subsequently broadened to include a diverse range of conditions. The scheme underwent restructuring following an evaluation (Grant, 1999), which examined a sample of individuals referred to ProActive (n=548) between 1995 and 1997. Overall, the referred population was above-average age (mean=51 yrs); predominantly female (60%); three-quarters of those who started the scheme were reported to have successfully completed programmes (≥80% sessions), with significant six-month increases in self reported physical activity in this group. However, there is a fundamental difference between the data available for this first evaluation and data used in the present study; a difference which resulted from scheme modifications made on the back of this earlier evaluation. The most important change was the introduction of a

Central Referral Mechanism (CRM) managed by the ProActive Management Service (PMS) in 2000.

8.1.2 ProActive Management Service, the CRM and the present study

The CRM is a central Microsoft Access database designed specifically to keep a record of *all* people referred to ProActive by health professionals, rather than being restricted to data from those who take up referral.[23]

Following the earlier evaluation (Grant, 1999), financial support for the scheme continued, which resulted in contracting of the PMS to provide an exercise science support service (Crone et al., 2004). Formerly provided by the University of Gloucestershire and more recently, Sheffield Hallam University, this was a unique aspect of the scheme that ultimately made the present research possible. Centralisation of data collection and affiliation with an academic institute was a clear demonstration of SPAG's commitment to developing evidence-based practice.

The ProActive Project Worker was primarily responsible for centrally coordinating the referral scheme made possible by the CRM; the researcher's experience in this role provided a valuable insight into the scheme (Section 13.5.4). Ever since the CRM was introduced, details of *all* referred participants[24] have been sent to the Project Worker, who was responsible for the day-to-day maintenance of the CRM. By collating details on all clients from the point of referral, the CRM has provided an opportunity to examine those who dropout or remove themselves before taking up referral. It is this group for whom data have traditionally not been available (Gidlow et al., 2005) (Section 5.5).

The following section provides an overview of the organisation of ProActive and the referral process to give further background to the data used in the present evaluation.

[23] Uptake is defined as attending an initial consultation or first exercise session with exercise professionals (refer to Section 5.5)
[24] All people referred to ProActive will be referred to as 'participants' or 'clients'.

8.1.3 Organisation and structure of the ProActive scheme[25]

Recognition of leisure providers

Ever since the establishment of ProActive in 1994, leisure providers have been unable to receive ProActive participants until they are recognised via SPAG. Another revision of the scheme in 2000 was renewal and improvement of the recognition procedure for leisure providers following national changes in the fitness industry. This unique aspect of ProActive has imposed a level of quality assurance and consistency in the service that is in keeping with national guidelines (Department of Health, 2001b). The process aims not only to provide quality assurance but also to help standardise the service across leisure providers (Crone et al., 2004).

Referring health professionals

Referrals are predominantly made by GPs (72.4%), practice nurses (13.1%) and physiotherapists (10.6%). The remainder come from other health professionals such as dietitians, cardiac nurses, and health visitors (Sidford, 2006). Therefore, the majority of referrals originate from the eighty or so general practices in Somerset, with others from hospital physiotherapy and cardiac departments, pain management clinics, and community health professionals (e.g. community dietitians; community nurses).

ProActive participants

All referring health professionals are provided with a list of medical conditions, including unstable angina and uncontrolled metabolic diseases that preclude some individuals from the ProActive scheme (Appendix 9). A minimum age of sixteen years is recommended for referrals. A small number of minors have been referred but their acceptance on the scheme is at the discretion of the leisure providers. Aside from these criteria the scheme is open to all those identified as insufficiently active and referred by a health professional. The most common reasons for referrals tended to be overweight

[25] Although the ProActive scheme is still running, it is described in the past tense because the description applies to the nature of the scheme and the status of the leisure providers at the time of the study

and obesity (30.3%), musculoskeletal conditions (26.3%) and cardiovascular disease (16.0%) (Grant, 1999; Sidford, 2006)

Leisure providers and exercise interventions

Over the three-year period of data collection for the present study (May 2000 - May 2003) participants attended a total of thirty different leisure providers. Most were leisure centres and health clubs that offered primarily gym-based programmes, some with optional pool-based or exercise classes. There were several independent instructors recognised by ProActive who ran various classes, including exercise to music, phase IV cardiac rehabilitation classes and Tai Chi. However, this accounted for less than two *per* cent of referrals during the study period.

Almost all leisure providers offered between eight and twelve weeks of supervised exercise at the leisure facilities, usually with twice-weekly sessions. Leisure providers run sessions specifically set aside for ProActive participants. The majority of these took place during the daytime (on weekdays), with several offering evening or weekend sessions. At most leisure providers (but not all) participation in ProActive was subsidised and typically less expensive than if clients were to attend as regular users. The total cost of participation to the individual could range between £28 and £69 depending on the leisure provider. Some offered concessions to those on benefits; for example, reducing the cost of an eight-week programme from £32 to £21. Only one leisure provider offered ProActive free of charge to benefit claimants.[26]

The final important point to note about leisure providers in the context of the present study is that the majority were based in urban areas of Somerset. Figure 8.1 indicates the location of the main towns and leisure providers (during the study period) across Somerset. With few exceptions, the main towns contained at least one ProActive leisure provider; several towns contained more than one (Taunton, Bridgwater, Street). Although not marked in Figure 8.1, a small number of leisure providers, mostly independent instructors rather than leisure facilities, were based outside of the larger

[26] Only one scheme at the time of the study offered ProActive free of charge to benefit claimants. More leisure providers have since followed this example (refer to Section 13.3)

towns (n=4). Clearly, this leaves a lot of rural areas in which residents are not in close proximity to a leisure provider.

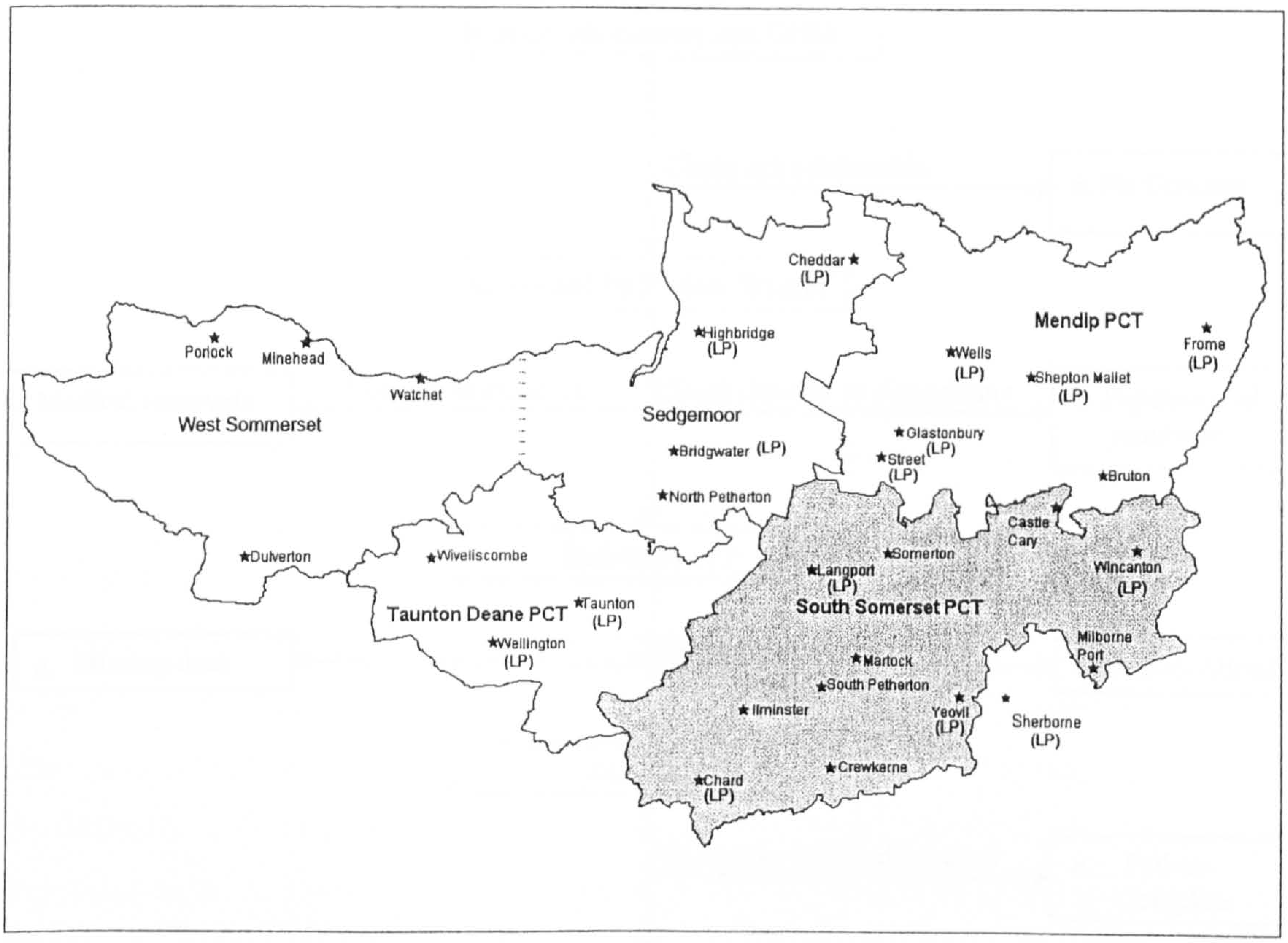

Figure 8.1 Map of major towns and ProActive leisure providers in Somerset (Note: leisure providers in West Somerset not marked as excluded from later analyses)

The ProActive scheme structure and the ProActive Project Worker

Figure 8.2 illustrates the various stages of a ProActive referral and the possible routes of clients referred by health professionals in terms of their removal, uptake and level of attendance (or completion). For each client, a referral form is completed by the referring health professional (Appendix 10). This provides details including client contact details, reason(s) for referral, the referrer, and signatures of referrer and client giving consent to being contacted by the Project Worker. All referral forms are sent to the Project Worker and the information entered into the CRM. The Project Worker attempts to contact each client with up to three telephone calls, leaving messages where possible. If there is no response, a letter is written to clients who are given two weeks to respond, after which time they are removed from the scheme and classified as 'No Contacts'.

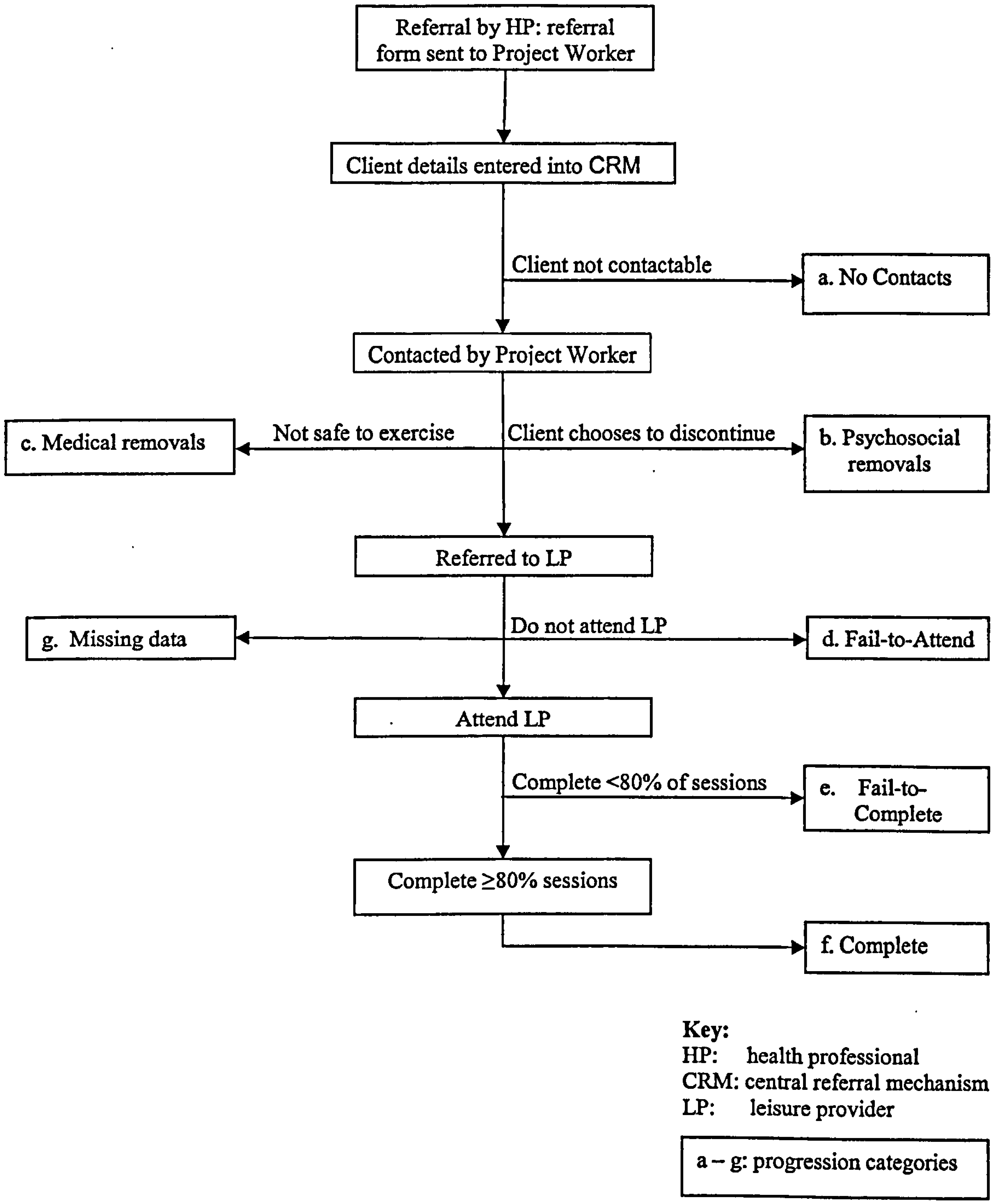

Figure 8.2 Participants' journeys through the ProActive PARS

Telephone consultations between the Project Worker and client involve risk stratification to identify any contraindicators that would preclude participants from the scheme according to the criteria shown in Appendix 7.[27] Individuals deemed unsafe for exercise are informed and removed from the scheme, and a letter is sent to the referring health professional. Others who are eligible but who choose not to proceed for non-medical reasons such as finance or transport problems are also removed from the scheme. These groups of clients are referred to as 'medical' and 'psychosocial' removals, respectively. 'Removing' individuals from the scheme simply refers to the ProActive Project Worker recording the reason for discontinuation in the CRM and the client progressing no further within the scheme. Their data however, are retained in the CRM for auditing and evaluation purposes.

For those who are both safe and willing to proceed, the consultation continues with a sharing of information about the scheme, the options available to them and further details such as cost, location and times of ProActive exercise sessions at leisure providers. Participants are then referred to the most appropriate leisure provider, often the one closest to their homes. Information from the health professional and any additional information collected by the Project Worker is sent to the appropriate leisure provider with a Personal Client Record (PCR: Appendix 11). The PCR form is used by supervising exercise professionals to keep a record of participant attendance level or failure to attend (in addition to other data) and is returned to the Project Worker post-intervention to be inputted into the CRM.

Upon receiving the PCR, leisure providers contact clients to arrange a pre-intervention assessment. If, however, clients cannot be contacted, fail-to-attend the initial assessment, or fail to commence their exercise programme, they are classified as 'Fail-to-Attend'. Those who attend at least one session but less than eighty *per* cent are classified as 'Fail-to-Complete'. Finally, clients who attend at least eighty *per* cent of their exercise sessions are considered 'Completers'. The PCRs are returned to the Project Worker for details of attendance or non-attendance to be entered into the CRM. Therefore, regardless of the fate of participants referred to ProActive, the CRM provides a complete record of their progress from the initial referral to the end of their participation.

[27] Criteria were created in accordance with recommendations of the NQAF (DoH, 2001), guidelines from the British Association of Cardiac Rehabilitation (BACR) and the American College of Sports Medicine (ACSM). Some patients require the professional judgement of the Project Worker and possibly other exercise and health professionals involved with the scheme, including the PMS (Crone et al., 2004).

The eighty *per* cent criterion used to define successful completion of programmes was consistent with the previous evaluation (Grant, 1999). The advantages and disadvantages associated with its use are discussed in Section 13.4.1.

The exception: West Somerset

The area of West Somerset is the exception to the general ProActive model. In West Somerset, within the district of Somerset Coast, an independent central referral system is operated by a West Somerset Coordinator who performs the role of the Project Worker at a local level. All clients referred from the West Somerset area are referred immediately to the West Somerset Coordinator by the Project Worker. As a result the participants become classified as 'referred' to leisure providers within the CRM, regardless of their subsequent fate within the scheme. Therefore, depending on the attendance information on the returned PCR, all West Somerset referrals become classified as either 'Fail-to-Attend', Fail-to-Complete', or 'Completers'. In reality, a proportion of this group of referrals would be uncontactable by the West Somerset Coordinator ('No Contacts') and others removed for 'medical' and 'psychosocial' reasons. Unfortunately, this level of information has not been consistently fed back to the ProActive Project Worker and was therefore unavailable. Consequently, data from participants referred from West Somerset were not eligible for inclusion in the second part of the present study (Section 9.4: RQ2).

8.2 Rationale for present study

It emerged in the earlier review of British PARS (Section 5.5) that there has not been an in-depth evaluation of *who* is referred to PARS, *who* removes themselves from the scheme at different stages, and *who* attends or successfully completes the exercise programmes. Moreover, there has been inadequate consideration of external factors such as SEP and area of residence. The researcher is aware of only one other PARS from which data have been published on participants who fail to take up referral by removing themselves from the scheme following the initial referral (Harrison et al., 2005a). However, the authors took no account of subsequent attendance by those who took up referral. Since the advent of the CRM both of these avenues can be explored within the ProActive scheme, offering an opportunity to make a unique contribution to the knowledge base.

Socio-economic position is positively related to physical activity levels (Section 3.4); yet the only studies to date that have examined socio-economic factors in relation to PARS have included them as confounding variables, rather than using them to answer specific research questions (Harrison et al., 2005a; Taylor et al., 1998). Moreover, the methods of socio-economic measurement might explain the lack of association (refer to Sections 12.3.2 and 5.5.3 respectively). Given the increasing problem of health inequalities (Section 2 .4), the importance of physical activity for health (Section 1.1) and the substantial number of PARS intended to improve public health through increasing physical activity (Section 5.2), this is certainly a priority area for investigation.

Furthermore, ProActive operates across Somerset, a largely rural county with several larger urban centres. As described in Section 10.3, over half of Somerset residents live in rural areas (51.6%), with almost one-third living in villages or hamlets and isolated dwellings (32.1%). Given the potential impact that access to leisure providers (and to a lesser extent health professionals) could have on participation, the urban-rural nature of participant area of residence is an important consideration.

The methodology that is introduced in the remainder of this chapter and detailed in Chapter 9 represents a major contribution to British physical activity research. There has been similar research activity in America by Stephen Blair and colleagues (Blair et al., 2001b; 1996; 1992). Yet, the epidemiological methods used here represents an original contribution within the context of physical activity research in Britain and enables engagement with issues and challenges in measurement of SEP that have been largely neglected. The following section describes the approach to socio-economic measurement in the present study that was selected on the basis of information discussed in Chapter 7.

8.3 Measuring socio-economic position in the ProActive population

Addresses and postcodes for all individuals referred to the ProActive scheme were given on referral forms, which provided an opportunity to socio-economically classify clients according to where they live using data collected in the national census. Clearly, the decision to use census data meant a reliance on area-level socio-economic data (Section 7.4).

8.3.1 Why use area level data?

The alternative to using area-level socio-economic data was to recontact ProActive participants to collect individual-level data. This would have involved distribution of a questionnaire to over 3500 individuals. To enable a comparison between socio-economic data from those referred to ProActive and census data for the Somerset population, questions would need to resemble those on the census questionnaire.

This option was eliminated for several reasons. First of all, a poor and biased response rate was anticipated. Low response to postal surveys greatly reduces their value, by reducing the numbers available for analysis and introducing response bias (Walsh 1994). Indeed, a retrospective PARS evaluation that relied on contacting previous participants reported an overall response rate of fifty-five *per* cent (686 out of 1254) and this was twice as high in those who completed compared with those who did not (466 *vs.* 220). A disproportionately low response in those who removed themselves prior to attending or completing the ProActive scheme would effectively negate the rare opportunity to study this group of self-removals made possible by the CRM. Moreover, although questions on income would not have been included, the nature of the questionnaire might further reduce response. It is possible that some individuals would be reluctant to disclose information relating to their occupation and assets, which could be perceived as sensitive information but when not in the context of the national census.

Secondly, SEP at the time of referral was required. This would have been reliant on clients recalling information from up to four years earlier, which would have created potential for recall error. Thirdly, there is an independent area-level socio-economic effect (Section 2.4.1), such that lower socio-economic groups placed in a middle-class environment will adopt health and behavioural advantages associated with their adopted environment and vice versa (MacIntyre et al., 1993). Because the present study is concerned with how people's socio-economic environment might be related to their opportunity and behaviour with respect to the ProActive scheme, measurement of the socio-economic environment was considered appropriate.

Finally, there were several practical advantages not only in terms of measurement, but also practical applications of findings. With knowledge of client postcodes, problems of incomplete and missing socio-economic data were minimised. Further, any apparent area-level effects would enable changes in practice to be targeted at areas with certain characteristics, rather than individuals. This is far less labour-intensive than attempting to identify certain types of individuals. Such a responsibility in the ProActive scheme would fall to health professionals who are unlikely to have the time, resources or necessary information on which to base such judgments.

In summary, the case *for* using census data and *against* gathering individual-level data was overwhelming; this was not simply a choice of convenience. The following section describes the process of census surveys and nature of census data, before describing how they were selected to address the research questions.

8.3.2 Census 2001

In Britain, the census is a compulsory survey of all people and households in the country that takes place every ten years. The 2001 census, which attempted to enumerate all British residents on 29th April 2001, is the most recent census and was an important source of data in the present study. All British residents were required to complete a form with a total of thirty-five questions relating to household accommodation (e.g. housing tenure; car ownership), household composition, personal information (e.g. age; gender; ethnicity), education and training, and occupation. Responses were combined to produce information in the form of approximately 20,000 variables.

Exactly how census data were obtained, processed, and used in the present study is discussed in Sections 9.2-9.3. Residential postcodes were used to assign census data to individuals depending on where they live. The geographical level of output for census data has attracted much attention as discussed in Section 7.4.2. As a result of problems associated with wards and enumeration districts, most census 2001 data were released at Output Area-level, the smallest areal units designed to overcome the limitations of their predecessors.

When using census data, there is potential for data to become 'out of date' as a result of the ten-year time lag. However, the present study used data for ProActive clients referred between 2nd May 2000 and 1st May 2003, the first thee years following the introduction of the CRM. This coincided with timing of census 2001 data collection and, therefore, potential problems were avoided.

8.3.3 Socio-economic variables in the present study

A range of socio-economic data is available through the census. It was important, however, to select variables using a consistent conceptual rationale rather than inclusion based on availability. For the purposes of the present study the Townsend score of material deprivation (Townsend et al., 1988) was selected as the main socio-economic variable (Section 7.7.2). An argument against using the Townsend score is that it was developed in largely urban areas and does not reflect social issues in rural areas such as access to services and social isolation. Neither the existence nor importance of social deprivation is in dispute. The aim of socio-economic measurement in the present study was to explore economic or material deprivation in those referred to the ProActive scheme, to identify possible bias in referral in areas of different affluence, and possible influences on subsequent progression through the scheme. There is evidence that material well-being is linked to social structure and this evidence can be used to discuss possible social implications of a disadvantaged environment in relation to the ProActive scheme. This was considered a more favourable approach than compromising on the conceptual clarity of socio-economic measurement through attempting to combine indicators of different types of deprivation within the same index. Separate rural-urban area variables were included to explore the potential impact of living in different types of area and related access issues. Furthermore, at the time of undertaking the present study, the literature had failed to provide evidence of a more effective alternative (Section 7.7.3).

As discussed in 7.7.2, the Townsend score is one of several deprivation indices and the specific reasons for not using the alternative indices will be outlined. Out of the other census-based indices, the Carstairs index (Carstairs and Morris, 1989) was derived specifically for use in Scotland and performs similarly to the English equivalent Townsend score (Morris and Carstairs, 1991). Therefore, there was no perceived benefit associated with this index. The Jarman score (Jarman, 1983; Jarman, 1984) was not considered because it was designed to measure factors contributing to GP workload and combines indicators of material and social deprivation.

The Index of Multiple Deprivation (IMD) 2004 (ODPM, 2004) was the most recent and obvious alternative. Although favoured by health bodies (e.g. Trusts; Strategic Health Authorities), the IMD 2004 was not selected as the primary socio-economic outcome in the present study for several reasons detailed previously (Section 7.7.2). Briefly, the Townsend score is composed from census data all collected at the same time, which coincided with the timing of participant referrals in the present study. The IMD 2004 on the other hand, comprises indicators collected between 1997 and 2003. Secondly, the Townsend score comprises only direct indicators of material deprivation. The IMD 2004 combines over thirty indicators of both *social* and *material* deprivation[28]. Thirdly, the previous IMD domain intended to capture access deprivation was expected to perform better and to be more relevant to rural areas; yet this was not supported in the literature. At the time of undertaking the present study there was no published evidence that the IMD 2004 was more effective in rural areas. Fourth, census variables used to construction of the Townsend score were available at OA level. In Somerset, OA-level data were mean values aggregated from an average of 299 people or 120 households. IMD 2004 data were only available at the level of Super Output Area-level, which on average contain approximately 1500 residents. Therefore, OA-level data census data were likely to be more sensitive to subtle areal variation, which is especially important in rural areas (Section 7.8) could be masked by aggregating data over larger areas. Finally, the Townsend score has been more widely used in the published literature, especially in public health research, and is more recognised in academic literature. Choosing the Townsend score as the main socio-economic indicator not only improved conceptual clarity but increased comparability with existing literature. However, in recognition of the applied nature of the present research, analyses were repeated

[28] Definitions of direct/indirect and material/social socio-economic indicators are provided in Section 7.2.

substituting the Townsend score with the IMD 2004. This ensured that findings were accessible and relevant to those in a position to use them in practice.

The final possible alternative was the Health and Social Needs Analysis Group deprivation index (HSNAG, 2004), developed to capture the range of needs of Somerset residents. The concept of HSNAG was similar to that of the IMD. Data were collected from a wide range of sources even more diverse than the IMD, to create several domains that combine to reflect different types of deprivation. Although developed specifically for the county of Somerset, the HSNAG index was not appropriate for the present study for similar reasons that prevented the inclusion of IMD 2004 as the primary socio-economic variable. In particular, it combined direct-indirect and material-social indicators, data were at ward-level, and the HSNAG index is not widely used.

In summary, the purpose of performing this area-level socio-economic classification was to gain an overall picture of the relative socio-economic environment using the most rigorous and conceptually robust area-level data possible. The Townsend score was deemed the most effective and widely used method of doing so. Therefore, census 2001 data extraction for analysis was limited to the four variables that make up the Townsend score, the NS-SEC to explore consistency with another dimension of SEP (without confusing the focus of the research questions), and demographic data for Somerset (to compare with the ProActive population).

8.4 Measuring relative rurality-urbanicity

The most recent official classification schema developed from a review by the Office of the Deputy Prime Minister was used to define the type of area in which ProActive participants resided (Bibby and Shepherd, 2004). One of the primary aims of those developing the schema was to produce a core definition of 'urban areas', and to define 'rural areas' reaching all the way down the settlement hierarchy to enable categorisation of the most remote settlements.

Classification was based on three main aspects: urban-rural distinction, morphology of rural settlements (i.e. type of settlement) and the wider geographic context of settlements.

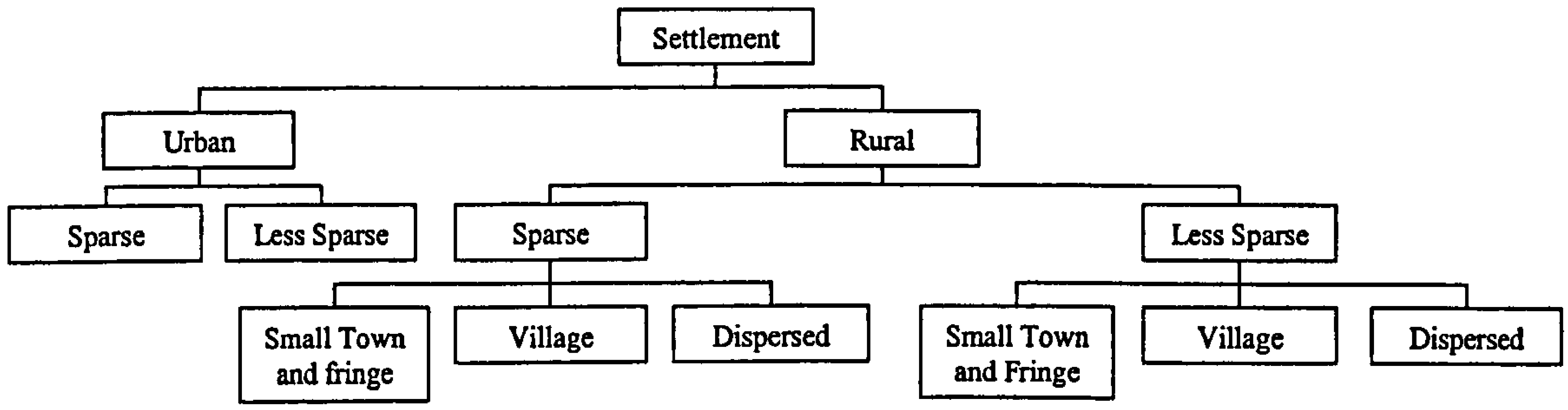

Figure 8.3 Classification of urban-rural areas and settlement type [Adapted from Bibby and Shepherd (2004): p.3]

Figure 8.3 shows the final classification scheme with a total of eight categories derived through a series of steps that will be described briefly. Firstly, urban areas were defined as settlements with a population of 10,000 or more; all other areas fell into the rural domain. Secondly, the locations of residential addresses within a grid of one hectare cells were recorded to form a pattern of household densities. Residential densities were then averaged for each one hectare cell using a set of varying radii around each cell to create density profiles that typified certain types of settlements. In other words, density profiles were created by calculating the density of residences at a series of fixed scales (200m, 400m, 800m and 1600m) around each cell. The profiles created were used to define each type of rural settlement as illustrated in Table 8.1.

Table 8.1 Measured density profiles for settlement types (Bibby and Shepherd, 2004: p.11)

Settlement form	Density of residential delivery points (mean)			
	At 200m	At 400m	At 800m	At 1600m
Small town	8.23	8.99	8.29	5.59
Fringe (urban, town)	6.46	7.21	5.90	4.68
Village	3.81	2.28	0.83	0.58
Peri-urban	0.30	0.59	1.57	2.80
Village envelope	0.94	1.15	1.31	0.59
Village envelope (in peri-urban)	2.96	3.27	1.81	2.13
Hamlet	0.65	0.21	0.13	0.20
Scattered dwellings	0.39	0.17	0.15	0.23
Urban areas (>10K)	16.09	15.17	13.78	11.89

The third step was to relate rural settlements to census OAs. Output Areas were classified according to the proportion of the population in settlements of various kinds within each OA. The fourth and final step was to provide a measure of the context of areas; i.e. to reflect the nature of the surrounding area. A similar approach to that described above (Table 8.1) was used. Average residential densities were calculated at a series of much larger geographic scales resulting in classification of settlements as 'sparse' or 'less sparse'. Sparse OAs were those that fell within the sparsest five percent of OAs at all three scales (10km, 20km and 30km). Less sparse OAs fell outside this threshold.

The classification schema shown in Figure 8.3 was employed, although not in full. The urban-rural distinction was used, and the sample further subdivided by settlement type; i.e. 'sparse' and 'less sparse' areas of each settlement type were combined to create a four category hierarchy: urban, small town and fringe areas, village, hamlet and isolated dwellings. Settlement types were not further divided into sparse-less sparse areas for several reasons. The four categories provided sufficient detail by accounting for urban-rural differences and residential density of areas (similar to widely used population density variables: Section 7.8.2). As indicated, using four settlement types enabled a logical hierarchy from urban to most remote rural areas (hamlets and isolated dwellings). Finally and more pragmatically, when the study sample was divided according to differential progression through the ProActive scheme (Section 9.1, RQ2), using four settlement type categories prevented sample subgroups becoming too small for analysis.

Overall, the schema described was recent, met the needs of the present study, and took into account both settlement size and residential density. Moreover, it was available at OA-level and avoided possible ambiguity, for example, regarding which population density thresholds should define urban and rural areas. The following section briefly compares Somerset with the rest of the country to provide a broader socio-demographic context for the present study.

8.5 Profile of Somerset

This final section provides some background beyond the ProActive scheme by comparing census 2001 demographic and socio-economic data for Somerset with mean values calculated from all counties and Unitary Authorities in England[29]. Data are presented in Table 8.2 (shown in full in Appendix 12).

Gender distributions (not shown) were similar, with approximately fifty-one *per* cent women. Age distributions, however indicated that Somerset residents were older than average. There was a smaller proportion of young adults and consistently higher proportions of those aged over fifty years, also reflected in the relatively high proportion of retired people in Somerset. Ethnic diversity in Somerset is below average with a ninety-nine *per* cent white population. Therefore, ethnic influences were not considered in the present study.

It was not possible to calculate the Townsend score from mean values alone. Nevertheless, the component variables were compared and all indicated a lower than average level of deprivation in Somerset. This by no means suggests that deprivation is not a problem in Somerset because data aggregated for large areas, especially as large as counties, can overlook pockets of extreme deprivation (Section 7.8).

This is merely an indication that overall, there is a lower prevalence of deprivation in Somerset compared with the national average and this is reflected across a range of socio-economic indicators: the lower proportion of socially rented properties; the higher proportion in routine and semi-routine occupations; and higher proportion of two, three and four car households. Differences in occupational social class might be attributable in part to types of occupation in largely rural counties like Somerset, where there is a higher prevalence of those employed in agriculture, and mining and quarrying, and the relatively low proportion of financial and business occupations. This is a likely reflection of the lack of large business centres in Somerset, rather than an indicator of disadvantage thus provides further justification for including the Townsend score as the primary socio-economic marker, rather than occupational class.

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[29] Most of the data presented in Table 8.2 are limited to socio-economic variables for which there were differences of at least ten *per* cent between Somerset and the rest of England.

Table 8.2 Census 2001 data for Somerset vs. all English counties/Unitary Authorities

		Mean %		Difference	
		Somerset	England	Eng-Som't	%
Age (% residents)	20-29	9.54	12.25	-2.71	-22.09
	30-39	14.01	15.29	-1.28	-8.38
	40-49	13.34	13.45	-0.11	-0.83
	50-59	14.03	12.79	1.23	9.63
	60-69	10.43	9.40	1.03	10.97
	70-79	9.03	7.48	1.55	20.75
	80-89	4.51	3.63	0.88	24.24
	90+	0.86	0.66	0.20	30.34
Ethnicity (% residents)	White	98.80	94.12	4.68	4.97
	Mixed	0.47	1.01	-0.54	-53.18
	Asian	0.28	3.21	-2.93	-91.35
	Black	0.15	1.03	-0.88	-85.58
	Chinese/other	0.30	0.63	-0.33	-52.79
Townsend variables	HH overcrowded	3.86	5.84	-1.98	-33.92
	Pers unemployed	2.46	3.21	-0.76	-23.55
	HH not owned	25.72	29.31	-3.59	-12.25
	HH with no car	17.57	24.79	-7.22	-29.13
NS-SEC Social Class (% residents)					
1	Higher managerial & professional	7.00	8.15	-1.15	-14.06
3	Intermediate	8.05	9.34	-1.29	-13.83
4	Small employers/own accounts	9.81	7.06	2.75	38.90
5	Lower supervisory, craft & related	8.24	7.61	0.63	8.23
6	Semi-routine occupations	13.13	12.17	0.96	7.89
8	Never worked, L-T unemployed	2.09	3.27	-1.18	-35.98
Car ownership (% households)	0 car	17.57	24.79	-7.22	-29.13
	1 car	46.22	44.20	2.03	4.58
	2 car	28.19	24.77	3.42	13.81
	3 car	5.97	4.78	1.19	24.97
	4+ car	2.05	1.46	0.58	39.84
	2+ cars	36.21	31.01	5.20	16.76
Housing tenure (% household)					
	social rented	13.82	17.42	-3.60	-20.69
Occupancy rating (% households)	2+	58.02	51.50	6.52	12.65
	0	14.23	17.13	-2.89	-16.90
	-1	3.01	4.31	-1.29	-30.06
	-2	0.85	1.53	-0.69	-44.75
Economic activity (% residents)					
	P-T employees	13.80	12.40	1.41	11.35
	self-employed	11.08	8.19	2.89	35.32
	unemployed	2.46	3.21	-0.76	-23.55
	retired	16.33	13.93	2.40	17.24
	Disabled/LLI	4.34	5.26	-0.92	-17.53
Industry (% residents)					
	Agriculture hunting and forestry	3.71	1.60	2.11	132.32
	Mining and quarrying	0.40	0.27	0.13	47.48
	Construction	7.68	6.94	0.74	10.61
	Transport, storage, communic'n	5.25	7.13	-1.88	-26.34
	Financial intermediation	2.28	4.14	-1.86	-44.87
	Real estate, renting and business	9.81	12.14	-2.32	-19.14

HH, households; L-T long-term; F-T, full-time; P-T, part-time

*

Now that the context of the PARS under evaluation and the rationale for the chosen approach have been described, the following chapter describes the methods used to execute this approach in terms of the data extraction, processing and analyses required to answer each research question.

Chapter 9: Methods

9.1 Extraction and cleaning of participant data

Central referral mechanism (participant) data

Ethical approval for the present study was granted by the West Somerset Local Research Ethics Committee. Refer to Appendix 11 for a copy of the letter of approval. Records for participants referred between May 2nd 2000 and May 1st 2003 in the Central Referral Mechanism (CRM) Microsoft Access database, were examined for missing data and apparent errors. For those identified there were three stages of data cleaning:

i. Paper records of referrals returned by leisure providers (PCR forms: Appendix 12) were examined. This enabled the correction or completion of records for which data inputting was erroneous or incomplete, respectively.
ii. For the majority of incomplete records, the paper records were also incomplete. In this instance letters were sent to leisure providers requesting the relevant information, which was subsequently entered into the CRM upon return.
iii. Other apparent typological errors and inconsistencies were corrected where possible.

A deadline for completion of this data cleaning phase was set (1st October 2004), after which incomplete data were classified as 'missing'. The only other source for missing data was the Health Informatics team (Taunton Deane PCT) who provided some missing information on participant age.

The following were extracted from the CRM into a Microsoft Excel spreadsheet:

i. Client ID number (anonymised)
ii. Age
iii. Gender
iv. Address and postcode
v. Reason for removal (if not referred to leisure provider)
vi. Leisure provider (if referred to leisure provider by Project Worker)
vii. Attendance of pre-assessment: yes or no
viii. Attendance of post-assessment: yes or no

ix. Number of sessions attended

x. Total number of sessions possible

All data obtained from sources other than the CRM will be referred to collectively as 'external data'. These include data on socio-economic and rural-urban profiles of participant area of residence.

Progression categories

Figure 8.1 illustrated how clients were placed into categories on the basis of their progression through the scheme, in terms of their removal, attendance or completion of the scheme. For the purposes of discussion these will be referred to as 'progression categories', which are defined in Table 9.1.

Table 9.1. Participant progression categories

Category	*Abbrev.*	*Definition*
No contact	NC	Not contactable by Proactive project worker
Medical removal	RMed	Removed from scheme by Proactive project worker for medical reasons
Psychosocial removal	RPsych	Chose not to proceed with the referral during conversation with Proactive project worker
Fail-to-attend	FTA	Referred to leisure provider - did not attend any exercise sessions
Fail-to-complete	FTC	Referred to leisure provider - attended <80% of exercise sessions
Complete	Comp	Referred to leisure provider – attended ≥80% of exercise sessions
Missing	-	Referred to leisure provider - PCR form not returned to Proactive project worker

The categories of interest in the present study were the 'No Contact', 'Psychosocial Removal', 'Fail-to-Attend', 'Fail to Complete', and 'Complete' categories. Participants in all of these categories effectively had a choice in whether or not to proceed; i.e. removal from ProActive was determined by participants rather than being under the control of the ProActive scheme. Therefore, differential progression by different socio-demographic groups might be attributable to social and physical environmental factors that differentially influence the behaviour of different groups. In contrast, the removal of participants for medical reasons ('medical removals') was determined by set criteria (Appendix 9) and not participant behaviour. This group was, therefore, excluded from analysis in this later part of the study. Participants for whom and data on progression or attendance were missing were classified as 'missing' and excluded from the later analyses (RQ2).

Verification of address and postcode data

Verification of address and postcode data was necessary prior to assigning socio-economic or urban-rural classification data to clients:

i. Royal Mail resources were used to obtain missing postcodes via the Royal Mail website (Royal Mail Group Plc, 2004) and address-postcode directories ordered from Royal Mail.[30]

ii. Residential addresses and postcodes were verified using the Quick Address™(v2.0) programme, a facility provided courtesy of the University of Leeds. The program uses existing data files of addresses and enhances them by verifying and correcting existing postcodes, and by adding missing postcodes to correct addresses.

Postcodes were necessary to assign external data to participants on the basis of where they lived. Therefore, if postcodes were unknown at the end of this process, they were excluded from analysis in RQ2.

9.2 Extraction and processing of 'external' data

9.2.1 Data extraction

Background of the census 2001 data

Census 2001 data were released in three forms. Standard Tables are the most detailed datasets, from which others are derived. They are Theme tables that deal with specific population subgroups such as dependent children or pensioner households. However, for reasons of confidentiality Standard Tables are only available at ward-level. For reasons discussed in Section 7.4.2, ward-level data were not considered sufficiently

[30] Postal Address Book South West 1, edition H 2002 and Postal Address Book South West 2, edition H 2002

sensitive for the present study; given that Somerset is a largely rural county, problems of heterogeneity in such large areal units would have been exacerbated. Less detailed subsets of Standard Tables called Census Area Statistics are available as both Theme and Univariate Census Area Statistics tables. The latter provide a more detailed breakdown for a single topic and are available at Output Area (OA) level (Section 7.4.2). Finally, Key Statistics are summaries of complete results and are available at OA level but provide insufficient detail for the present study (Hayes, 2004b; Office for National Statistics, 2005e; 2005g).

Table 9.2 'External variables' retrieved

Data source	Variable	Units of output	Output Level	Townsend score
Census 2001	UV003: Sex	Residents	OA	
	UV004: Age	Residents	OA	
	UV028: Economic activity	Residents	OA	✓
	UV031: NS-SEC (social class)	Households	OA	
	UV059: Occupancy	Households	OA	✓
	UV062: Cars and vans	Households	OA	✓
	UV063: Tenure (households)	Households	OA	✓
ONS	Urban-rural, and settlement type	OA	OA	
SHA	IMD 2004	SOA	SOA	

OA, Output Area; SOA, Super Output Area (lower); ONS, Office of National Statistics; SHA, Somerset Health Authority.
Data sources: Census 2001 (Casweb, 2004); ONS (Office for National Statistics, 2004); IMD 2004 (Taunton Deane PCT)

Univariate Census Area Statistics tables were used to obtain most external data in the present study as they provide sufficient detail and are released at OA level. Tables listed in Table 9.2 were downloaded from the Casweb website (Casweb, 2004) as comma separated files and saved as Excel spreadsheets. The breakdown of each table into the component variables is provided in Appendix 14.

Other external data

Data on urban-rural classification and settlement type were obtained from the Office for National Statistics website (Office for National Statistics, 2004). Table 9.3 presents the two variables derived from an eight category described in Section 8.5.

Table 9.3. Area morphology variables and categories

Variable	Categories	Definition
Urban-rural	Rural	<10K residents
	Urban	>10K residents
Settlement type	Hamlets & isolated dwellings	Hamlet: Clusters of 3-8 historic farmsteads within 250m of each other
	Village	Based on density at different distances
	Small town and fringe	Based on density at different distances
	Urban	>10K residents

The rural-urban classification was used to make a dichotomous variable on the basis of settlement population size (< or ≥10,000). The second variable used definitions of 'settlement type' to create four categories.

Index of Multiple Deprivation 2004

Data for the Index of Multiple Deprivation (IMD) 2004 score and its seven constituent domains were supplied by the Health Informatics team at Taunton Deane PCT. A more detailed breakdown of the IMD 2004 is provided in Appendix 8.

9.2.2 Data processing

Census data processing

Socio-economic data were downloaded from the Casweb website (Casweb, 2004). Figure 9.1 illustrates the format in which census data were obtained using the examples of car ownership and NS-SEC social class.

Example: census table for car ownership

OA code	Total HH	0 cars	1 car	2 car	3 cars	4+ cars	Total cars
40UBGK0001	122	11	51	43	12	5	193
40UBGK0002	119	11	41	52	11	4	194
40UBGK0003	125	9	39	54	16	7	223
40UBGK0004	127	11	58	46	9	3	189
Etc...							

Example: census table for NS-SEC Social Class

OA code	Total people	Class								
		1	2	3	4	5	6	7	8	Unclass'd
40UBGK0001	241	7	42	18	35	19	30	33	3	54
40UBGK0002	217	33	50	12	21	14	21	15	0	51
40UBGK0003	230	29	84	12	27	12	11	12	3	40
40UBGK0004	213	28	54	22	13	13	22	6	3	52
Etc...										

Figure 9.1 Illustration of format of raw census data

Each example table gives the number of residents or households per OA with a given characteristic (e.g. own 1 car; unemployed; in social class 1) and the total number of residents or households within each OA. In Somerset there is a total of 1748 OAs and therefore each table comprised 1748 rows of data. To enable comparisons between OAs, percentages were calculated. For example, in 40UBGK0001, 11 out of 122 households did not own a car and 7 out of 241 people were in social class 1; i.e. 9% of households with 0 cars and 2.9% of residence in social class 1. The primary socio-economic variable in the present study, the Townsend score of material deprivation, was not released in the census but was calculated from four census variables. The following section describes this process.

Construction of the Townsend score

The census definitions of the four variables used to construct the Townsend deprivation score are listed in Table 9.4.

Table 9.4. Townsend score of material deprivation

Townsend component	Definition
i Overcrowding	Proportion of households with an occupancy rating of -1 or less
ii Unemployment	Proportion of economically active people aged 16-74 yrs who are unemployed
iii Home ownership	Proportion households not owned by occupants
iv Car ownership	Proportion of households not owning a car

Table 9.5 illustrates the first three stages of a four stage calculation required for the construction of the score, for each OA. All calculations shown below were performed in Microsoft Excel. Stage 1 involved calculating percentage values for each component

(Table 9.4). Stage 2 created four variables (Var) by transforming the proportions for unemployment and overcrowding using a logarithmic transformation. This created symmetrical distributions before the next step of standardisation. In this next stage (Stage 3), each variable was standardised to a mean of zero with a standard deviation of one, to ensure that all four variables contributed equal weight in the index. The resultant standardised Zscores were simply summed in the final stage (Stage 4) to produce a Townsend score for each OA (n=1748), which ranged from -5.99 to +12.97; higher values indicate high levels of deprivation.

Table 9.5. Stages in construction of the Townsend score

Townsend component	Stage 1 Percentages	Stage 2 Var	Stage 3 Zscore
1. Overcrowding	$\frac{UV0590005 + UV0590006}{UV0590001} \times 100$	$Log(\%overcrowdedHH + 1)$	$\frac{Var1 - Mean}{SD}$
2. Unemployment	$\frac{UV0280012}{UV0280002} \times 100$	$Log(\%unemployedHH + 1)$	$\frac{Var2 - Mean}{SD}$
3. Home ownership	$100 - \frac{UV0630002}{UV0630001} \times 100$	*% HH not owner occupied*	$\frac{Var3 - Mean}{SD}$
4. Car ownership	$\frac{UV0620002}{UV0620001} \times 100$	*% HH without a car*	$\frac{Var4 - Mean}{SD}$

Var, variable

Urban-rural area type

As described in Section 8.5, each OA was defined as a rural or urban area and as belonging to a particular settlement type (Table 9.3). Therefore, further data processing was not necessary.

Index of Multiple Deprivation 2004

Similarly, processing of IMD 2004 data was not necessary. Scores were available for each SOA (n=328) for each of the IMD domains and for the overall IMD score.

9.3 Assigning external data to clients

All external data were assigned to individual participants according to their postcode using Postcode-OA and SOA look-up files obtained from the Taunton Deane PCT Health Informatics Team. Microsoft Excel spreadsheets for client data (from the CRM), census variables (socio-economic and demographic), Townsend score and constituent Zscores, urban-rural and settlement type classifications, IMD 2004, and postcode-OA and SOA look-up files, were imported into a Microsoft Access database. An update query was designed to assign OA and SOA codes to each individual according to postcode. Further update queries were then created to assign external data to participants by OA code (and SOA code for IMD 2004). The main data table containing all the participant CRM data and assigned external data, was exported back into Excel before finally being exported into SPSS for subsequent coding and data analysis. Figure 9.2 illustrates this process using the example of car ownership data taken from census 2001.

9.4 Statistical analysis

Research Question 1: Are those referred to ProActive different from the Somerset population as a whole, in terms of demographics, or the socio-economic or rural-urban profile of their area of residence?

The first research question required a comparison between the sample of Somerset residents referred to the ProActive scheme and the population of Somerset as a whole in terms of demographics and area of residence (socio-economic and urban-rural context). Therefore, a small proportion of clients who lived outside of Somerset were excluded from analysis (n=144; 3.8%).

Age and gender of the ProActive sample were provided by the CRM and percentages were calculated to compare age and gender distributions of the sample with those for Somerset according to census 2001. The percentages of the ProActive and Somerset populations living in urban-rural areas and different settlement types were similarly compared. Somerset data were obtained from census 2001 at county level for these comparisons (Casweb, 2004).

Excel

Client data from CRM

ID	Pcode	Gender	Age	Ref category	Att..
3090	BA5 2XW	Male	60	0	2
3091	TA10 0HY	Female	-	0	2
3092	BA5 1ED	female	-	0	1
etc					

Postcode-OA look up file

OA code	Pcode
40UBGK0001	BA3 4TG
40UBGK0001	BA3 4UY
40UBGK0001	BA3 4UX
etc	

External data: e.g. car ownership

OA code	% 0 car	% 1 car	% 2 cars
40UBGK0001	9.02	41.80	35.25
40UBGK0001	9.24	34.45	43.70
40UBGK0001	7.20	31.20	43.2
etc			

Update query

Access

Client data + OA codes

ID	Pcode	OA code	Gender	Age	.
3090	BA5 2XW	40UBHX0013	Male	60	
3091	TA10 0HY	40UDKE0002	Female	-	
3092	BA5 1ED	40UBHL0001	female	-	
etc					

Update query

Client data + external data assigned to individuals by OA code

ID	Pcode	OA code	% 0 car	% 1 car	% 2 cars	% 3 cars	.
3090	BA5 2XW	40UBHX0013	20.31	57.81	21.88	0.00	
3091	TA10 0HY	40UDKE0002	4.08	48.99	31.63	.12.24	
3092	BA5 1ED	40UBHL0001	3.03	43.94	45.45	5.30	
etc							

Exported into Excel and SPSS

Excel

Figure 9.2 Process of assigning external data to participants: example of car ownership

The primary aim of exploring potential area-level socio-economic bias in referrals required a statistical difference test. Prior to any statistical comparisons it was first necessary to determine whether data were normally distributed using a Kolmogorov-Smirnoff test. Appendix 15 presents the results; only two of the socio-economic variables were normally distributed (reflected by non-significant outcomes). Therefore, non-parametric difference tests were appropriate.

To compare means from samples of nonparametric data Mann-Whitney and Kruskal-Wallis tests were used; Mann-Whitney tests for single category variables (Townsend score and IMD 2004) and Kruskal-Wallis for the remaining socio-economic variables, all of which comprised multiple related indicators (e.g. Social class 1, 2, 3, etc; 0 cars, 1 car, 2 cars, etc). However, such tests operate by comparing two columns of data from which measures of both the mean and variance can be used in calculations. For the ProActive sample, a column of data for each variable assigned to participants on the basis of the OA in which they lived made this possible. Yet, simply obtaining the county-level mean values for Somerset was not sufficient as this gave no measure of variance. Therefore, each of the 1748 OAs in Somerset was effectively treated as a member of the Somerset study population to compare with the population referred to ProActive. This enabled statistical comparison because measures of both mean and variance could be obtained from the dataset of 1748 OAs. Furthermore, this approach enabled the Townsend score to be calculated for Somerset County, which requires values of mean and standard deviation, as detailed previously.

However, this approach carried with it an assumption that all OAs were equally populated and contained an equal number of households. Although the creation of OAs has greatly reduced variation in the sizes and social composition of census areal units (Section 7.4.2), variation still exists (mean residents per OA=299.2 ± 72.3; mean households per OA=120.5 ± 19.4; mean residents per SOA=1514.1 ± 323.8). In an attempt to overcome this problem, socio-economic data were weighted by OA population size using the 'weighting' function in SPSS. Weighted and unweighted mean socio-economic values for Somerset OA are presented in Table 9.6. This function does not produce new columns of weighted data within the spreadsheet, instead taking relative weights into account during subsequent analysis. This does not, however, extend to the Mann-Whitney and Kruskal-Wallis tests, which could not be run.

Table 9.6. Mean socio-economic variables for OA in Somerset with and without weighting by OA population size

Socio-economic variables	Mean values for Somerset OA (n=1748)		Difference*
	Unweighted	Weighted	
Townsend Score	0.00	-0.07	0.068
IMD 2004	15.89	15.76	0.13
Car ownership (% households)			
0	17.21	16.76	0.448
1	45.99	45.99	0.002
2	28.54	28.94	-0.408
3	6.13	6.16	-0.028
4+	2.13	2.14	-0.014
Mean cars per HH	1.31	1.32	-0.010
% HH with 2 or more cars	36.80	36.80	0.000
Housing tenure (% households)			
owned	74.27	74.67	-0.404
social rented	13.65	13.70	-0.046
private rented	9.48	9.08	0.402
rent free	2.60	2.55	0.048
Occupancy rating (% households)			
2+	58.50	59.01	-0.513
1	23.66	23.51	0.151
0	14.03	13.80	0.235
-1	2.96	2.88	0.081
-2	0.86	0.81	0.046
Economic activity (% residents)			
economically active (total)	67.44	67.69	-0.246
employees (total)	51.71	52.12	-0.414
P-T employees	13.72	13.83	-0.114
F-T employees	37.99	38.29	-0.301
self-employed	11.19	11.00	0.194
unemployed	2.52	2.49	0.029
economically inactive (total)	32.56	32.31	0.246
retired	16.81	16.40	0.408
carers	6.14	6.19	-0.0523
Disabled/LLI	4.45	4.39	0.063
Social Class (% residents)			
1	6.92	6.91	0.011
2	17.75	17.75	0.004
3	7.87	7.97	-0.099
4	9.92	9.75	0.172
5	8.18	8.24	-0.057
6	13.01	13.14	-0.124
7	9.95	10.03	-0.0818
8	2.12	2.12	-0.006
unclassifiable	24.27	24.09	0.178

*Note: difference = unweighted-weighted means

Therefore, technical limitations prevented statistical comparisons using the weighted data set for Somerset.

Following consultations with a statistician, the absence of a satisfactory statistical alternative combined with the small effect that weighting had on mean values for socio-economic variables (Table 9.6), meant that the most satisfactory approach was to perform statistical difference tests on the unweighted dataset to give a best impression of the direction, magnitude and significance of differences. The alternative methods explored are outlined in Appendix 16.

Research Question 2: Are participant demographics, socio-economic environment or urban-rural residency related to how far through the scheme they progress and subsequent levels of attendance at leisure providers?

The second research question required an exploration of factors that influenced the likelihood of clients falling into each of the 'progression categories' (defined in Section 8.2.3). Logistic regression (LGR) was employed for several reasons. Firstly, LGR is a form of multiple regression and, therefore, examines the influence of several independent or exposure variables on the dependent or outcome variable (Kirkwood and Sterne 2003). In the context of the present study, this enabled the influence of the socio-economic characteristics, urban-rural area type, age and gender to be considered simultaneously to determine independent effects. Secondly, LGR can be used to examine the impact of both continuous and categorical independent variables on a categorical dependent variable (Kirkwood and Sterne 2003), in this case 'progression category'. Most commonly, LGR is performed for binary dependent variables. For dependent variables, such as progression category, which comprise more than two categories, multinomial or polychotomous LGR can be used. However, by performing several binary LGR models (rather than a single model) it was possible to determine which factors impacted on clients' progression/self-removal at various stages of their journey through the ProActive scheme, whilst simplifying interpretation.

Table 9.7. Four binary logistic regression models

Model	Group 0		Group 1
1	No contacts + Psychosocial removals	*vs.*	Fail-to-Attend +Fail-to-Complete + Completers
2	No contacts + Psychosocial removals + Fail-to-Attend	*vs.*	Fail-to-Complete + Completers
3	Fail-to-Attend	*vs.*	Fail-to-Complete + Completers
4	Fail-to-Complete	*vs.*	Completers

Consequently, four separate LGR models with binary dependent outcomes were employed (Table 9.7). Figure 9.3 illustrates how the binary LGR groups were formed.

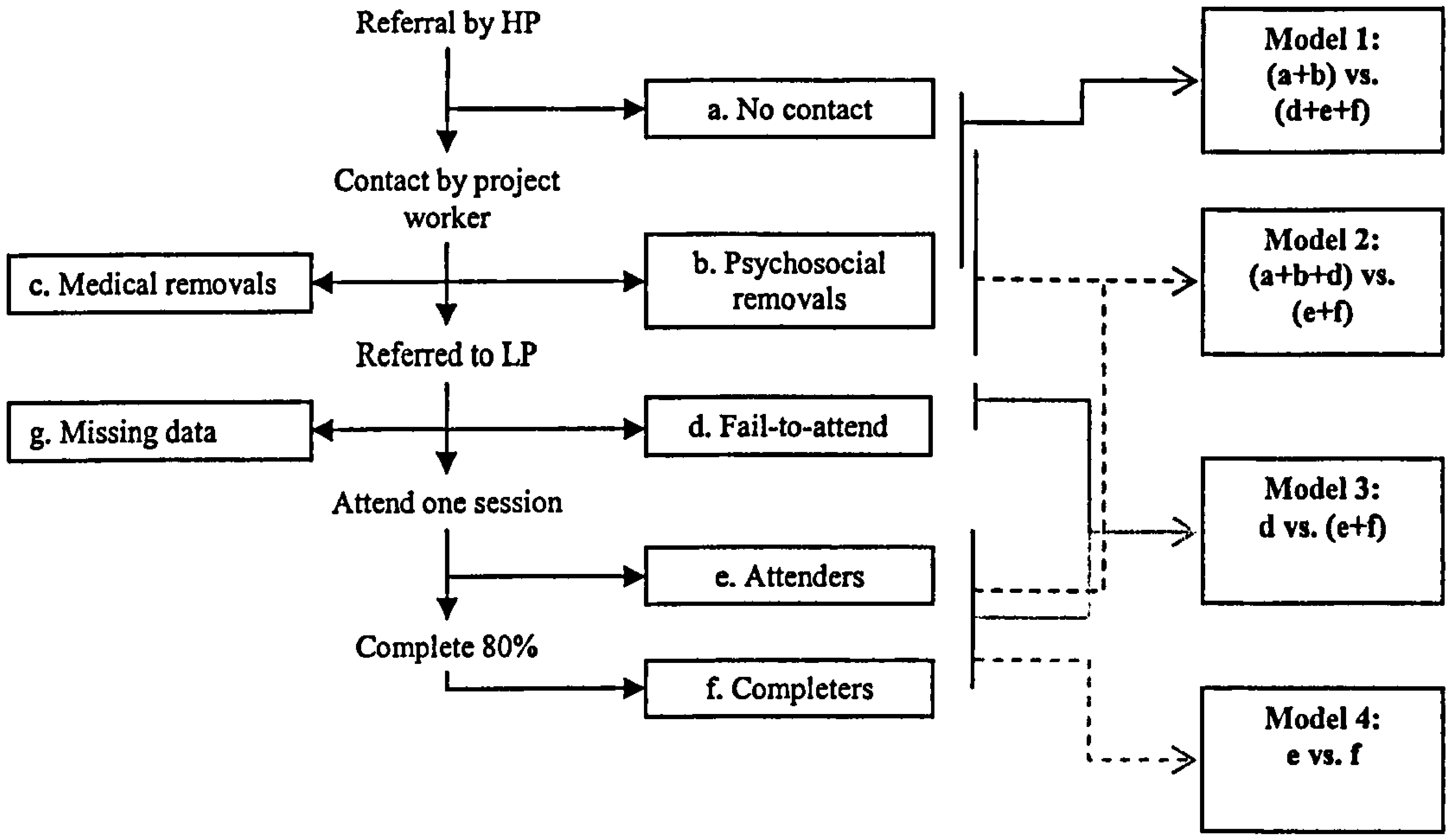

Figure 9.3 Derivation of groups for logistic regression models

Explanation of outcome categories (dependent variables)

Model 1 was performed to determine which participants 'fell at the first hurdle'; i.e. removed themselves from the scheme at the first opportunity following referral by the health professional. This could have been through participants not responding to attempts by the Project Worker to contact them, or by informing the Project Porker that they did not want to proceed. Model 2 explored the socio-demographic characteristics of those who removed themselves from the scheme at the first or second opportunity and those who made it to the leisure providers. It, therefore, compared all those who removed themselves before attending the leisure providers with all those who attended one or more sessions. Model 3 focused only on the sub-sample of ProActive participants that were referred to leisure providers by the Project Worker and explored participant characteristics in relation to the likelihood of attending one or more exercise session(s) or failing to attend any sessions. Finally, out of the sub-sample of participants who attended one or more sessions at the leisure provider, Model 4 explored characteristics associated with completing or not completing eighty *per* cent of exercise sessions.

Independent or exposure variables

For reasons discussed previously (Section 8.4.3), the Townsend score was included as the primary socio-economic variable. To determine whether it was necessary to include further socio-economic variables in addition to the Townsend deprivation score, socio-economic variables were tested for correlations with the Townsend score. Spearman's Rank correlation tests were used because of the largely non-parametric data. Significant correlations between the Townsend score and almost all other socio-economic variables were evident (refer to Appendix 17 for statistical output), which justified inclusion of the Townsend score of material deprivation as the sole socio-economic variable in the regression models.[31] The results for the correlation tests are shown in Section 10.2.2 (Table 10.3).

Other independent variables selected were age, gender and rural-urban area of residence. Age and gender were included as known correlates of physical activity (Section 3.3). The urban-rural variable was included initially to provide insight into geographical access issues and was later substituted by the four-category settlement type variable.

*

Chapter 10

Chapter 8 provided some background to the study and rationale behind some of the design choices made. The present chapter outlined the methods used in order to explore the research questions, for which the following section presents the main results of analyses.

[31] IMD 2004 used in supporting analysis for reasons outlined in Section 8.4.3

Chapter 10: Results

10.1 Results for Research Question 1

Are those referred to ProActive different from the Somerset population as a whole, in terms of demographics, or the socio-economic or rural-urban profile of their area of residence?

10.1.1 Data processing

The total number of referrals recorded in the CRM between May 2nd 2000 and May 1st 2003 was 3762. To enable a comparison between the population of Somerset as a whole and those referred to the ProActive scheme, two further stages of data processing were necessary:

i. duplicate referrals were removed (n=50)
ii. participants whose postcodes were unknown or who resided outside Somerset were removed (n=143)

Consequently, data from 3569 participants were available for comparison with census 2001 and urban-rural data from the 1748 Output Areas (OA) that comprise Somerset (Sections 7.4.2 and 9.4).

10.1.2 ProActive versus Somerset population comparison

Age and gender

The proportion of women referred to ProActive was markedly higher than for Somerset as a whole (61.1 *vs.* 51.4%). Figure 10.1 illustrates the difference in age distribution. The proportion of forty to seventy year olds referred to ProActive is above the Somerset average. This age group accounted for over half of those referred to the ProActive scheme (56.5% aged 40-69 yrs) and approximately forty *per* cent were aged between fifty and seventy (40.5% aged 50-69 yrs).[32]

[32]Percentages calculated as proportion of total sample (n=3569) although valid data available not available for all (n=2993). As proportion of valid data sample percentages are 67.4% and 48.3% respectively.

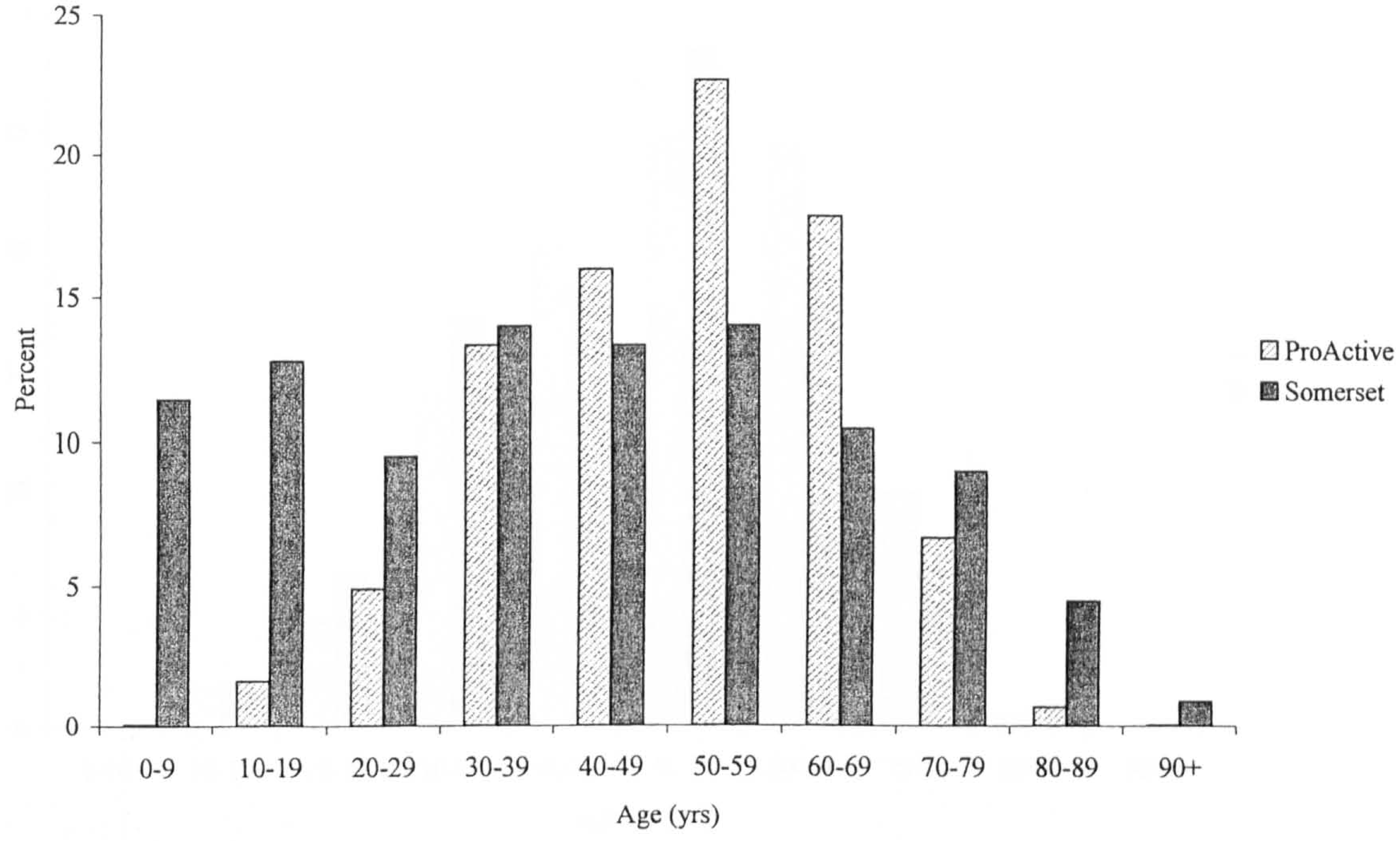

Figure 10.1 Age distributions of the ProActive and Somerset Populations

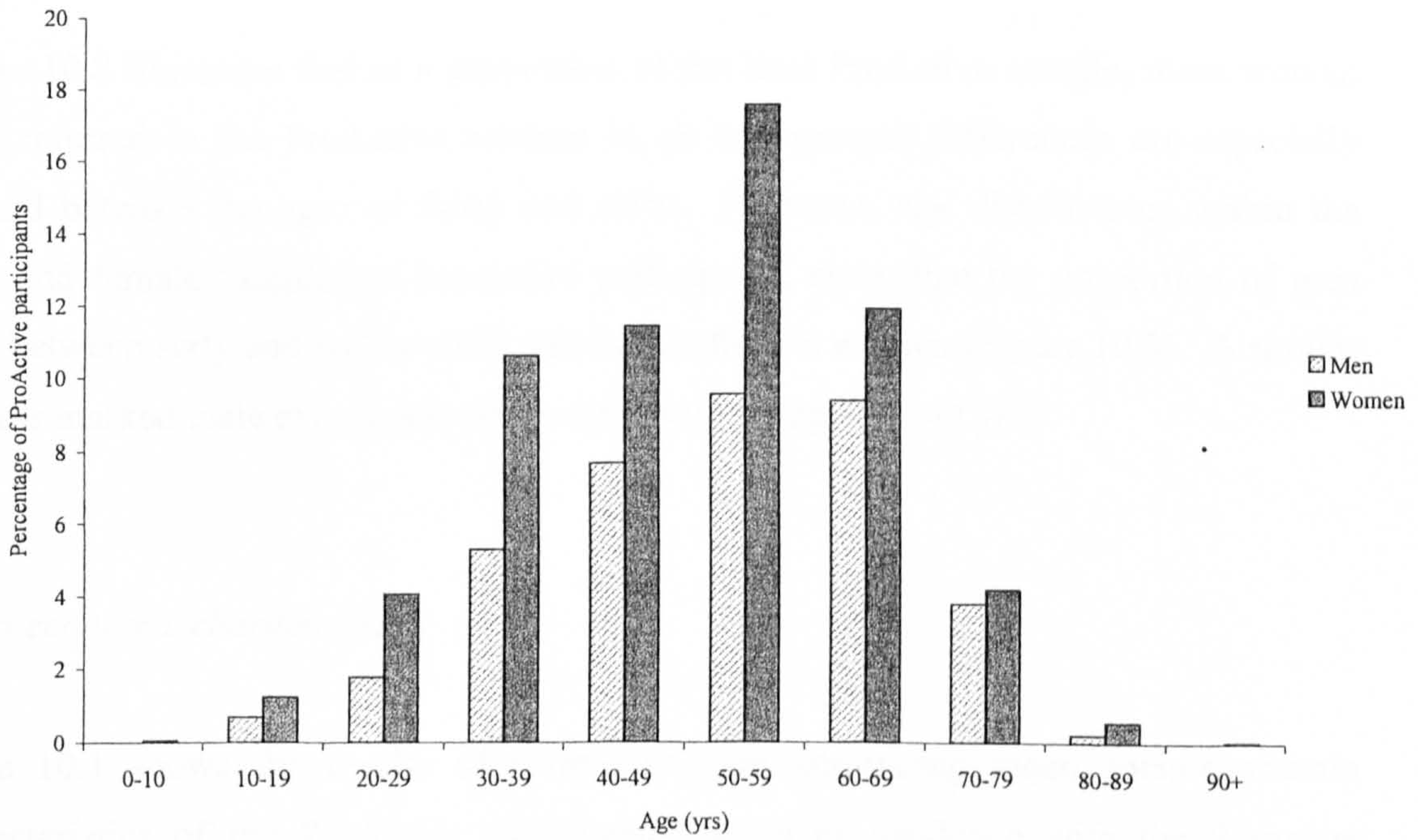

Figure 10.2 Age distribution of men and women in the ProActive sample

Conversely, individuals below the age of forty years and above the age of seventy were under-represented in the ProActive sample. Appendix 18 presents complete statistical output for descriptive data.

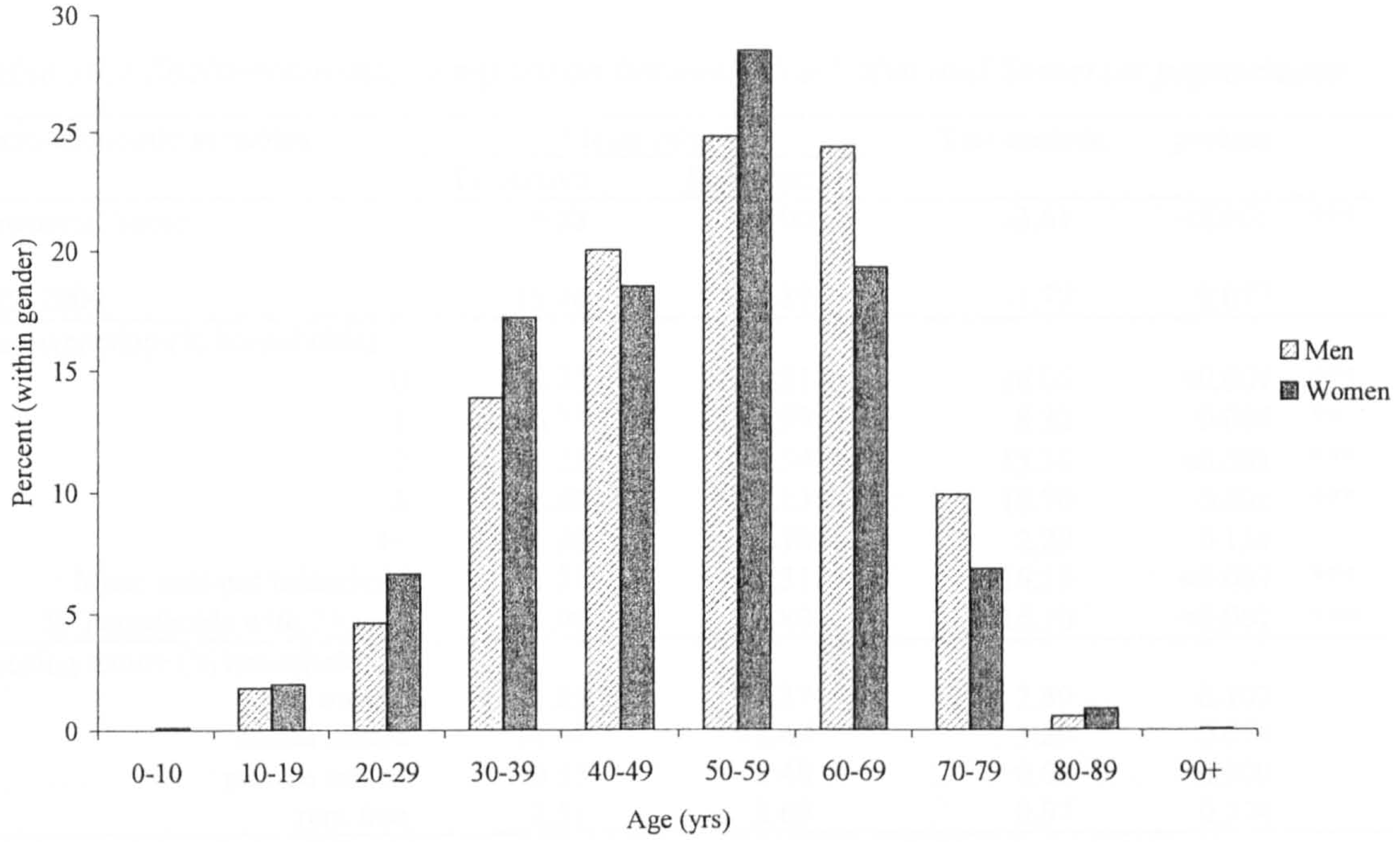

Figure 10.3 Age distribution within populations of men and women referred to ProActive

Figure 10.2 illustrates that as a proportion of the total ProActive sample, more women were referred to the ProActive scheme in all age groups; differences are especially marked between the ages of thirty and sixty. However, age distributions within the male and female samples of ProActive participants, show that the proportion of men aged between sixty and eighty years was higher than in women (Figure 10.3). A similar but less marked male excess was observed in middle-age (40-49 yrs).

Socio-economic characteristics

Table 10.1 shows the results of difference tests comparing mean socio-economic characteristics of the ProActive participants' areas of residence with the Somerset average (refer to Appendix 19 for statistical output). There were small but significant differences for several of the socio-economic variables, all of which indicated higher than average levels of deprivation in the population of ProActive participants.

The significant difference in Townsend material deprivation score is supported by differences in three out of the four constituent factors: lower levels of car ownership, higher levels of household overcrowding and higher unemployment; housing tenure, however, appeared to account for less of the overall difference in material deprivation.

Table 10.1 Socio-economic comparison between ProActive and Somerset populations

Socio-economic variables	Mean values		Test statistic	p-value	
	ProActive	Somerset			
Townsend Score	0.33	0.00	-3.61	<0.001	***
IMD 2004	16.46	15.89	-1.77	0.077	
Car ownership (% households)					
0	18.35	17.21	16.05	<0.001	***
1	46.75	45.99	8.32	0.004	**
2	27.25	28.54	15.16	<0.001	***
3	5.67	6.13	10.70	0.001	***
4+	1.98	2.13	2.29	0.131	
Mean cars per household	1.27	1.31	16.19	<0.001	***
% households with 2+ cars	34.90	36.80	16.10	<0.001	***
Housing tenure (% households)					
owned	73.25	74.27	2.59	0.107	
social rented	14.67	13.65	3.20	0.074	
private rented	9.57	9.48	0.01	0.909	
rent free	2.51	2.60	0.97	0.324	
Occupancy rating (% households)					
2+	56.91	58.50	9.21	0.002	**
1	23.97	23.66	2.22	0.136	
0	15.01	14.03	9.88	0.002	**
-1	3.19	2.96	7.47	0.006	**
-2	0.93	0.86	2.72	0.099	
Economic activity (% residents)					
economically active (total)	67.03	67.44	3.33	0.068	
employees (total)	51.50	51.71	0.52	0.470	
P-T employees	13.88	13.72	3.97	0.046	*
F-T employees	37.62	37.99	2.54	0.111	
self-employed	10.80	11.19	1.78	0.182	
unemployed	2.72	2.52	8.48	0.004	**
economically inactive (total)	32.97	32.56	3.33	0.068	
retired	16.73	16.81	0.18	0.669	
carers	6.02	6.14	4.19	0.041	*
Disabled/LLI	4.80	4.45	20.63	<0.001	***
Social Class (% residents)					
1	6.55	6.92	9.69	0.002	**
2	17.52	17.75	3.18	0.075	
3	7.78	7.87	1.17	0.279	
4	9.59	9.92	1.83	0.177	
5	8.09	8.18	0.04	0.840	
6	13.39	13.01	5.48	0.019	*
7	10.38	9.95	9.47	0.002	**
8	2.36	2.12	15.30	<0.001	***
unclassifiable	24.33	24.27	0.26	0.610	

*p<0.05, **p<0.01, ***p<0.001
LLI, long-term limiting illness.
NS-SEC social classes: 1 higher managerial/professional: 2 lower managerial/professional; 3 intermediate; 4 small employers/own account workers; 5 lower supervisory/craft and related occupations; 6 semi routine; 7 routine; 8 and never worked/long-term unemployed

This overall pattern was further supported by differences in National Statistics Socio-Economic Classification (NS-SEC) social class profiles. ProActive participants appeared to live in areas with lower proportions of residents in the highest social class (higher managerial and professional) and significantly higher proportions in the three lowest social classes (semi-routine; routine; never worked and long-term unemployed). For most of the remaining socio-economic variables there were non-significant trends towards higher area deprivation in the ProActive samples areas of residence, including the IMD 2004 (P=0.077). This could be a reflection that the IMD was at Super Output Area-level and, therefore, potentially less sensitive to areal variation than the remaining socio-economic variables (OA-level).

Post-hoc analyses were used to explore the difference between ProActive participants' areas of residence and Somerset as a whole, in terms of Townsend score distribution. Using the range observed across the 1748 OAs in Somerset, cut-points for 20-80th percentiles were calculated; the distribution of the ProActive sample within these percentiles is presented in Table 10.2 (refer to Appendix 20 for statistical output). The gradual increase in the proportion of ProActive participants in quintiles of increasing deprivation, further confirms the apparent trend of ProActive participants residing in areas of above-average deprivation.

Table 10.2 Distribution of the ProActive sample in relation to Somerset deprivation percentiles

Percentiles	Townsend range			Distribution within ProActive sample	
				n=	%
0-20th	-5.99	to	-2.74	595	16.67
20-40th	-2.74	to	-1.30	646	18.10
40-60th	-1.30	to	0.14	700	19.61
60-80th	0.14	to	2.42	783	21.94
80-100th	2.42	to	12.97	845	23.68

Note: 0th percentile = least deprived, 100th percentile = most deprived

Urban-rural area of residence

The proportions of ProActive participants and Somerset residents that lived in different area types, in terms of urban-rural nature and settlement type, were compared (refer to Appendix 21 for statistical output). A slightly higher proportion of individuals referred to ProActive were found to live in urban areas compared with Somerset (49.7 *vs.* 48.4%), and therefore the opposite was true for the relative proportions residing in rural areas (50.3 *vs.* 51.6%). A similar pattern was observed using the four-category 'settlement type' variable. As Figure 10.4 illustrates, compared with Somerset as a whole, a slightly higher proportion of ProActive participants resided in small towns and urban areas, and a lower proportion lived in smaller, more rural settlements (villages, hamlets and isolated dwellings).

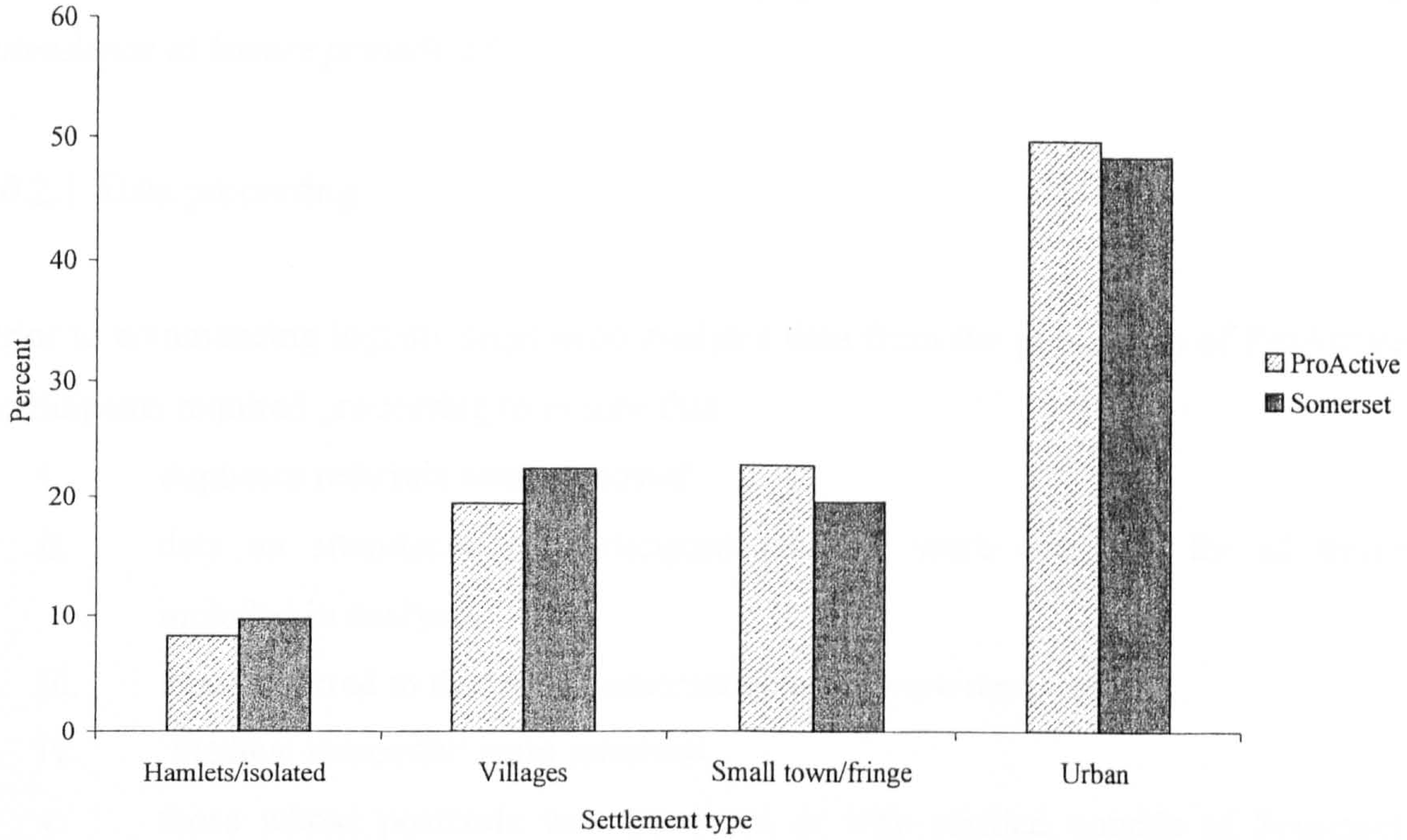

Figure 10.4 Proportions of ProActive and Somerset populations living in different types of settlement

10.2 Results for Research Question 2

Are participant demographics, socio-economic environment or urban-rural residency related to how far through the scheme they progress and subsequent levels of attendance at leisure providers?

10.2.1 Data processing

Prior to commencing logistic regression analysis data from the population of ProActive participants required processing to ensure that:

i. duplicate referrals were removed
ii. data on attendance or participant removal were complete for all those included in analysis
iii. those referred to the West Somerset scheme were removed
iv. 'medical removals' were removed
v. those whose postcode was unknown or who resided outside of Somerset were removed[33]

Figure 10.5 summarises this process and how this affected sizes of 'progression categories' at each stage. Removal of subgroups had a minimal effect on demographics increasing only slightly the proportion of women (from 61.1 - 61.8%) and the mean age (from 50.8 - 51.2 years). The mean Townsend deprivation score decreased slightly (from 0.33 - 0.25) indicating a slight reduction in deprivation with the removal of West Somerset referrals. The proportion of Proactive clients residing in rural areas was reduced (from 50.3 to 48.1%), thus the proportion of urban dwellers increased (from 49.7 to 51.9%).

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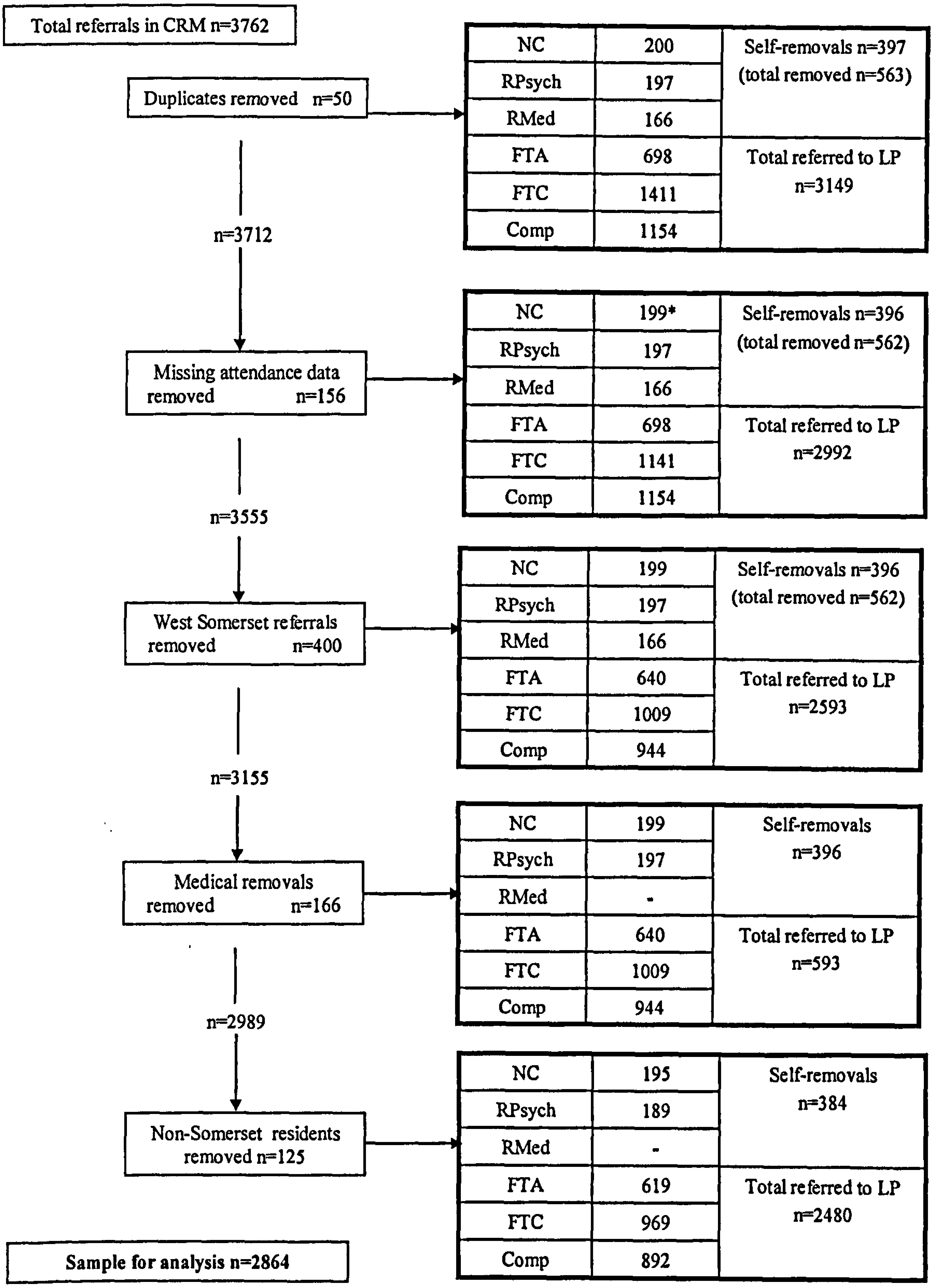
[33] Because data processing was calculated in this order (Figure 10.5), the number of people removed with unknown postcodes/for living outside of Somerset (n=125) differs from the figure cited in Chapter 9 (n=143); i.e. 18 people removed in stages ii-iv were excluded from RQ1 because of unknown postcode/non-Somerset residency.



*199 as one participant had missing gender

Figure 10.5 Removal of subgroups to attain sample for analysis

10.2.2 Tests for correlations

Spearman's rank correlation tests (two-tailed) revealed significant correlations between the Townsend deprivation score and all other socio-economic indicators. Results for most variables are presented in Table 10.3 (refer to Appendix 22 for complete statistical output).

Table 10.3 Correlations between the Townsend score and other socio-economic variables

	Correlation Coefficient	p-value		
IMD 2004				
IMD 2004 Score	0.623	<0.001	***	
Income domain	0.640	<0.001	***	
Employment domain	0.605	<0.001	***	
Health deprivation and disability	0.607	<0.001	***	
NS-SEC Social Class (% residents)				
1	-0.558	<0.001	***	
2	-0.514	<0.001	***	
3	-0.357	<0.001	***	
4	-0.260	<0.001	***	
5	0.283	<0.001	***	
6	0.413	<0.001	***	
7	0.592	<0.001	***	
8	0.569	<0.001	***	
Car ownership (% households)				
0	0.817	<0.001	***	T
1	0.087	<0.001	***	
2	-0.746	<0.001	***	
3	-0.558	<0.001	***	
4+	-0.356	<0.001	***	
Mean cars per household	-0.775	<0.001	***	
Housing tenure (% households)				
Owned	-0.858	<0.001	***	T
Social rented	0.726	<0.001	***	
Private rented	0.198	<0.001	***	
Rent free	0.337	<0.001	***	
Occupancy rating (% households)				
+2 or more	-0.777	<0.001	***	
+1	0.384	<0.001	***	
0	0.798	<0.001	***	
-1	0.742	<0.001	***	T
-2 or less	0.493	<0.001	***	
Economic activity (% residents)				
Economically active	-0.174	<0.001	***	
Economically inactive	0.174	<0.001	***	
Unemployed	0.702	<0.001	***	T
Retired	-0.248	<0.001	***	

***p<0.001; T, used in calculation of the Townsend score

Variables most strongly correlated with the Townsend score were the four composite indicators ('T' in Table 10.3), although relatively strong relationships were observed between the Townsend and IMD 2004 scores (and the constituent domains shown) and NS-SEC social class. When two exposure variables are highly correlated they are said to be 'collinear'. Including two highly correlated independent variables in a regression model can give the impression that neither is associated with the outcome, even if each independent variable is strongly associated individually (Kirkwood and Sterne, 2003). In addition to the previously detailed rationale for using the Townsend score of material deprivation, avoidance of problems associated with collinearity provided justification to include the Townsend score as the sole socio-economic indicator in regression analyses.

10.2.3 Binary logistic regression analysis

The four independent variables included in the binary logistic regression models were age, gender, the Townsend score of material deprivation and rural-urban area type. Age and gender were included as known correlates of physical activity (Sections 3.3). The Townsend deprivation score was included as a measure of material deprivation and the potential influence of relative urbanicity-rurality was taken into account by including the rural-urban variable. Settlement type was included in supporting analyses.

Table 10.4 presents the four regression models performed in SPSS using a forward, stepwise method. This enters variables into the model one by one, in various orders and determines which have a significant impact on the dependent variable; in this case the binary outcomes presented in Table 10.4. By entering the independent variables in a stepwise manner rather than simultaneously, the likelihood of associations being hidden or masked can be reduced (Hinton, 1995). However, outcomes were unchanged when models were run entering independent variables simultaneously ('ENTER' method).

Age data were usually obtained by the ProActive worker during telephone consultations with participants. Consequently, they were only available for a small proportion of the 'No Contact' group (12 out of 195, 6.2%). In regression analysis, the SPSS program excluded clients for whom any data were missing and, therefore, the inclusion of age in Model 1 resulted in a 'Self-removal' group that was too small for analysis, and that under-represented the 'No Contact' group. Thus, age was not included as a covariate in Model 1.

Table10.4 Final size of study population available for analysis

	Group			Group size		
	Code	Name	Composition	Total	Missing age	Analysed
Model 1	0	Self-removal before referral to LP	NC + RPsych	384	218	166
	1	Referred to LP	FTA + FTC + Comp	2480	103	2377
Model 2	0	Self-removal before referral to LP or attending LP	NC + RPsych + FTA	1003	242	761
	1	Attended ≥1 session at LP	FTC + Comp	1861	79	1782
Model 3	0	Self-removal after referral to LP	FTA	619	24	595
	1	Attended ≥1 session at LP	FTC + Comp	1861	79	1782
Model 4	0	Attended <80% sessions at LP	FTC	969	39	930
	1	Attended ≥80% sessions at LP	Comp	892	40	852

NC, No Contacts; RPsych, Psychosocial removals; FTA, Fail-to-attend; FTC, Fail-to-complete; Comp, Complete; LP, leisure provider
Code = binary code of dependent variable in the regression model.

10.2.4 Description of main results

Table 10.5 presents the significant outcomes from regression Models 1-4, which are also illustrated diagrammatically in Figure 10.6. Non-significant outcomes are not shown but are presented in the complete statistical output (Appendix 23)

Model 1

The outcome for Model 1 indicates that whether or not participants chose to remove themselves from the scheme prior to being referred onto the leisure provider was significantly related to their area of residence, in terms of both deprivation (Exp(B)=0.948; 0.916–0.980; p=0.002) and urban-rural area type (Exp(B)=1.356; 1.087-1.691; p=0.007). Participants living in more deprived or rural areas were less likely to be referred to a leisure provider and thus more likely to remove themselves from the scheme at the earliest opportunity. There was no apparent gender effect.

Table 10.5 Outcomes for all covariates in binary logistic regression Models 1-4

		Gender (m=0, f=1)	Age (continuous)	Townsend Score (continuous)	Rural-urban (rural=0, urban=1)
Model 1	Exp(B)			0.948	1.356
	95% CI			0.916–0.980	1.087-1.691
	p-value			0.002	0.007
Model 2	Exp(B)		1.014	0.933	1.317
	95% CI		1.008-1.020	0.908-0.959	1.104-1.570
	p-value		<0.001	<0.001	0.002
Model 3	Exp(B)		1.016	0.932	
	95% CI		1.010-1.023	0.905-0.959	
	p-value		<0.001	<0.001	
Model 4	Exp(B)	0.818	1.018		
	95% CI	0.675-0.992	1.011-1.025		
	p-value	0.041	<0.001		

Note: age was not included as a covariate in Model 1
Exp(B) = equivalent to and Odds Ratio.

Model 2

Model 2 explored the likelihood of participants removing themselves prior to attending the leisure provider (referral uptake). Gender was the only independent variable that did not exhibit a significant effect; age, area deprivation and rural-urban area type all had a significant effect. The positive relationship for age indicated that increasing age, increased the likelihood of participants taking up referral (Exp(B)=1.014; 1.008-1.020; $p<0.001$). A negative relationship, similar to that in Model 1, was observed for deprivation and rural-urban area type. Out of all those referred to ProActive by health professionals, individuals living in more deprived or rural areas were significantly more likely to remove themselves prior to attending leisure providers (Exp(B)=0.933, $p<0.001$ and Exp(B)=1.317, $p=0.002$, respectively).

Model 3

Using only data from the sample of clients that were referred to leisure providers by the ProActive Project Worker (i.e. excluding 'No Contacts' and 'Psychosocial removals'), logistic regression was used to determine which of the covariates influenced the likelihood of individuals failing-to-attend, or attending one or more exercise session(s). In contrast to Model 2, rural-urban area type was no longer a significant influence, although a non-significant trend towards rural dwellers being more likely to fail-to-attend was observed ($p=0.067$). Again, increasing age was associated with an increased likelihood of attending (Exp(B)=1.016; 1.010-1.023; p<0.001) and as the level of area deprivation increased, the likelihood of individuals attending leisure providers was reduced (Exp(B)=0.932; 0.905-0.959; p<0.001).

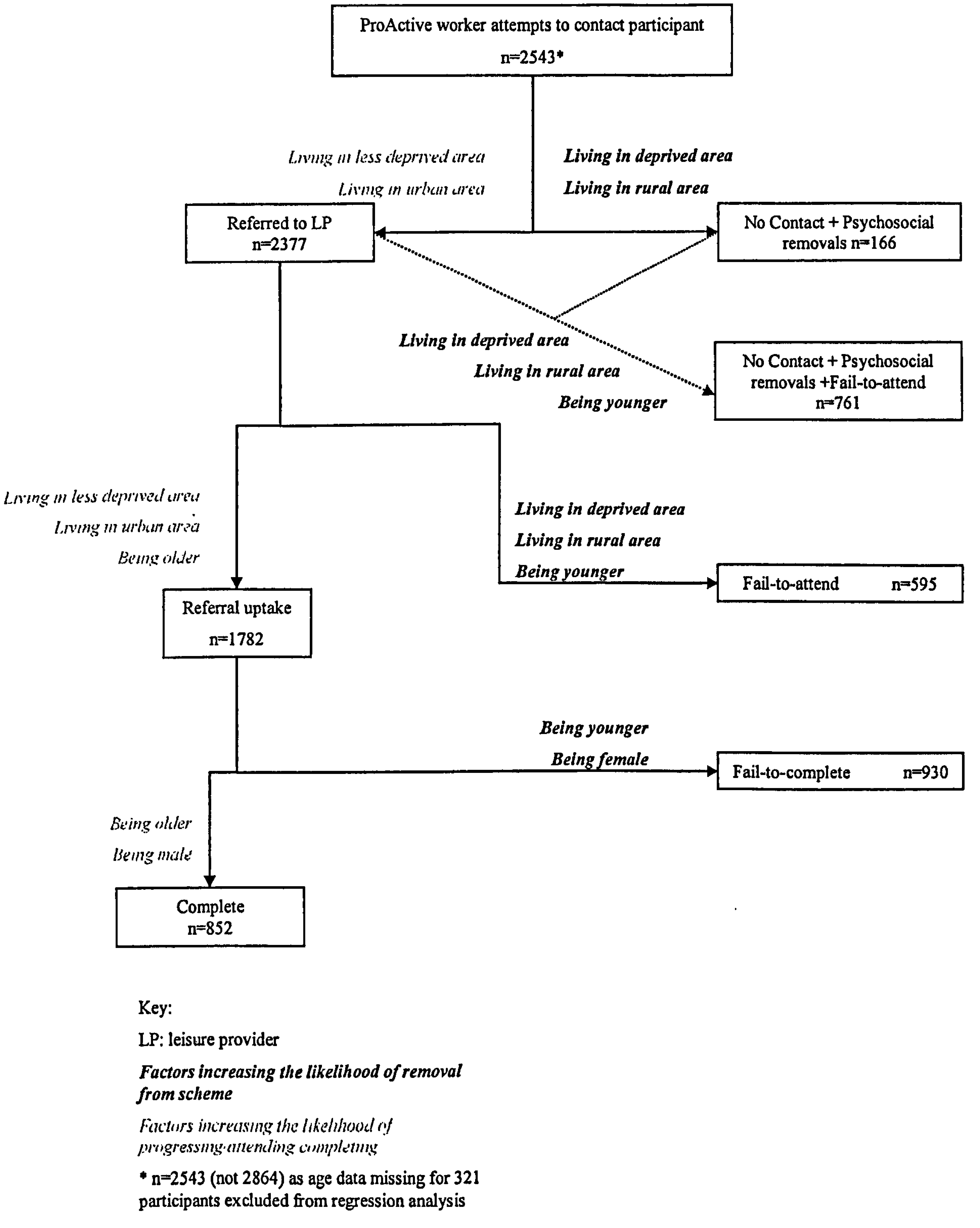


Figure 10.6 Diagram of significant outcomes from binary logistic regression models

Model 4

Models 1 to 3 suggested that participant gender did not have a significant influence on whether or not participants removed themselves prior to being referred to a leisure provider, or the likelihood of taking up referral. However, Model 4 demonstrated that out of all those who attended at least one exercise session, women were less likely to complete eighty *per* cent (or more) of the programme than men (Exp(B)=0.818; 0.675-0.992; p=0.041). Furthermore, the likelihood of completion increased with age (Exp(B)=1.018; 1.011-1.025; p<0.001). Area of residence did not have a significant influence on completion in terms of deprivation (p=0.119) or rural-urban area type (p=0.737).

Several variations on logistic regression Models 1 to 4 were performed in addition to Discriminant Analysis. These supporting analyses that were performed to confirm and further explore the findings presented in Table 10.5 are described in the following section.

10.2.5 Supporting analyses

First of all, Discriminant Analysis was used not only to verify findings from each regression model by an alternative method, but also to determine whether or not differences in group size, such as the large discrepancy in Model 1 (Group 0: n=384; Group 1: n=2480), influenced outcomes. Table 10.6 presents the findings (refer to Appendix 24 for statistical output).

Table 10.6 Significant outcomes from Discriminant Analysis

	Variables included	Wilks' λ	Wilks' λ (cumulative)	p-value
Model 1	Townsend score	0.998	0.995	0.001
	Rural-urban	0.998		
Model 2	Age	0.985	0.977	<0.001
	Townsend score	0.986		
	Rural-urban	0.980		
Model 3	Age	0.986	0.976	<0.001
	Townsend score	0.986		
Model 4	Age	0.997	0.982	<0.001
	Gender	0.984		

Note: independent variables: Gender (m=0, f=1); Age (continuous); Rural-urban (rural=0, urban=1); Townsend Score (continuous)

The small but significant effects observed for covariates in each regression model were confirmed. Moreover, the results presented were the same regardless of whether group sizes were assumed to be equal or were accounted for in calculation of outcomes. This was true for all models.

Secondly, the Townsend score was broken down into its four constituent Zscores: Z1=Overcrowded households; Z2=Unemployment level; Z3=Households not owner-occupied; Z4=Households without a car. Regression models were repeated, substituting the Townsend score with each of the component Zscores in turn, in order to identify components of the overall score that might have been dominant. The findings are presented in Table 10.7 (refer to Appendix 25 for statistical output).

Table 10.7 Outcomes for logistic regression models with each Townsend Zscore

		Exp(B)	95% CI	p-value	
Model 1	Townsend score	0.948	0.916–0.980	0.002	**
	Zscore				
	1	0.871	0.779-0.973	0.015	*
	2	0.880	0.787-0.984	0.025	*
	3	0.882	0.796-0.977	0.016	*
	4	0.843	0.755-0.942	0.003	**
Model 2	Townsend score	0.933	0.908-0.959	<0.001	***
	Zscore				
	1	0.865	0.793-0.945	0.001	***
	2	0.872	0.798-0.954	0.003	**
	3	0.825	0.758-0.897	<0.001	***
	4	0.792	0.723-0.868	<0.001	***
Model 3	Townsend score	0.932	0.905-0.959	<0.001	***
	Zscore				
	1	0.861	0.783-0.947	0.002	**
	2	0.858	0.777-0.947	0.002	**
	3	0.811	0.742-0.887	<0.001	***
	4	0.775	0.703-0.855	<0.001	***
Model 4	Townsend score			0.119	
	Zscore				
	1			0.139	
	2			0.555	
	3	0.899		0.032	*
	4			0.064	

Zscore1 = Overcrowding; Zscore2 = Unemployment; Zscore3=Non-home ownership; Zscore4=Non-car ownership.
*p≤0.05, **p≤0.01, ***p≤0.001

In Models 1 to 3, in which deprivation was a significant factor (Table 10.5), each Zscore exhibited a stronger relationship with the dependent variable than the composite score (indicated by lower Exp(B) values). However, confidence intervals were wider, which explains the attenuated levels of significance. None of the Zscores emerged as being particularly dominant. The relationships between the other independent variables (age, gender, rural-urban area) and the dependent variable were not greatly affected and the overall trends shown in Table 10.5 were unchanged with two exceptions: when Zscore 4 was entered into Model 3 the rural-urban area type became a significant influence with urban area of residence increasing the likelihood of attending (p=0.012); when Zscore 3 was entered into Model 4 it became a significant factor (p=0.032).

Table 10.8 Outcomes for 'settlement type' from logistic regression Models 1 and 2

	Settlement type	Exp(B)	95% CI	p-value	
Model 1	Overall effect			0.034	*
	Urban (ref)	1.000			
	Hamlet and isolated dwelling	0.620	0.417-0.921	0.018	*
	Village	0.718	0.531-0.970	0.031	*
	Small town and fringe	0.794	0.604-1.044	0.099	
Model 2	Overall effect			0.008	**
	Urban (ref)	1.000			
	Hamlet and isolated dwelling	0.838	0.596-1.178	0.308	
	Village	0.671	0.529-0.850	0.001	***
	Small town and fringe	0.809	0.650-1.007	0.058	

*$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$

The third supporting analyses involved, again repeating regression analyses but substituting the dichotomous rural-urban variable with the four-category 'settlement type' variable. Table 10.8 presents the outcomes from Models 1 and 2 only because neither of the area morphology variables demonstrated a significant influence in Models 3 or 4 (refer to Appendix 26 for statistical output).

Again, the overall relationships indicated that those living in urban areas were more likely to be referred to the leisure provider (Model 1) and attend one or more sessions (Model 2), although the effects were slightly attenuated. When this was broken down into the four 'settlement types' (with urban as the reference category), the effects were not significant for all rural area types. In both models, the rural effect was significant for those living in villages, although living in hamlets and isolated dwellings was a significant factor in Model 1 only. Non-significant trends were apparent for those living in small town and fringe areas.

Table 10.9 Outcomes for all covariates in logistic regression models with IMD 2004 as the measure of deprivation

		Gender (m=0, f=1)	Age (continuous)	IMD 2004 score (continuous)	Rural-urban (rural=0, urban=1)
Model 1	Exp(B)			0.977	1.347
	95% CI			0.964-0.990	1.082-1.678
	p-value			<0.001	0.008
Model 2	Exp(B)		1.015	0.974	1.295
	95% CI		1.009-1.021	0.964-0.985	1.088-1.543
	p-value		<0.001	<0.001	0.004
Model 3	Exp(B)		1.017	0.976	
	95% CI		1.010-1.024	0.965-0.987	
	p-value		<0.001	<0.001	
Model 4	Exp(B)	0.818	1.018		
	95% CI	0.675-0.992	1.011-1.025		
	p-value	0.041	<0.001		

Finally, regression analyses were repeated using the Index of Multiple Deprivation (IMD) 2004 as the socio-economic independent variable in place of the Townsend score. The IMD 2004 score demonstrated a significant effect in Models 1-3 of a similar magnitude to the Townsend score as shown in Table 10.9 (refer to Appendix 27 for statistical output). For each Model the general patterns for age, gender and urban-rural area type were the same as those observed when using the Townsend score (Table 10.5): in Model 1, deprivation and urban-rural location influenced the likelihood of participants removing themselves at the earliest opportunity; in Model 2, deprivation, urban-rural location and age influenced participant self-removal prior to uptake of referral; in Model 3, deprivation and age (but not urban-rural location) remained significant factors in determining uptake (out of those referred to leisure providers); and in Model 4, only gender and age influenced completion of physical activity programmes.

Table 10.10 presents data for regression models using each of the seven IMD domains in turn. In particular the income and employment domains, which best reflect material deprivation, were very strongly associated in all of the Models (1-3).

Table 10.10 Outcomes for logistic regression models for IMD 2004 and component domains

		Exp(B)	95% CI	p-value	
Model 1	IMD score	0.977	0.964-0.990	<0.001	***
	Domain				
	Income	0.101	0.020-0.298	0.007	**
	Employment	0.026	0.002-0.298	0.003	**
	Health deprivation and disability			0.758	
	Education skills and training			0.444	
	Barriers to housing and services			0.485	
	Crime and disorder	0.724	0.627-0.835	<0.001	***
	Living environment	0.984	0.975-0.993	0.001	***
Model 2	IMD score	0.974	0.964-0.985	<0.001	***
	Domain				
	Income	0.037	0.010-0.146	<0.001	*
	Employment	0.018	0.002-0.144	<0.001	***
	Health deprivation and disability	0.696	0.578-0.838	<0.001	***
	Education skills and training	0.990	0.983-0.997	0.007	**
	Barriers to housing and services			0.089	
	Crime and disorder	0.807	0.717-0.909	<0.001	***
	Living environment	0.986	0.978-0.993	<0.001	***
Model 3	IMD score	0.976	0.965-0.987	<0.001	***
	Domain				
	Income	0.042	0.010-0.171	<0.001	***
	Employment	0.020	0.002-0.180	0.001	***
	Health deprivation and disability	0.653	0.532-0.801	<0.001	***
	Education skills and training	0.989	0.981-0.996	0.003	**
	Barriers to housing and services			0.076	
	Crime and disorder	0.855	0.752-0.973	0.018	*
	Living environment	0.989	0.980-0.997	0.007	**
Model 4	IMD score			0.417	
	Domain				
	Income			0.557	
	Employment			0.888	
	Health deprivation and disability			0.406	
	Education skills and training			0.298	
	Barriers to housing and services			0.899	
	Crime and disorder			0.366	
	Living environment			0.476	

$*p \leq 0.05$, $**p \leq 0.01$, $***p \leq 0.001$

*

Chapters 11 and 12

The following two chapters consider the results described in the present chapter in the context of the literature discussed in earlier chapters (Chapters 2-7), before considering their implications for practice, future research, and the wider implications in relation to Government policy (Chapter 13).

Chapter 11: Discussion for Research Question 1

11.1 Introduction

The first research question was concerned with bias at the point of referral; whether or not certain population groups are 'under' or 'over-referred', when compared with the population of Somerset as a whole. This chapter discusses findings in the context of existing evidence, to elucidate likely explanations for social patterning of referrals. Chapter 12 goes on to consider such patterning in relation to subsequent self-removal from the scheme, referral uptake and attendance.

To recap, compared with the population of Somerset, the following groups were over-represented in the ProActive sample: women, adults aged between forty and sixty-nine years, residents of more deprived areas, and to a lesser extent, urban dwellers. Unfortunately the nature of the data only permitted a statistical comparison for deprivation (Section 9.4). The significance (or otherwise) of differences by age, gender and urban-rural residence was unknown. Nevertheless, differences in gender and age profiles of the ProActive and Somerset populations were sufficiently marked to warrant discussion. This is the first time such analysis has been undertaken in this context and therefore, represents an original contribution to the area by addressing a gap in the evidence base identified in Section 5.5.3. Consequently, there were no data from previous PARS research for comparison. Rather evidence from literature and some official statistics (Office of National Statistics and census 2001 data) discussed in earlier chapters are used to help explain the observed patterns. To maximise clarity, avoid unnecessary repetition and to comply with space limitations, throughout this discussion the reader is referred back to themes identified in the earlier literature review (Chapters 2-7), rather than referring directly to the literature once more.

Socio-demographic patterning of ProActive referrals, on one level appeared to meet the greater need of certain population groups, in terms of physical activity and/or health. Activity levels tend to be lower in women (Section 3.3.1), older adults (Section 3.3.2), the socio-economically disadvantaged (Section 3.4.2), and residents of rural areas (Section 3.5). Moreover, there is strong evidence that older people (Section 2.2.1) and those living in relative disadvantage (Section 2.4.1) report poorer health than their younger and more affluent counterparts, respectively.

From a public health perspective, moving people from sedentary behaviour to performing some physical activity is most important (Blair and Connelly, 1996). Therefore, by over-referring women, late middle-aged-older adults and those from deprived areas, it might appear that the ProActive scheme is targeting some population groups with most to gain from a physical activity referral. However, other factors need to be taken into account. Not only were socio-demographic characteristics associated with differential progress and success within the ProActive scheme (Section 12.3.1-12.3.4), but gaining access to a physical activity referral is dependent upon more than individuals being recognised as insufficiently active. As outlined in Section 1.2, a series of events are involved in the initial referral process that depend upon: individual's perception of poor health; access to and use of primary care; health professionals recommending a ProActive referral; and patients giving their consent. The following sections consider each of these in relation to age and gender, and socio-economic and urban-rural context, in an attempt to explain the present findings and determine why certain groups were under- or over-represented in ProActive.

11.2 ProActive referral patterns by age and gender

11.2.1 Contribution of differences in health

In Britain, gender differences in self-reported health vary according to age and the specific type of morbidity. If anything, the literature and national statistics indicate a female excess in morbidity overall, especially in young adulthood and for psychological morbidity (Section 2.2.2). When census 2001 data on self-reported health were obtained for the county of Somerset, differences between men and women were similarly small and variable with age (Casweb, 2004). Figure 11.1 presents the age distributions for self-reported health status (rated as 'not good') of Somerset men and women. Figure 11.2 presents the gender and age[34] profiles of those referred to ProActive. Data for both figures are presented in Appendix 28.

[34] Age categories were adapted to enable a comparison with census 2001 data on health

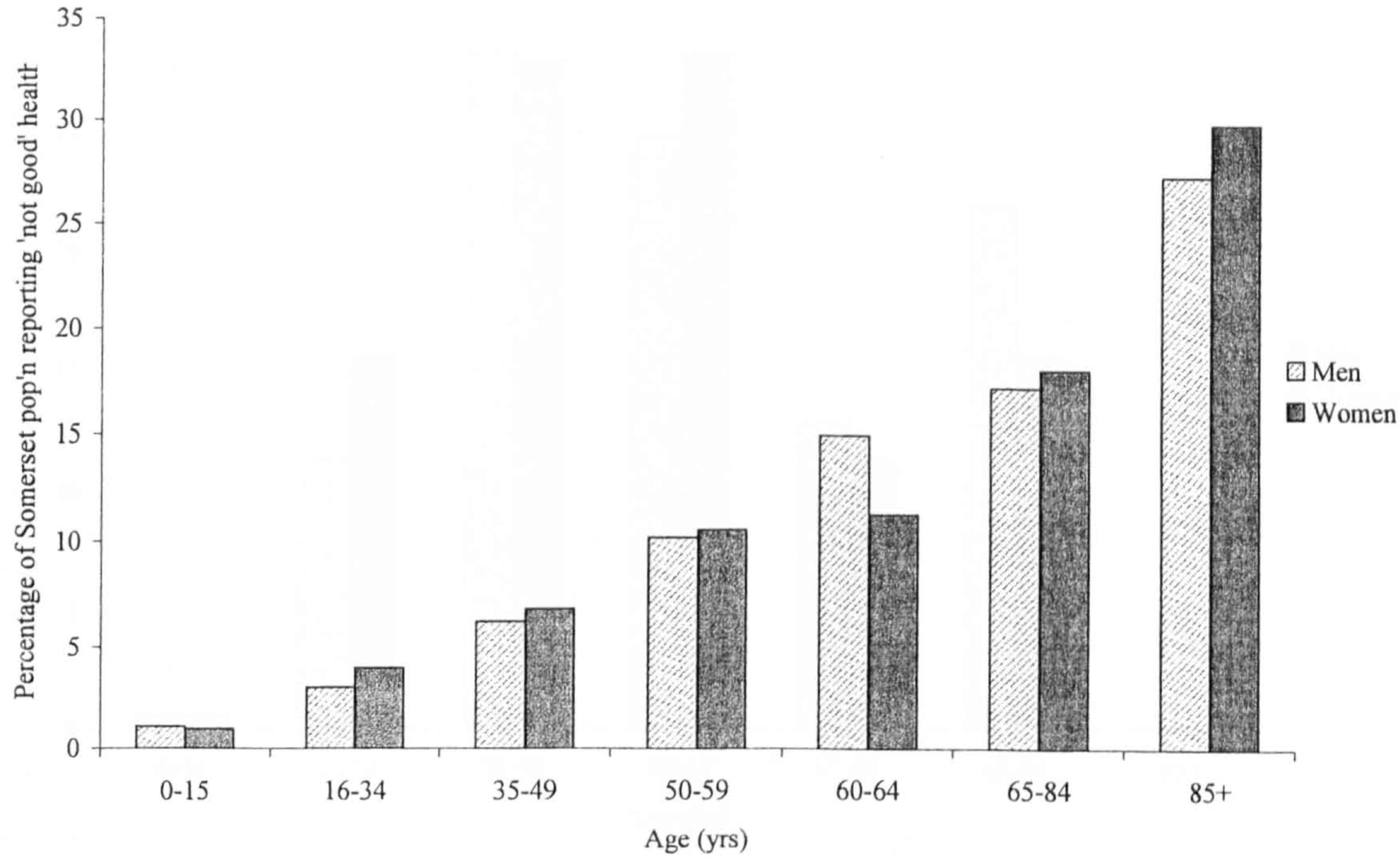


Figure 11.1 Proportions of Somerset population reporting 'not good' health by gender and age (Casweb, 2004)

Overall, a slightly higher proportion of Somerset women report 'not good' health compared with Somerset men (18.0 *vs.* 16.7%). Differences within each age group are, nevertheless, small. The greatest difference in the oldest age group of less than one *per* cent (29.8% of women *vs.* 29% of men) might simply reflect greater longevity in women. Furthermore, in Somerset residents approaching retirement age (60-64 yrs), a higher proportion of men than women report poor health (13.1 *vs.* 11.3%, respectively). Given the age distribution of the men and women referred to ProActive (Figure 11.2), it seems unlikely that the over-representation of women in the ProActive sample (61%) was attributable to differences in health alone. Indeed, when Figures 11.1 and 11.2 were compared in terms of the relative gender differences within age groups, there were few similarities.

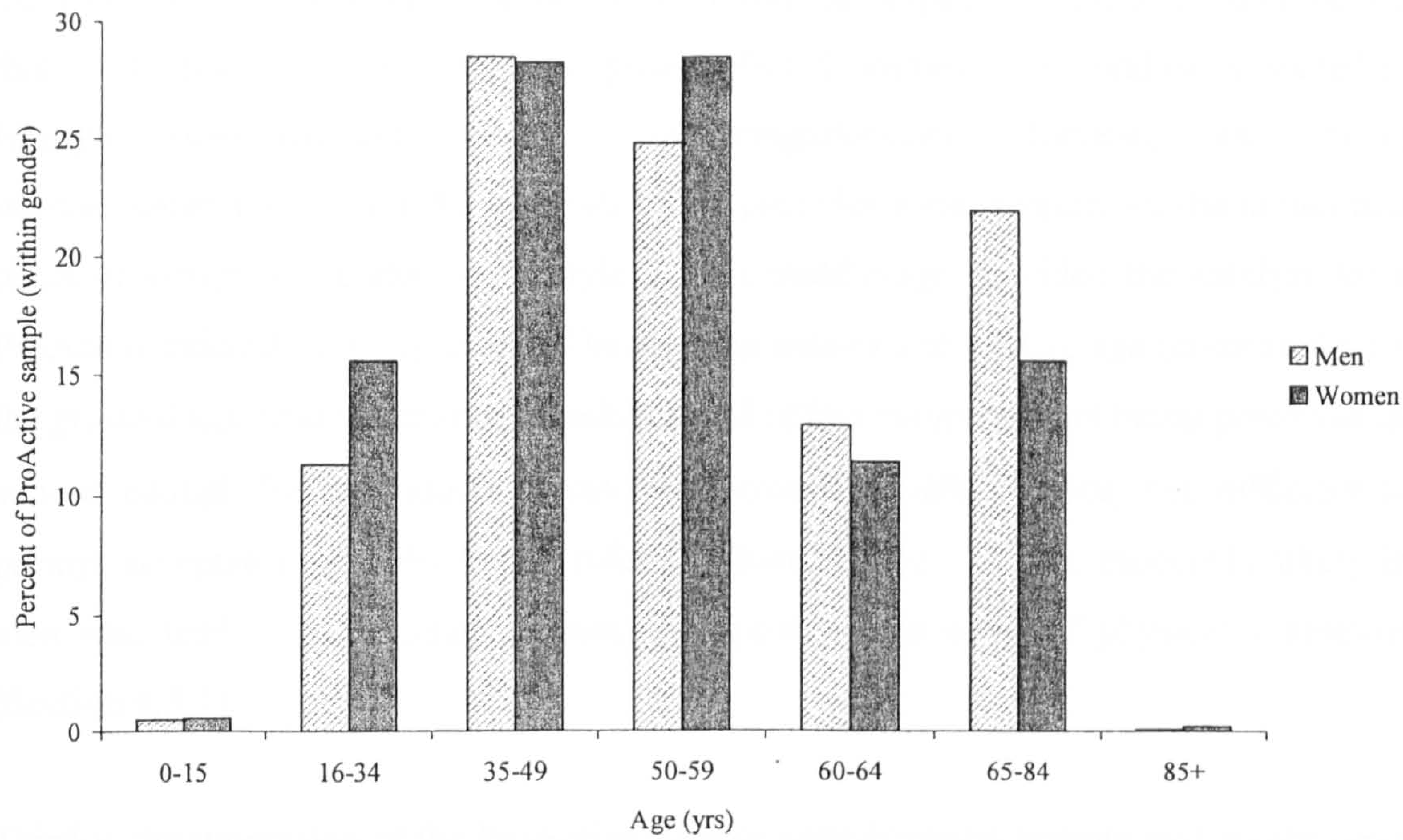


Figure 11.2 Age and gender profile of participants referred to the ProActive scheme

When comparing Figures 11.1 and 11.2, if the way in which age groups were defined is considered, a further difference emerges. The age bands used in the census were not consistent across the age range comprising ranges of five (60-64 yrs), ten (50-59 yrs), fifteen (35-49 yrs) and twenty years (15-34 and 64-85 yrs). The fact that a gradual decline in health is observable over the life course is presumably a consequence of using narrower age bands to stratify adults aged from middle to retirement age, a period of life in which the cumulative adverse health effects of lifestyle and age often manifest (Boreham and Riddoch, 2003). When the study sample of ProActive participants was re-stratified using the same age boundaries (Figure 11.2), the resultant age profile on the ProActive scheme did not reflect a gradual age-related decline in health. There are logical explanations as to why this should be the case.

Firstly, the minimum age requirement employed in the ProActive scheme usually precludes the participation of minors (<16 yrs). Although this is at the discretion of the leisure provider, only a very small proportion of ProActive participants were in the youngest age group.

Secondly, the age-related decline in health discussed in Section 2.2.1 could account for the high proportion of ProActive referrals aged between thirty-five and fifty-nine years, especially if accelerated by years of inactivity preceding the referral. Indeed, findings from the simultaneous investigation of ProActive participants (Sidford, 2006) revealed that the largest proportions of participants referred primarily for conditions related to lifestyle (cardiovascular disease, overweight/obesity, diabetes, and being unfit/sedentary) were aged 50-69 years. This provides some support for the notion that onset of symptoms related to lifestyle during middle-age provided the catalyst for a ProActive referral in many cases. The jump in referrals in middle-age (compared with the *gradual* age-related decline in health) could reflect symptoms not being perceived as serious enough for individuals to rate their overall health as poor, but sufficient to prompt acceptance of a ProActive referral when offered. This is especially likely in men who tend to be reluctant to seek help prior to the onset of physical symptoms (Section 6.3.1).

Thirdly, the proportion of the ProActive sample aged between seventy and eighty years was below the Somerset average; the proportion aged over eighty was far lower (Figure 10.1). However, Figure 11.1 clearly illustrates that the oldest age group report the poorest health. Therefore, although changes in health might account for the over-referral of middle-aged individuals, alone they could not explain the sharp decline in referrals of older adults, thus implicating differential rates of GP consultation or referrals from primary care.

11.2.2 Contribution of differences in primary care consultations

Gender differences in rates of primary care consultation provide a plausible explanation for the *overall* female dominance in referrals to ProActive. Section 6.3.1 presented evidence that women not only seek consultations in primary care more frequently than men, but the magnitude of this gender difference is similar to that observed in the ProActive scheme and other PARS (approx. 60% women; Section 5.5.3). However, this is complicated by the variability of gender differences in consultation behaviour (and referral patterns) with age, and with the type of consultation (or referral) as discussed in Section 6.3.2. Therefore, the changing gender profile of the ProActive sample across the age range must be considered in context, ideally taking some account of the age profile of men and women referred to ProActive and the type of condition with which patients consulted GPs.

Consequently, a comparison was made between the age distributions of men and women in the ProActive sample and national survey data on GP consultation rates taken from the General Household Survey. It was considered appropriate to use GHS data on GP consultations, because less than fifteen *per* cent of ProActive referrals were known to originate outside of general practice: GPs = 72.4%, practice nurses = 13%, physiotherapists = 10.6%, other = 4% (Sidford, 2006). Figures 11.3 and 11.4 present data on the proportions of men and women (respectively) in the ProActive sample compared with the proportion of the British population who consulted their GP in the two weeks preceding the survey.[35]

The overall gender split of the ProActive sample was similar to that for GP consultations, but differences emerged when age was considered. General Household Survey data demonstrated that the proportion of *men* recently consulting their GP rose steadily from young adulthood into old age (Figure 11.3). The proportion of male participants within the ProActive sample also increased in sequentially higher age bands. However, the marked jump between young adulthood (25-34 yrs: 7.9%) and middle-age (45-54 yrs: 19.2%), and the increasingly rapid decline in older age (65-74 and ≥75 yrs) are not consistent with consultation patterns. This could be an indication that health professionals are only referring those with established symptoms, which become increasingly likely during middle-age. Consequently, important questions are raised regarding health professionals using the ProActive scheme for prevention or rehabilitation (Section 11.4.2 and 13.2). The decline in old age, however, suggests that some older men were not referred as a result of their age; i.e. health professionals might not perceive that physical activity is appropriate for older people who might be considered too frail (Section 11.4.2). It is also possible that older adults chose not to take up their referral; again, maybe as a result of health-related barriers, but those perceived by the patient. These potential influences at the point of referral are considered in 11.4.

[35] Ten-year age bands used to stratify the ProActive sample were altered to match those from General Household Survey

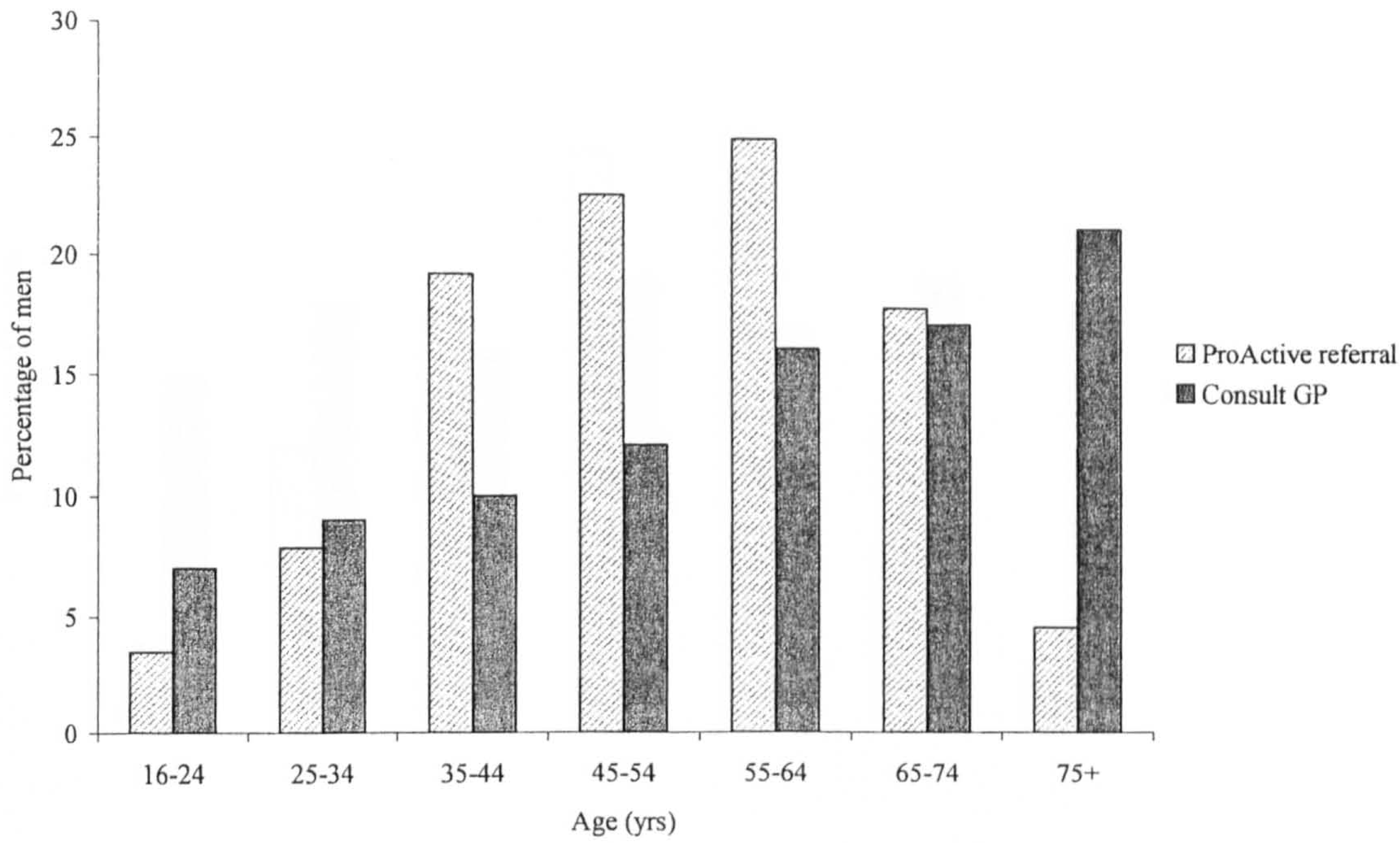


Figure 11.3 Comparison between age distribution of men referred to ProActive and consulting GP in England

Similar, but less marked differences were apparent in *women* (Figure 11.4). Rates of GP consultations in women were higher than in men during young adulthood. They fluctuated throughout the life course but increased only slightly overall (Figure 11.4 and Section 6.3.1). This female excess in GP consultations at a younger age corresponded to some extent with the higher proportion of ProActive referrals in younger women compared with men (refer to Figure 10.3). Approaching middle-age, a similar but slightly less marked jump in the proportion of women referred to ProActive deviates somewhat from gender differences in GP consultation. However, the reduction in the gender discrepancy towards middle-age is common to both GP consultation rates and ProActive referrals.

A similar but even sharper drop in ProActive referrals observed in women (compared with men) in the older age groups, again differed from the rate of GP consultations that apparently increase. This corresponds with the higher proportion of men (compared with women) referred to ProActive who are in the over-sixty age groups (Figure 10.3). Yet again, this is suggestive of important influences operating at the point of referral (Section 11.4).

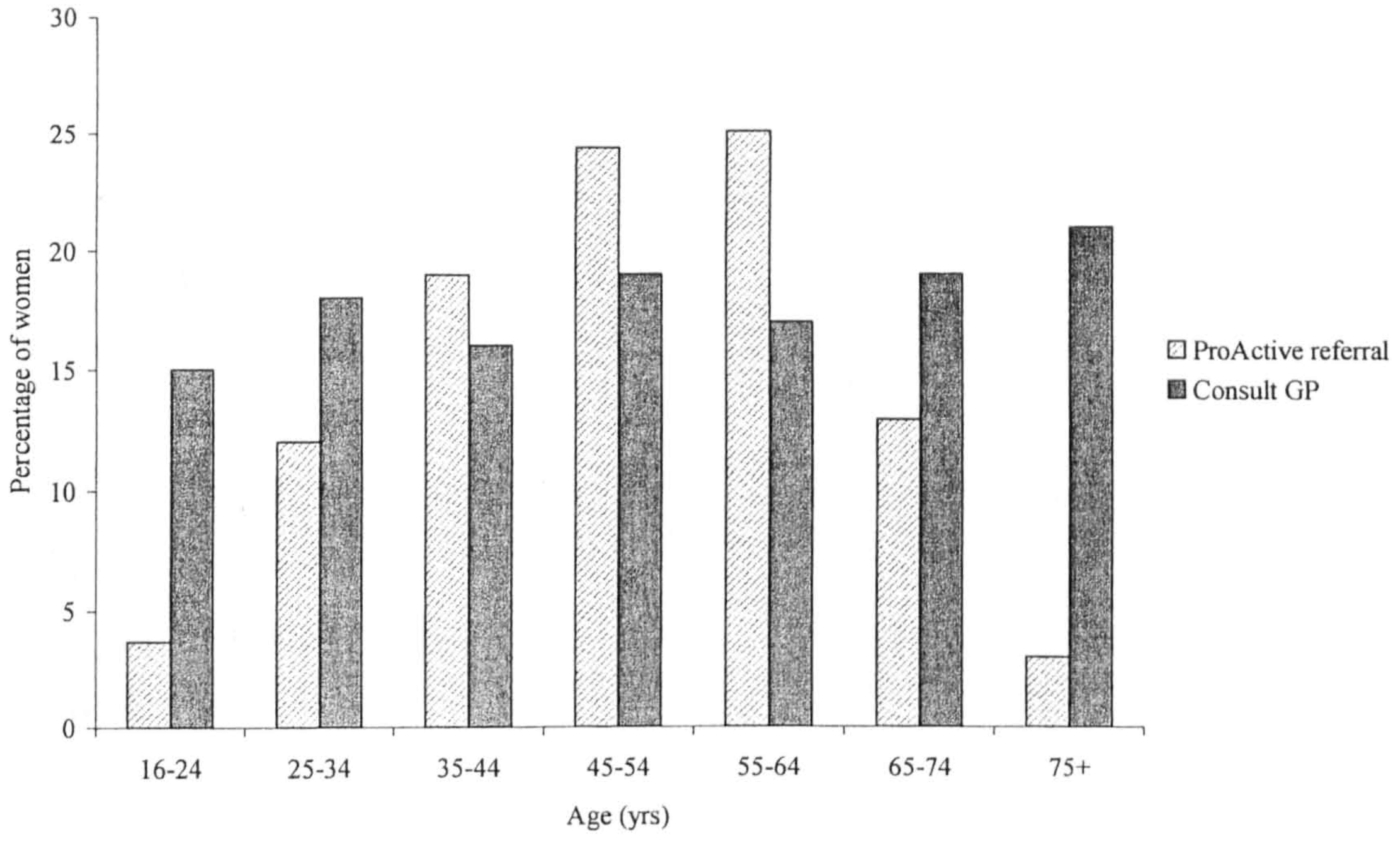


Figure 11.4 Comparison between age distribution of women referred to ProActive and those consulting GPs in England

A final point relating to age that could indicate slight bias in referrals in favour of women, is worth highlighting. The majority of ProActive referrals were between early middle-age and retirement age. In contrast, the female excess in GP consultation rate that is greatest in young adults, reduces slightly during middle-age and almost disappears by retirement age. Given the difference in age distribution it might be expected that the overall gender difference in consultation rate of approximately sixty *per* cent (Kapur et al., 2005; Ronalds et al., 2002) would be greater than the difference in consultation rate within the ProActive sample; yet they were similar.

Overall, the rise in GP consultations (particularly in men) explains increases in ProActive referrals from youth to late middle-age. However, it would seem likely that influences, possibly health-related, at the point of referral are responsible for the sudden rise in referrals to the ProActive scheme of adults approaching middle age and into retirement age. This could also explain why, despite continued health decline and increasing contact with GPs into old age, older adults (especially older women) appear less and less likely to likely to receive a ProActive referral. Health professional perceptions of the appropriateness of physical activity for older people and use of PARS for prevention versus treatments emerge as likely contributors (Section 11.4.2).

Men's empowerment through health and health-help seeking behaviour

Before moving on, it is worth considering reasons for the apparent reluctance of men to report ill-health and seek help prior the onset of sufficiently 'serious' physical symptoms that emerge from a growing feminist and constructionist literature (Courtenay, 2000). Describing these patterns can lead to the portrayal of men as victims; a group whose health suffers through trying to conform to masculine stereotypes of men as the more independent self-reliant, strong, robust and tough gender (Courtenay, 2000). Indeed, young males have identified health cost (amongst other grievances) as a result of pressure from societal expectations of masculine behaviour (Gough and Peace, 2000). From a social constructionist perspective, however, males are not merely passive victims of a socially constructed role. Rather, conforming to these stereotypes can be a means of empowerment; i.e. by dismissing their health needs, men reinforce cultural beliefs and legitimise themselves as the stronger sex, (Courtenay, 2000; Gough and Peace, 2000). Claims by men that it is they who suffer has been recognised as a softer, but still masculine defensive barrier to protect masculinity through 'disempowerment' from ongoing social change; a more subtle and complex way of stalling change of the present status quo.

For the age-gender patterns observed in the present study, it is useful to place them in the context of such ideas. Men are less likely to visit their GP and therefore, were less likely to be referred o ProActive. Although to some extent this is likely to have been a manifestation of some men conforming to masculine stereotypes, it might not be just to view them as the victims because such behaviour also represents a means through which social gender inequality is preserved.

11.2.3 Contribution of differences in primary care referral rates

Again, referring back to the literature and ONS data discussed in Section 6.3.2, it appeared that in the adult British population (≥16 yrs), age and gender patterns for 'total referrals' (i.e. all types of primary care referral) were similar to those for GP consultations: a general increase with age and a female excess that reduces with age, disappearing by retirement age (refer to Figure 6.2). However, referral rates differed from rates of GP consultation by declining in old age, similar to the pattern observed in ProActive referrals. Furthermore, within the male British population receiving primary care referrals, a higher proportion belonged to the older age groups (compared with women), which is again consistent with the sharper decline in ProActive referrals observed in older women (refer to Figure 10.3).

Possibly the most salient feature of primary care referral rates from Section 6.3.2 was the substantial variation in age-gender patterns between different *types* of referral. In the context of the present study, this poses a problem because a referral to the ProActive scheme is somewhat different to other types of referral traditionally offered in primary care (e.g. surgery; psychiatry; rheumatology). A referral to an exercise professional for up to twelve weeks of supervised physical activity in a leisure centre or gym environment is a quite different prospect to being referred to a surgeon, rheumatologist, psychiatrist or other types of referral for which data were available (refer to Section 6.3.2 and Appendices 5-6). Moreover, the intention to use PARS as preventive interventions to promote positive health rather than treatment of ill-health, is somewhat removed from the traditional symptom-treatment paradigm in medicine. This might require an appreciation of the more holistic benefits associated with physical activity in both the health professional and patient. Indeed, the way in which referring health professionals promote or recommend a physical activity referral and the level of endorsement, is likely to have an influence on the patient's response. This is discussed further in Section 11.4.

11.2.4 Summary

From the discussion so far, age-related health changes and increasing GP consultation rates provide a plausible explanation for the high proportion of middle-to-retirement aged ProActive referrals. The greater propensity of women to seek primary care consultations is a likely explanation for the over-representation of women within the ProActive sample, although a degree of over-referral is possible. There are, however, further important considerations. Now that possible factors influencing the likelihood of different age-gender groups placing themselves in a primary care setting (from which a physical activity referral is possible) have been discussed, Section 11.4 considers subsequent influences; i.e. influences at the point of referral such as attitudes of the patient and health professional towards PARS. But first, the nature of ProActive participants' area of residence are similarly considered in relation to the likelihood of them being in a primary care setting using existing evidence and data on health, GP consultations and referral rates.

11.3 ProActive referral patterns by area of residence

11.3.1 Contribution of differences in health

Section 2.4.1 provided some background to health inequalities and described evidence that consistently demonstrates a positive gradient between the health of the British population and relative socio-economic advantage, with an independent association for area SEP. Moreover, there is also consistent evidence of a positive association between SEP (at both individual- and area-level) and physical activity participation (Section 3.4.2). There was less evidence of discrepancies in health between residents of urban and rural areas (Section 2.4.2 and 3.5). Those living in rural areas tend to report worse health than suburban dwellers but often better than those living in the largest urban centres (Section 2.4.2). Further, urban-rural variation in the relationship between perceived health (self reported morbidity) and objective health outcomes (mortality rate) suggested that rural dwellers might have poorer perceptions of health; a possible consequence of feeling more limited by the environment in terms of access to health care and other services (Section 2.4.2 and 6.4.2) or as a result of social exclusion (Collins, 2004). Evidence presented in Section 3.5 was generally indicative of rural dwellers being less active and facing greater barriers to increasing activity than those in more urban areas.

Therefore, over-referral of people from more deprived areas was encouraging as it appeared to meet their greater need in terms of health and physical activity. Under-representation of rural dwellers in the ProActive sample was marginal but indicated that greater physical activity barriers associated with rural residence were not being addressed through over-referral to ProActive. Findings must, however, be considered in relation to primary care consultations and related access issues.

11.3.2 Contribution of GP consultations rates and access to primary care

The generally poorer health experienced by residents of more deprived areas (Section 2.4.1) is reflected in higher rates of GP consultation (Section 6.4.2). It is possible that this marked socio-economic effect on GP consultation rates was greater than the small but significant effect observed in ProActive referrals. If so, this would indicate socio-economic bias *against*, rather than in favour of residents of deprived areas. Anecdotal evidence has suggested that some Somerset GPs do not refer to ProActive, patients whom they know would be unable to afford participation (Kweatowski, 2006; Sidford, 2006). However, in the absence of data on which patients are offered but refuse referral, this should remain speculation.

As detailed previously (Section 6.4), the propensity of an individual to use primary care services is to some extent dependent upon physical accessibility. Figure 10.4 indicated that the proportion of the ProActive sample living in urban areas was slightly above average for Somerset. This could be interpreted as rural residents having poorer access to primary care. However, studies conducted in rural regions of England (East Anglia and the South West) reported good access to GP practices for the majority of people living in both urban and rural areas (Jordan et al., 2004a; Lovett et al., 2002). This small difference between the proportion of Somerset and ProActive residents residing in rural areas, combined with evidence from the literature demonstrating generally good access for rural dwellers, suggests that rural residency was not a major determinant of obtaining an initial referral. From the literature, it appeared that access to secondary health care (e.g. hospitals; specialist services) was a greater problem because services tend to be more centred around urban areas (Gulliford et al., 2001). In the context of the ProActive scheme, this could be equated to leisure providers: the specialist service to which ProActive participants are referred. With this in mind, rural residency as a barrier to uptake and attendance of PARS is discussed in Sections 12.2-12.3.

11.3.3 Contribution of differences in primary care referral rates

Rates for other types of primary care referral by area-type were explored to provide insight into possible bias in ProActive referrals (6.4.3). Relationships linking area deprivation and referral rates were complicated by some researchers apparently failing to take into account socio-economic differences in morbidity or subsequent primary care consultation rates, in the calculation of referral rates. When researchers made some attempt to do so, apparent bias in favour of lower socio-economic groups generally disappeared or was slightly reversed in favour of the more affluent (Goddard and Smith, 2001). In the present study, it is likely that the higher mean deprivation level of areas in which ProActive participants lived (compared with the Somerset average) is a reflection of differential GP consultation rates. If health professionals were also referring proportionately more people from deprived areas to ProActive, one would expect a greater difference than that observed.

Furthermore, the literature in Section 6.4.3 and official statistics (Figure 6.7; Appendix 6) indicated that socio-economic patterning of referral rates varied according to the *type* of referral. For example, socio-economic bias in favour of residents of more affluent areas is most consistently demonstrated for surgical referrals (Goddard and Smith, 2001; Hippisley-Cox et al., 1997b; Office for National Statistics, 2005d) but a trend in the opposite direction is observed for psychiatric referrals (Figure 6.7 and Appendix 6). This again implicates the *type* of service as an important factor relating to socio-demographic patterning of use. The nature of physical activity referrals in relation to the likelihood of certain groups being referred are therefore considered subsequently (Section 11.4).

11.3.4 Summary

The apparently encouraging pattern of over-referral of residents from deprived areas is somewhat misleading. If differences in health and subsequent GP consultation rates are considered, a slight under-referral is more plausible (if socio-economic bias exists at all). Nevertheless, from the available evidence discussed so far it would appear that residents of deprived and rural areas do not necessarily experience poorer access to ProActive referrals through differential access to, or use of, primary care services.

Some factors related to socio-demographic profile have been used to explain how different groups were more or less likely to visit a primary care setting, and influences on obtaining referrals in general. However, once an individual was in the primary care setting (often the GPs office), as described in Section 1.2, there are several possible factors that could have determined the likelihood of referral to the ProActive scheme. This discussion follows.

11.4 ProActive referrals from primary care

Once individuals are in the primary care setting, potential influences to consider include: the knowledge, beliefs and attitudes of both health professional and patient in relation to physical activity and PARS; potential barriers to participation; patient characteristics that might prevent a health professional from recommending a physical activity referral; and the influence that the health professional might have on the individual. The following subsections consider each of these potential influences in the context of the physical and social environment to explain how these might be used to better understand differential referral of different socio-demographic groups to ProActive from primary care.

11.4.1 Patient-related determinants of consenting to a ProActive referral

Gender

Women are generally thought to be more knowledgeable and conscious of their health than men, placing greater value on health and health behaviour, including physical activity (Section 2.2.3 and 2.2.5). Although it is widely acknowledged that women tend to be less active than men, they appear more motivated to participate in physical activity-related interventions and surveys (Chambers et al., 2000; Clark and Nothwehr, 1999; Elley, Kerse and Arroll, 2003; Kaplan et al., 2001; Salmon et al., 2000; Tudor-Locke et al., 2004; Wardle and Steptoe, 2003; Yen and Kaplan, 1998). Women are more likely to be motivated into activity for health and fitness reasons rather than by competition and performance-related factors that tend to be stronger motivators in men

(Section 3.3.5). It might, therefore, be expected that women would exhibit a more positive attitude towards, and be willing to consent to, a physical activity referral, especially considering their greater susceptibility to social cues, such as a health professional's recommendation (Sallis et al., 1992).

Furthermore, women not only visit primary care more frequently than men but are more likely to do so for preventive purposes (Section 6.3.1) and are more likely to use most preventive health services (Section 6.5.3). The specific nature of preventive health services emerged as a potential determinant of gender differences in use. Because women appear more predisposed to participation in physical activity interventions, this would again suggest that they would be less likely to refuse a physical activity referral than men.

As discussed in relation to differences in physical activity (Section 3.3.5), patients' confidence in their ability to undertake exercise (self-efficacy) could have been a factor. It is thought more important in men (especially younger men), who tend to be more motivated by competition and performance than health and fitness. A man who has been sedentary for a long time might refuse a physical activity referral because of low self-efficacy. A woman with similarly low efficacy might be more motivated to participate for other reasons (e.g. health; to improve appearance) or again, as a result of an increased susceptibility to social cues (Section 3.3.5).

Nevertheless, there are several factors identified in the literature that were used to explain generally lower levels of physical activity in women, which are not consistent with the higher proportion of women referred to the ProActive scheme (e.g. combined domestic and work commitments; negative self-perceptions; importance of social support). It would, therefore, appear unlikely that these factors were important determinants of initial referral in men and women. As discussed in the following chapter, such factors did emerge as possible contributors to differential completion rates of those referred to ProActive (Section 12.3.4).

Age

A general reduction in physical activity with age, again conflicts with observations of age-related increases in health awareness and the perceived value of health behaviours (Section 2.2.3), especially around middle-age in men. Not only are middle-aged and older adults more likely to visit their GP because of declining health, but increased health concern might prompt them to accept a ProActive referral more readily than their younger counterparts. This effect might be reversed after a certain age (approx. 70 yrs; refer to Figure 10.2), after which health problems might present a barrier rather than an incentive to participation. Indeed, health-related barriers are commonly cited in relation to physical activity in this age group (Section 3.3.4). This could have contributed to the low proportion of the ProActive sample in the older age groups, despite the increased GP contact and sedentary behaviour associated with old age.

Several other factors could have caused younger adults to decline, if offered, a ProActive referral: relative health and consequently lower health concern associated with youth; greater time constraints from work and family commitments; perceptions that physical activity referrals are not befitting a younger person (i.e. not conforming to social norms).

In addition to the likelihood of health-related barriers, aspects of the social environment could have prompted older adults to decline physical activity referrals. Indeed, it is not surprising that inactive older adults, who may have been sedentary for much of their lives, would not perceive themselves as suitable candidates for ProActive. As described in Section 3.3.4, the majority of inactive older adults have no intention of increasing activity levels (Dishman, 1994). Although health is a commonly cited reason, lack of knowledge, personal experience and the sedentary behaviour of peers are potentially negative influences on the self-efficacy of older adults to undertake physical activity and, therefore, accept a ProActive referral (Section 3.3.4). Although PARS should be promoted as an initial aid to becoming more active (i.e. in a structured and safe environment) it is possible that this is not adequately conveyed at the point of referral. Indeed, the need to learn more about this is considered later (Section 13.3.2).

Although these factors are relatively consistent with the age profile of those referred to ProActive, older adults in particular tend to hold GPs in greater esteem than younger people (Stathi et al., 2003). It is, therefore, possible that it was the GPs influence that prompted older adults below the age of eighty to accept a ProActive referral despite the likelihood of personal apprehension (Section 11.4.2).

Deprivation

As described previously, lower socio-economic groups are reported to perceive a lower level of control over their health and health behaviour, exhibiting more fatalistic attitudes compared with their more affluent counterparts (Section 2.5). They are also more likely to feel restricted by barriers of facility access, health status, lack of motivation, leisure-time, money and transport (Section 3.4.3). A lower prevalence of regularly active individuals in socio-economically disadvantaged environment reduces the likelihood of becoming active through social modelling, a perceived lack of social support for activity, and with potentially negative implications for self-efficacy (Section 3.4.3). Moreover, physical activity research consistently finds that those who respond to invitations to participate, or who respond to health or lifestyle related surveys tend to be more educated and of higher SEP (Hillsdon et al., 2005).

Therefore, in the context of ProActive, residents of more deprived areas, to whom a physical activity referral was recommended, might have exhibited a more negative response because such behaviour does not conform to that frequently observed in their environment. Indeed, all of these factors would have been expected to increase the likelihood of a negative response in primary care patients from deprived areas when offered a ProActive referral. However, this is not apparent from the findings.

It is possible that patients received insufficient information relating to the ProActive scheme at the point of referral for potential practical barriers to influence the decision of whether or not to consent. Indeed, this is supported to some extent by various reasons given by participants who later removed themselves from the scheme, such as finance or the location of the leisure providers. This emerged in a previous evaluation of people removed from the ProActive scheme (Johnston et al., 2005), in descriptive post-hoc analyses reported in Section 12.2.1 (Table 12.1), and through the researcher's personal experience as the ProActive Project Worker (Section 13.5.4). Once again, the actions of the referring health professional emerge as a likely influence.

Therefore, the observation that people referred to ProActive lived in areas that were significantly more deprived than the Somerset average raises several possibilities. Firstly, health-damaging attitudes associated with socio-economic disadvantage did not extend to the ProActive scheme. Secondly, such negative perceptions were a factor, but the socio-economic discrepancy in GP consultation rates was greater. Finally, it is quite plausible that at the point of referral, the influence of personal attitudes were secondary to that of the referring health professional (Section 11.4.2).

Summary

Overall, from literature discussed in Section 3.4.3 and 3.3.5, those factors relating to the social and physical environment that were used to explain socio-demographic patterning of physical activity can explain some, but by no means all aspects of the socio-demographic profile of ProActive participants.

11.4.2 The influence of the referring health professional

Despite social influences of peers, family and friends, it is possible that the most influential 'significant other' at the point of referral would be the referring health professional, in most cases, the GP (approx. 75%). How this balance changed once patients were away from their direct influence (post-referral) is discussed in Sections 12.2-12.5.

The general public, especially older people, often hold GPs in high esteem (Hardcastle and Taylor, 2001; Stathi et al., 2003). Therefore, a recommendation for a ProActive referral on the grounds of health could have been sufficient to promote a positive response in many patients.[36] The strength of this effect would depend largely on the manner in which health professionals offered or recommended the ProActive scheme. If physical activity referrals were endorsed as a necessity in a similar way to other types of referral (e.g. surgery; rheumatology), then it would be expected that the vast majority

[36] The concurrent evaluation of ProActive revealed that the majority of patients were referred for specific medical reasons; only 7.1% of participants were referred for being 'unfit/sedentary' (Sidford, 2006).

of patients to whom they were recommended would accept. However, some qualitative research has indicated that this is not the case. There is evidence that health professionals do not prioritise physical activity promotion or PARS compared with equivalent lifestyle-related services, such as dietitians or smoking cessation services (Gould et al., 1995; Graham et al., 2005). A lack of promotion or endorsement was also evident in a PARS trial that was aborted because of low numbers recruited by GPs (Fielder et al., 1995). The PARS model is slightly removed from traditional medicine. Therefore, not only is there a lack of physical activity promotion and exercise science in GP training (Gould et al., 1995; Graham et al., 2005; McKay et al., 2003; Steptoe et al., 1999) but GPs do not have the time to educate themselves through the academic physical activity literature (Smith and Bird, 2004). Therefore, it is no surprise that physical activity interventions like ProActive are met with scepticism among many health professionals (Graham et al., 2005; Steptoe et al., 1999).

The influence of the health professional could also have contributed towards the age profile of ProActive participants, and through perceptions of ProActive as a therapeutic rather than preventive intervention. Although ProActive was intended for CHD prevention, PARS are often not perceived as such. Health professionals have reported viewing them as a means to reduce medication for established disease rather than for prevention of disease onset (Smith et al., 1996). Therefore, it is quite possible that for the majority of Somerset residents who visited primary care, only those who presented established symptoms were recommended a physical activity referral. This could account for the marked jump in referrals around middle-age that was not concordant with patterns for GP consultation rates (Section 11.2.2). Although it is unlikely that ProActive was perceived in a preventive capacity, how 'prevention' is defined in this context is open to interpretation; i.e. referral of a patient to reduce blood pressure could be considered as treatment for hypertension or prevention of CHD. In any case, health professionals are more readily referring those with established symptoms, rather than relatively healthy sedentary adults. This may be an inherent limitation of using the primary care setting (discussed in Section 13.3.3).

The sharp decline in referrals of older adults could also be attributed in part to health professionals perceiving physical activity as inappropriate for this age-group. Indeed, in relation to health professional-delivered physical activity interventions, practice nurses have identified frailty (associated with old age) as a limiting factor in physical activity or exercise (Devereaux Melillo et al., 2000). They also identified the difficulty associated with promoting activity in older people who have been sedentary for many years (Devereaux Melillo et al., 2000; Tai et al., 1997). Similar considerations could easily have influenced the decision of health professionals not to refer older adults to ProActive.

There are two further considerations that emerge from the literature. It is possible that referring health professionals were fearful of the medico-legal issues involving the referral of high risk groups (Graham et al., 2005). For this reason the national guidelines for PARS include recommendations that responsibility passes to the exercise professional following referral (Department of Health, 2001b). Moreover, Somerset has a peer review system in the recognition process, which is designed to overcome such concerns (Crone et al., 2004). The substantial number of participants removed for being medically inappropriate (Johnston et al., 2005) (Figure 10.5 and Table 12.1) serves as evidence that ill-health and frailty were not barriers to referral in all health professionals. Nonetheless, it remains a possibility.

The aforementioned anecdotal evidence of Somerset GPs admitting to deliberately not referring individuals whom they believe could not afford to participate in ProActive adds support to the notion of under-referral of individuals from deprived areas. The aforementioned study of practice nurses (Devereaux Melillo et al., 2000) indicated that health professionals might anticipate a worse response to physical activity promotion from those in lower (compared with higher) socio-economic groups. This cannot be inferred from the present findings, but raises a question to be addressed through future research.

Summary

From the patterns observed, the various possibilities discussed in this section, and from the researcher's personal experience of speaking with participants following referral by health professionals (Section 13.5.4), it seems plausible that the greatest influence on patients giving consent at the point of referral was that of the referring health professional. The esteem that many people associate with GPs, and the desire to provide a socially desirable response, could prompt patients to consent to a ProActive referral as they might to any other (e.g. rheumatology; physiotherapy). This could occur regardless of the negative perceptions and other barriers (related to physical activity, gym-based exercise, or PARS) in different population groups that might be expected to create a sociodemographic ProActive profile somewhat different to that observed. Furthermore, incorrect or insufficient information provided by health professionals about the scheme could have contributed towards some individuals from more deprived areas consenting to referrals, thus exhibiting an intention to participate that conflicts with general trends from physical activity research (Section 3.4).

11.5 Conclusion

From this chapter, two key events emerge as most likely explanations for socio-demographic patterning of referrals to ProActive: differential GP consultation rates and the influence of the referring health professional. The conclusions made here are further supported by differential progression of groups within the ProActive scheme that were more in keeping with expected trends (Section 12.3.1-12.3.4).

The female excess in ProActive referrals was in keeping with the gender difference in GP consultation rate (especially in young adulthood). If a slight over-referral of women did occur, it would be consistent with increased susceptibility to social cues (Section 3.3.5), greater use of preventive health services (Section 6.5.3) and greater participation in physical activity interventions.

The rapid rise in referrals to the ProActive scheme around the age at which physical symptoms of disease are more likely to manifest, is likely to be a reflection of both increasing GP consultation rate (in men at least) and health professionals using ProActive for the treatment rather than prevention of lifestyle-related diseases. It would be unfair to claim that this represents misuse of a scheme originally intended for prevention because of the ambiguity regarding how one defines 'prevention' in this context. Nevertheless, sedentary younger people not yet exhibiting symptoms of lifestyle disease and who are less likely to visit primary care (especially in men), would benefit from physical activity referrals; yet this group appear to receive them less frequently. Declining ProActive referrals into old age could be a result of perceptions of the patient and health professional. Given that older people are likely to hold GPs in higher esteem than their younger counterparts, the latter is more likely. It would appear that there exists a relatively narrow window of age during which referral to the ProActive scheme is most likely (approx. 40-69 yrs). This effectively neglects a substantial proportion of the population, the implications of which are discussed in Section 13.3.3.

Finally, people living in more deprived areas are more likely to be physically inactive, experience ill-health and visit their GP more frequently. They might, therefore, have been expected to be referred more often than residents in more affluent areas. This was indeed the case in the ProActive scheme. From this it appears that for many residents of deprived areas the influence of the health professional overcame the potential social and physical environmental constraints associated with socio-economic disadvantage; the kinds of factors that would be expected to reduce the likelihood of consenting to a physical activity referral.

Once patients were outside of the GPs office and away from the influence of the health professional (or became fully aware of exactly what participation entailed), the constraints of their social and physical environment are more likely to have become the dominant influence (discussed in Section 12.3). However, at the point of referral, such influences appeared secondary to that of the health professional. Unfortunately, on the basis of the data from the present study, it is not possible to attribute with certainty, the relative contributions towards referral patterns of either the referring behaviour of the health professional or patient circumstances and environmental influences. However, in any case, the referring health professional is implicated, especially with regards to the age distribution. On the one hand, health professionals could be failing to refer an adequate number of younger people for preventive reasons and potentially not giving some older adults the opportunity to participate. Alternatively, patients might not be provided with sufficient information at the point of referral to make an informed decision; the result of which is that factors that could have been expected to cause them to refuse a referral instead resulted in their subsequent self-removal from the scheme. This latter point will become clearer in the following chapter, when differential progression of sociodemographic groups through the ProActive scheme is considered.

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Chapter 12

By focusing only on the differential opportunities of obtaining an initial referral in different population groups, the present chapter was concerned with the apparent intention of primary care patients who accepted a referral to ProActive from their health professional. This fundamentally important aspect of the referral process has not been examined in such detail previously and therefore presents new insight within PARS research; yet it is clear that there is much still to be explored, especially with regard to the role of the health professional (refer to Section 13.4.2). The following chapter considers how social and physical environmental factors could explain differential progression through the scheme and attendance of different population groups once referred to ProActive.

Chapter 12: Discussion for Research Question 2

12.1 Introduction

The second research question examined uptake and attendance of different population groups referred to ProActive, again defined by gender, age, and the socio-economic and urban-rural context in which they lived. This involved using four regression models as described in Section 9.4. Briefly, Model 1 explored participant characteristics associated with self-removal before being referred on to a leisure provider; i.e. who 'fell at the first hurdle' following the health professionals' referral. Model 2 explored participant characteristics associated with referral uptake, defined as attending the leisure provider at least once. Model 3 focused on the sub-sample of participants who were referred to leisure providers (by the Project Worker). Again this considered who took up referral/failed to attend (as in Model 2), but excluded from analyses those who removed themselves prior to the leisure provider referral (unlike Model 2). Finally, out of the sub-sample of participants who did take up referral, Model 4 examined participant characteristics in relation to the likelihood of completing physical activity programmes (≥80% sessions). Before findings from these four regression models are discussed in the context of current literature (Section 12.3), Section 12.2 provides a descriptive account of participants' progression through the ProActive scheme and where possible, compares with existing PARS data.

12.2 ProActive *vs.* other PARS: a descriptive comparison

12.2.1 Self-removal *vs.* leisure provider referral: who "falls at the first hurdle"?

There is a point following the initial referral to PARS at which a substantial proportion of potential participants are lost. In the present study, over five hundred ProActive participants who resided in Somerset (548 out of 2864, 19.1% included in analysis) were removed from the scheme by the Project Worker, of which almost four hundred (384 out of 2864, 13.4%) removed themselves for non-medical reasons ('No Contact' or 'psychosocial' removals[37]) and 166 (5.7%) for 'medical' reasons (Figure 10.5).

[37] Definitions of 'progression categories' are given in Section 9.1, Table 9.1

Table 12.1 Rates of progression through the ProActive scheme (overall and by gender)

Progression category	n	% of total sample	% of n in LGR *	Men		Women	
				n	% within gender	n	% within gender
Referred to LP (M1)	2480	86.6	86.6	933	85.4	1547	87.4
Referral uptake (M2)	1861	65.0	65.0	716	65.5	1145	64.7
Attended LP (M3)	1861	65.0	75.0	716	76.7	1145	74.0
Completed (M4)	892	31.1	47.9	370	51.7	522	45.6

LGR, logistic regression; M1-M4, regression Models 1-4
Note: total sample=2864. *Model 1, n=2864; *Model 2, n=2864; *Model 3, n=2480; *Model 4, n=1861

As illustrated in Table 12.1, within the male and female subgroups, proportions of ProActive participants who were referred to a leisure provider (by the Project Worker) were approximately equal, being only slightly higher in women than men (87.4 *vs.* 85.4%).

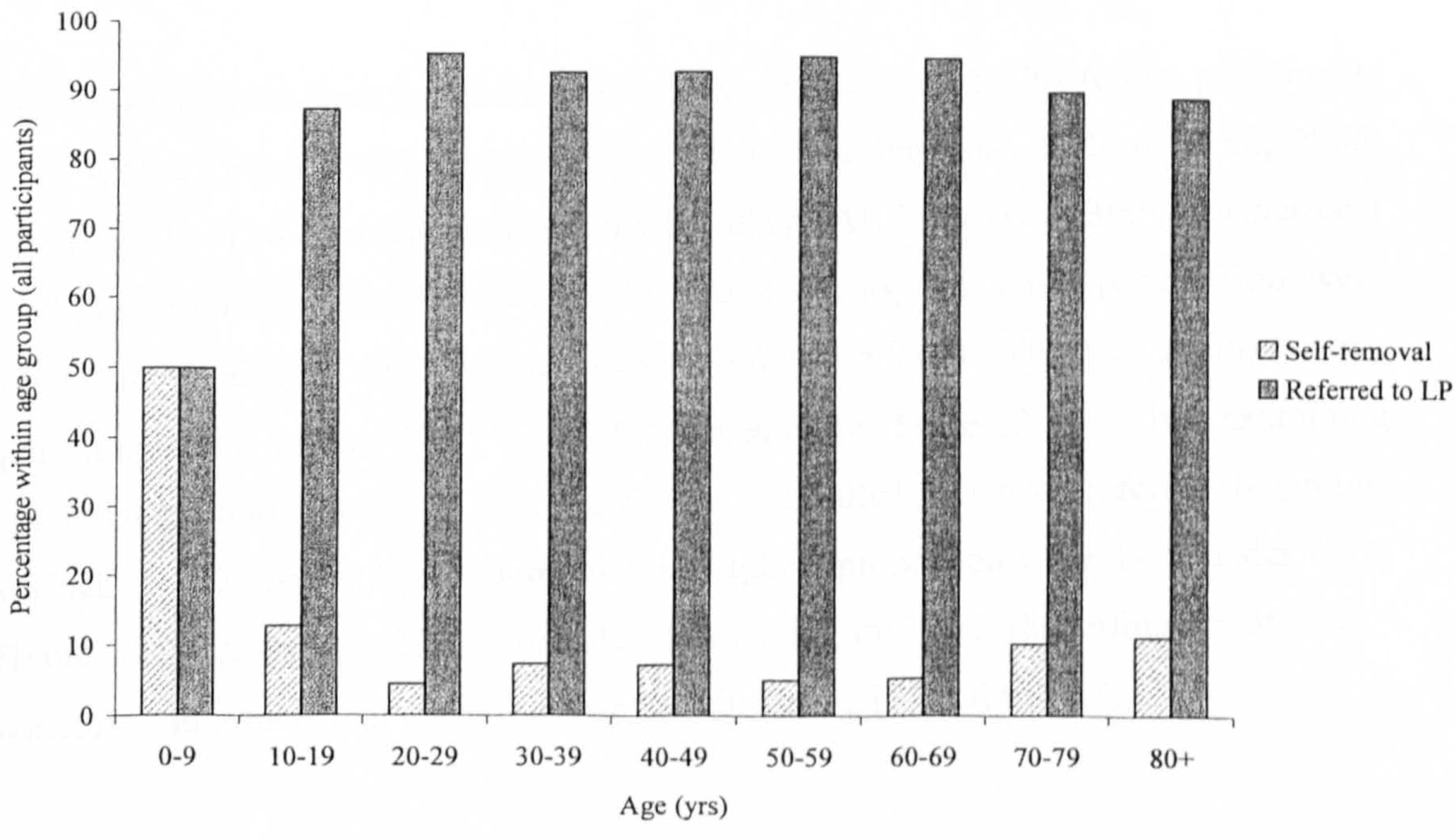

Figure 12.1 Within-age group relative proportions of ProActive participants who removed themselves or received a referral onto a leisure provider

The age groups in which self-removal at this early stage were most prominent were the under-twenties and the over-seventies (Figure 12.1; Appendix 29). Unfortunately, a fundamental weakness of the most PARS has been failure to put in place systems to keep a record of this group who have subsequently been neglected in previous research with few exceptions (Harrison et al., 2005a; Johnston et al., 2005). As a result, comparisons with existing data were limited.

Similar to the present study, Harrison et al (2005a) conducted applied research using data routinely collected by an existing PARS. However, the primary outcome was participant attendance at their first meeting with an exercise professional. Because this equates to uptake of referral in the present study, the author's findings are considered subsequently (Section 12.2.2 and 12.3.2). The only published study of applied research to report characteristics of this group also used data from the ProActive scheme (Johnston et al., 2005). Similar descriptive post-hoc analyses as used in this earlier study were, therefore, conducted to further explore socio-demographic differences in the reasons for participant removal at the first stage. These are described in Section 12.3.1.

12.2.2 Self-removal *vs*. uptake of referral

Attendance at initial consultation or the first exercise session by ProActive participants fits in with a broadly accepted definition of referral 'uptake' (Gidlow et al., 2005: Section 5.5.3). This enabled comparison with other PARS research. Sixty-five *per* cent of all Somerset residents referred to ProActive during the study period who were included in the analysis (n=1782 out of 2864) took up referral. This was approximately equal in men and women (65.5 *vs*. 64.7% respectively; Table 12.1). When examining the relative proportions of different age groups who failed to take up referral, the groups in which 'failed-to-attend' accounted for the highest proportion were those under thirty (Figure 12.2; Appendix 29). Possible reasons for this and the influence of socio-economic and urban-rural context are further discussed in Section 12.3.2.

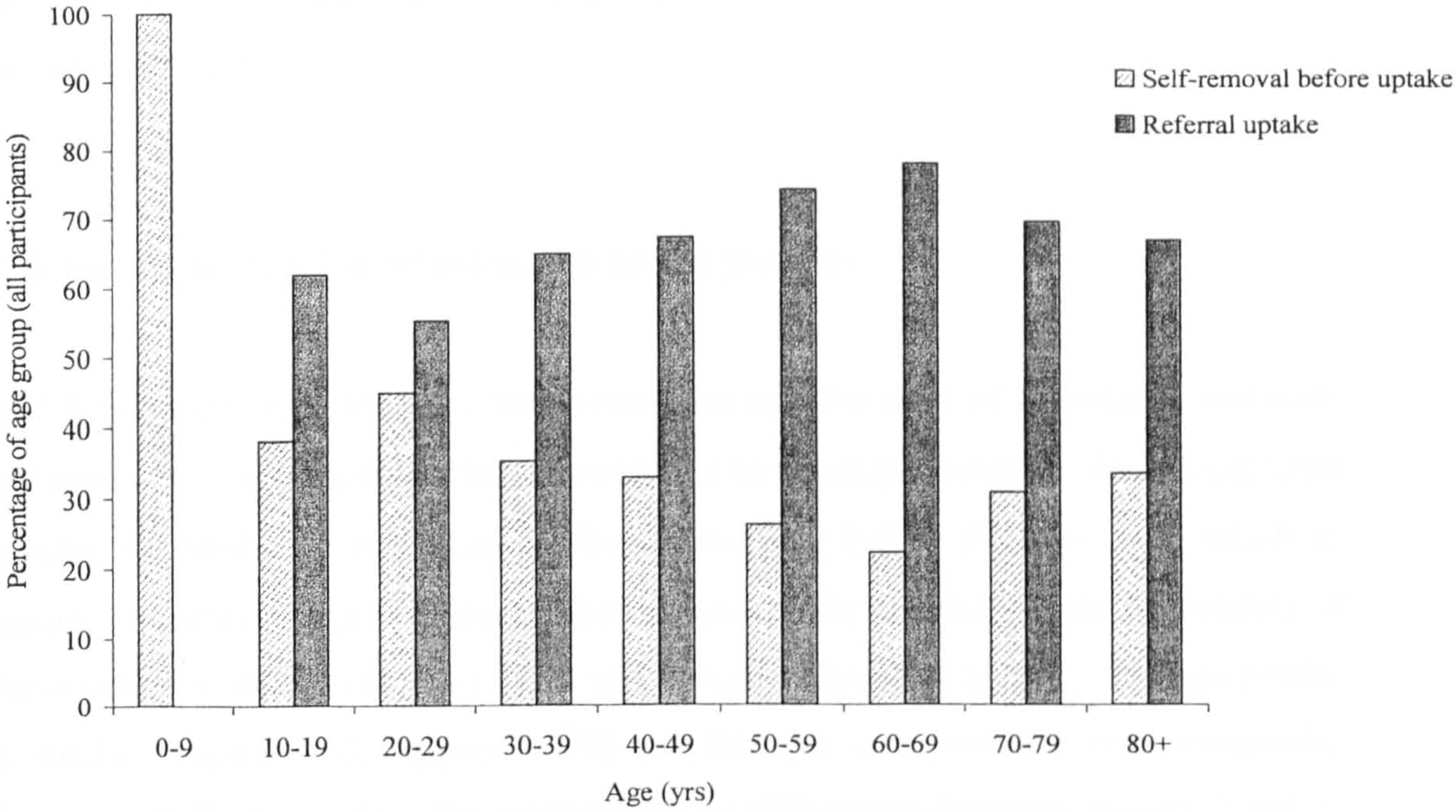

Figure 12.2 Within-age group relative proportions of ProActive participants who removed themselves or took up referral at a leisure provider

The overall rate of uptake in the present study compares favourably with most previous evaluations of British PARS and related RCTs,[38] which ranged from thirty-five to seventy-nine *per* cent (Section 5.5.3; Table 5.2). As described in Section 5.5.3, on the surface it appeared that rates of uptake in PARS-based RCTs were high. However, when calculated as the proportion of the people who responded to initial invitations to participate, which would be equivalent to primary care patients consenting to a ProActive referral, rates of uptake were less encouraging: forty-nine *per* cent (Taylor et al., 1998) and forty-one *per* cent (Harland et al., 1999).

Similarly low uptake was reported in the evaluation of a PARS in the Northwest of England (43% Dugdill and Graham, 2004). An earlier evaluation reported higher uptake, similar to ProActive, despite being located in a particularly deprived area (60% Lord and Green, 1995). However, high uptake might have been attributable to most participants being volunteers for health checks offered to local residents aged thirty-five and over; i.e. participants were already motivated by health and approaching middle-age. Such response bias was discussed as a limitation of RCTs (Section 4.3.3). Indeed, this recruitment method could also explain the higher rate of uptake in women the

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[38] Distinction between evaluations versus RCTs or experimental PARS studies was made in Section 5.5.1

authors reported in women (69% *vs*. 51%) who tend use preventive health services more than men (Section 6.5.3).

12.2.3 Failure-to-attend *vs*. attendance at leisure provider

Model 3 was similar to Model 2 but focused on relative rates of attendance and non-attendance within participants who were referred to a leisure provider. As this outcome is similar for Model 2, there was no further existing PARS literature with which to compare. In terms of age and gender, they did not differ markedly from the patterns of referral uptake within the whole sample just described (Section 12.2.2). The age profile was similar (Figure 12.3; Appendix 29) and the rate of attendance now marginally higher in men (Table 12.1). The implications of differences between Models 2 and 3, and different socio-demographic influences highlighted in regression analyses are considered in Section 12.3.3.

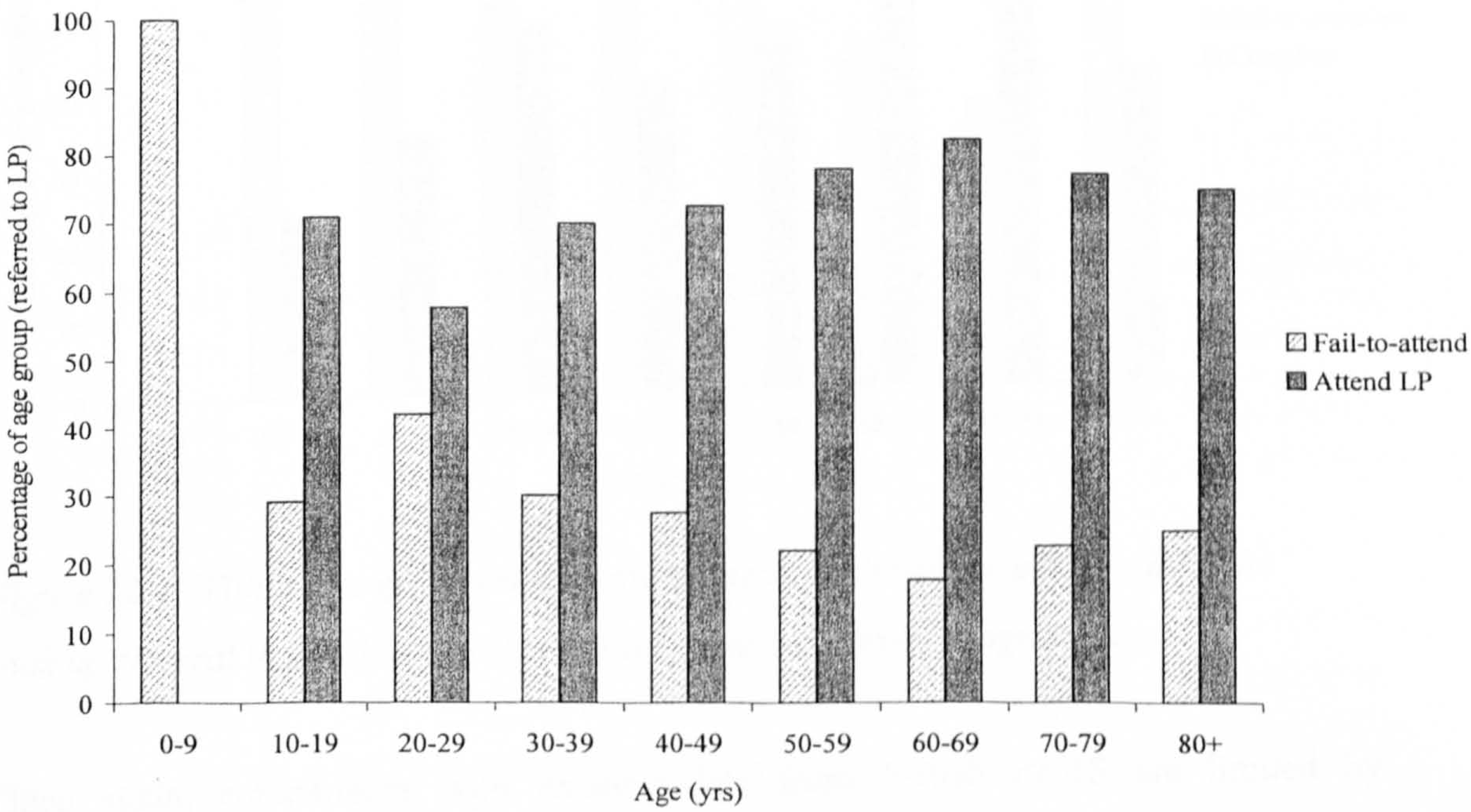

Figure 12.3 Within-age group relative proportions of ProActive participants who failed-to- or attended leisure provider (following referral to the provider)

12.2.4 Failure-to-complete *vs.* completion

Out of participants who attended leisure providers at least once, almost one-third (892 out of 2864, 31.1%; Table 12.1) were classified as 'Completers' (≥80% attendance). The use of the eighty *per* cent completion criterion is discussed in Section 13.4.1. As a proportion of all those who took up referral, almost half completed their programme (892 out of 1861, 47.9%). Completion rate was higher in men than women (51.7 *vs.* 45.6%; Table 12.1). Within age-group proportions of 'Completers' generally increased with age but were highest in the sixty-to-seventy-nine year age group, accounting for more than half of these participants (Figure 12.4; Appendix 29).

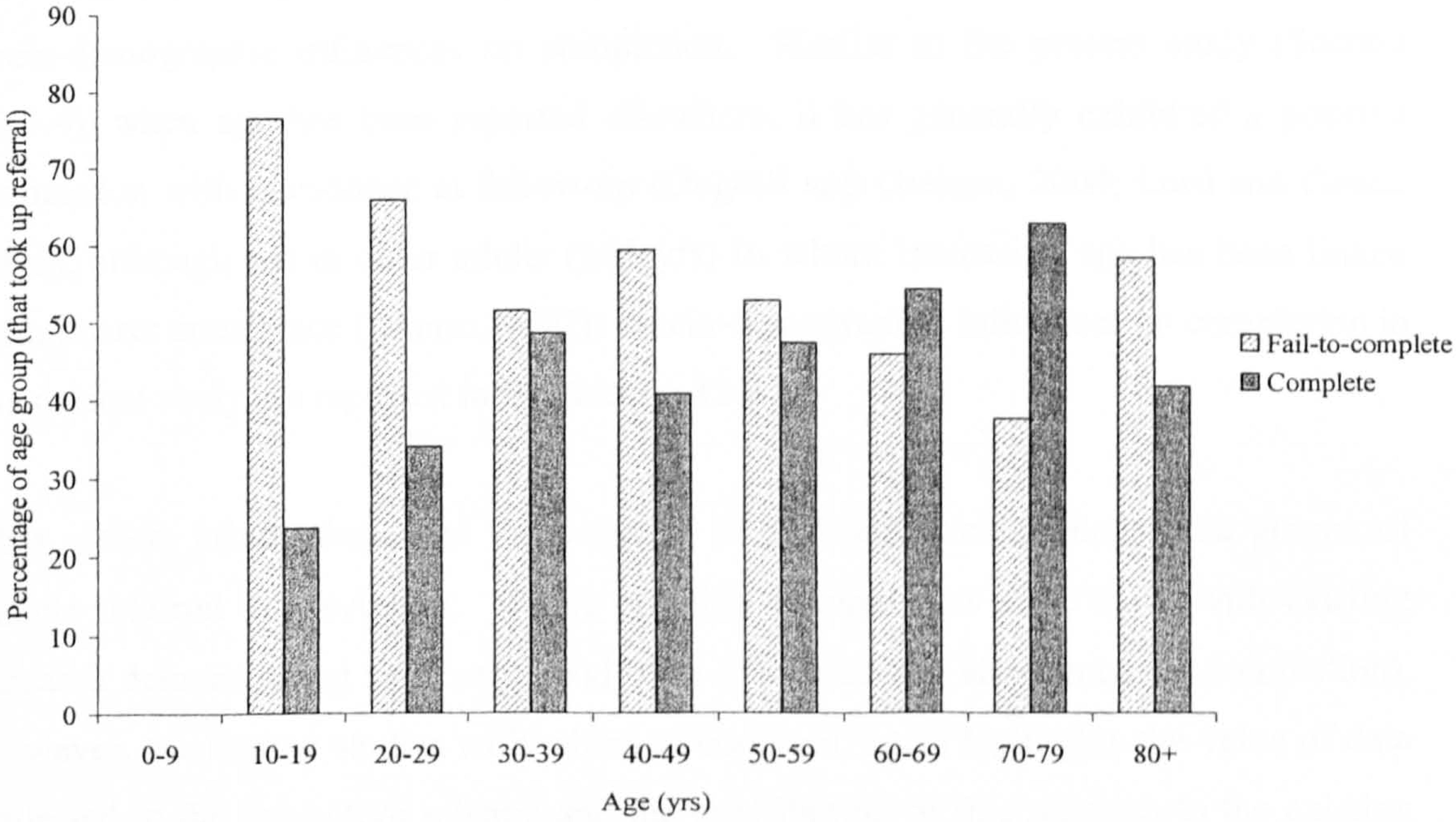

Figure 12.4 Within-age group relative proportions of ProActive participants who took up referral that failed-to or completed physical activity programmes

Once again, comparisons with existing data from British PARS are limited by differences in measurement of attendance. Only the RCT by Taylor et al (1998) defined success on the basis of sessions attended but employed a slightly less stringent attendance criterion (75%). As discussed in Section 5.5.3, most evaluations of existing PARS (rather than experimental studies) defined *completion* or successful *attendance* as attendance at the final assessment, thus failing to adequately consider attendance level (Dugdill and Graham, 2004; Hammond et al., 1997; Jackson et al., 1998; Lord and Green, 1995). Rates of attendance at follow up reported in these studies were 18.4%

(Lord and Green, 1995), 20.4% and 56% (Hammond et al., 1997), 12% (Martin and Woolf-May, 1999) and 42% (Dugdill and Graham, 2004). Taylor et al (1998) reported that twenty-eight *per* cent of participants successfully attended at least three-quarters of sessions, although as a proportion of the total number of respondents to initial invitations, this equates to just sixteen *per* cent. Therefore, the completion rate in the present study (31.1%) compares favourably, especially considering the relative stringency of the completion criterion (discussed in Section 13.4.1).

As detailed previously (Section 5.5.3), there were few consistently reported age or gender differences associated with successful attendance in previous studies. Some reported higher completion in women (Lord and Green, 1995); others, in men (Dugdill and Graham, 2004); whereas Taylor et al (1998) found no evidence of any significant socio-demographic influences on completion. Similar to the present study (Section 12.3.4), when age has been reported elsewhere, it has generally exhibited a positive association with attendance at follow-up (Dugdill and Graham, 2004; Lord and Green, 1995); although not in older adults (≥65 yrs) in whom increasing age has been linked with poorer attendance (Munro, 1997). Socio-demographic influences on completion in the present study are reported in the Section 12.3.4.

This section briefly described the progress of different socio-demographic groups of people referred to ProActive. Where possible, comparisons were made with existing research demonstrating relatively good rates of uptake and attendance (or completion). However, the limited studies with which to compare, again highlights the value of data collected in the ProActive scheme and the contribution of this research to the existing body of knowledge. Furthermore, it emphasises the importance of continuing and improving PARS data collection processes in order to learn more about those who remove themselves from schemes. The following section discusses findings from regression Models 1-4 to determine likely explanations behind differential progress of socio-demographic groups through the ProActive scheme.

12.3 Results from logistic regression

12.3.1 Model 1: self-removal *vs.* referral to leisure provider

The findings from Model 1 indicate that once the direct influence of the referring health professional was no longer present, participants residing in more deprived or rural areas were significantly more likely to remove themselves from the ProActive scheme. Indeed, supporting regression analysis confirmed the rural effect (Table 10.8). The negative influence that rural residency had on progression through the scheme was strongest in the most remote rural areas ('hamlets and isolated dwellings'; p=0.018). It remained significant for residents of 'villages' (p=0.031), but was no longer significant at the ninety-five *per* cent confidence level in the less remote 'small town and fringe' areas (p=0.099). There was no evidence of a gender effect from Model 1, as indicated by the similar proportions of men and women referred to leisure providers by the ProActive Project Worker (Table 12.1). The presence of an age effect could not be tested because of missing age data in the 'No Contact' group (Section 10.2.3).

As discussed in the previous chapter (Section 11.3), those referred to ProActive tended to live in areas of above average deprivation for Somerset. Although explicable through differential GP consultation rates and the influence of the health professional, this conflicted with generally lower physical activity participation (Hillsdon et al., 2005) and lower participation in physical activity research of lower socio-economic groups. The results of Model 1 were, therefore, more in keeping with expectations. Consequently, themes that emerged from the literature in earlier chapters were used to elucidate possible explanations to understand outcomes from Model 1; i.e. why, following the initial referral and once the direct influence of the health professional was no longer present, people living in increasingly deprived or rural areas were more likely to remove themselves from the ProActive scheme.[39]

[39] As a result of the common patterns in both Models 1 and 2, some of the themes discussed in relation to findings from Model 1 are pertinent to Models 2 and 3. These are discussed in detail here but will only be referred to in subsequent sections (12.3.2 and 12.3.3).

Social influences of the socio-economic environment

As discussed in Section 2.4.1, a socio-economically disadvantaged environment confers an independent health risk. For example, individuals in lower socio-economic groups who move into a middle-class area tend to adopt similar behaviours, efficacy and share the health advantages of other residents in the area. Physical activity levels tend to be lower in deprived areas (Section 3.4.2). Therefore, residents are not only less likely to be active themselves but also less likely to frequently observe such exercise behaviour within their environment (e.g. by family and peers). These kinds of social influence associated with disadvantage that were discussed in Section 3.4.3 (and referred to in Section 11.3), have several potentially important consequences that could have contributed towards the present findings. First of all, through social modelling of physical inactivity, participation in a PARS would be more likely to conflict with accepted behavioural norms in deprived areas, thus reducing the likelihood. Secondly, this could also have adverse consequences for social support. Some participants, especially women (Section 3.4.3), would be more likely to pursue a ProActive referral if they perceived that they would be supported. Evidence of lower social support for physical activity in lower socio-economic groups could be extended to participation in ProActive, such that residents of deprived areas were more likely to be inhibited by a lack of support, even be actively discouraged. Thirdly, as suggested above, the behaviour and attitudes of others within more disadvantaged environments are important in shaping individuals' attitudes towards health and health-related behaviour, often resulting in more fatalistic outlooks. This could also have contributed towards the early self-removal of more deprived residents.

Additional barriers to physical activity associated with adverse socio-economic circumstances include reduced level of self-efficacy and the increased likelihood of stress as a barrier to participation (Section 2.5 and 3.4.3). A major source of self-efficacy is previous personal experience as well as vicarious experience from observing exercise in others (Bandura, 1986). By definition, sedentary or relatively inactive individuals who require a physical activity referral lack the confidence or ability to undertake physical activity of their own accord (assuming participants are appropriately referred). Those living in deprived areas are more likely to lack both personal and vicarious experience of exercise, further reducing self-efficacy and again, increasing the likelihood of self-removal. Finally, ill-health can act as both a barrier and a motivator for physical activity (Section 3.3.4). Generally poorer health associated with disadvantage increases the likelihood of both; yet considering the themes just described, ill-health would be more likely to act as a deterrent in lower socio-economic groups. Moreover, stress is one health-related factor that has emerged as a physical activity barrier (Section 3.4.3). Through the combination of a demanding daily life with relatively low rewards (financial or emotional), socio-economic disadvantage has been linked with a chronic stress response in lower socio-economic groups. Therefore, residents of deprived areas are not only more likely to experience ill-health as a result, but even if they consult their GP and obtain a ProActive referral, this stress represents another possible barrier to participation experienced disproportionately by this group.

Real and perceived access barriers

The influence of the physical environment is another important consideration in the present study for several reasons: Somerset is a largely rural county; approximately half of the resident population live in rural areas (Section 10.1.2); residents of rural areas tend to experience poorer access to services, including leisure facilities (Section 3.5.2); most recognised ProActive leisure providers were located in urban centres (Section 8.2.3). These factors could create *real* barriers to participation in terms of physical accessibility providing a likely explanation for rural dwellers being more likely to remove themselves from the scheme at the earliest opportunity.

Such barriers could also have contributed to higher self-removal by residents of deprived areas. As discussed in Section 3.4.3, there is some evidence that people in less affluent neighbourhoods have significantly fewer physical activity facilities (Estabrooks et al., 2003; Sallis et al., 1990). However, there is also evidence that socio-economic disadvantage can have a negative impact on perceived access to facilities, which could explain why the independent area effects were observed for rural and deprived areas of residence. Greater perceived barriers to physical activity participation have been reported in lower socio-economic groups, in terms of financial constraints and inconvenient access to leisure facilities (Section 3.4.3). A group of American researchers found that sedentary or insufficiently active respondents tended to have less accurate perceptions of access to public recreational facilities (Kirtland, Porter, Addy et al., 2003). As all participants referred to the ProActive scheme should have been sedentary or relatively inactive, this would suggest a greater propensity to distorted perceptions of leisure provider accessibility. Moreover, the authors posited that cultural, behavioural and psychological factors could explain the lack of agreement between perception and objective measures. Given that all of these types of factor are inter-related and can be adversely affected by socio-economic disadvantage, it might be expected that such distortion would be exacerbated in those from more deprived areas.

Indeed, others have found that perceived access is poorer in more disadvantaged environments (Sallis et al., 1997) and that use of recreational facilities in less affluent areas can be lower despite better objectively measured geographical access in some cases (Giles-Corti and Donovan, 2002b). Sallis et al (1997) even went as far as to conclude that the socio-economic nature of the area could account for most of the association between physical activity and environmental characteristics (Section 3.4.3). Despite some limitations in terms of the comparisons that can be made between these and the present study, there is a reasonable conceptual argument to suggest that ProActive participants in deprived areas would feel more constrained by access to leisure providers regardless of actual proximity.

In summary, residents of both deprived and rural areas were more likely to perceive or experience (respectively) access barriers to attending leisure providers, which could have contributed towards their early self-removal from ProActive. It could be argued that such barriers would prevent participants from accepting the initial referral. However, there are two reasons why this might not have occurred. Firstly, as discussed in relation to Research Question 1 (Section 11.4.2), it is quite plausible that the influence of these and other barriers to participation was secondary to that of the referring health professional, whom participants might be reluctant to challenge. Secondly, from personal experience as the ProActive Project Worker (Section 13.5.4), the researcher became aware that participants were not always fully informed of the cost of participation, or restrictions on which leisure providers were available through Proactive. Findings from Model 1, therefore, add further support to the earlier notion that the role of health professionals is of primary importance; either in providing sufficient information for such barriers to manifest prior to participants giving consent, or attempting to reduce barriers at the point of referral. This certainly emerges as an area worthy of further attention (Section 13.4.2).

The remainder of this section reports on some post-hoc descriptive analyses involving reasons for participant removal by the ProActive Project Worker prior to them being referred to a leisure provider. The aim of this was to explore any differences in the reasons for different population groups failing to progress past this first stage, to see whether they provide support for the suppositions described so far in relation to the findings from Model 1.

Reasons for removal: post-hoc descriptive analysis

Participants removed from the ProActive scheme at this stage were broadly grouped by 'reason for removal' using similar (but not identical) categories[40] as used in the aforementioned study by Johnston et al (2005).

Table 12.2 Reason for removal from scheme by gender

Reason for removal	Men		Women		Total	
	n	%	n	%	n	%
Psychosocial (total)	**79**	**31.98**	**110**	**36.54**	**189**	**34.49**
Family and time-related	26	10.53	26	8.64	52	9.49
Practical	28	11.34	40	13.29	68	12.40
Already active	14	5.67	31	10.30	45	8.20
Other (mostly 'not interested')	11	4.45	13	4.32	24	4.38
No Contact	**81**	**32.79**	**114**	**37.87**	**195**	**35.58**
Medical	**87**	**35.22**	**77**	**25.58**	**164**	**29.93**
Total	**247**		**301**		**548**	

Note: Medical removals n=164 not 166 (as in Figure 10. 5): 2 participants were removed as non-Somerset residents

Tables 12.2-12.5 present data for participants categorised by gender, age, median deprivation score and urban-rural residency, respectively (Appendices 30-33 present statistical output). Missing age data substantially reduced the number of participants included when age was considered (Table 12.2). Similar to the findings of Johnston et al (2005), a higher proportion of women than men removed themselves, as psychosocial removals (36.5 *vs.* 32.0%) or 'No Contacts' (37.9 *vs.* 32.8%). Correspondingly, the opposite was true for women and men whose removal for 'medical' reasons was beyond their control (25.6 *vs.* 35.2%). This could be a reflection of the aforementioned male reluctance to seek primary care consultation prior to the onset of symptoms perceived as

[40] 'Other' includes not interested/other; Practical reasons include transport/cost/venue location; Family and time-related include family commitments/carer commitments/inconvenient times/bereavement; for definitions of 'Medical' and 'No Contact' refer to Section 9.1

serious enough (Section 6.3.1), resulting in more men being contraindicated for exercise. Aside from this, there were few gender differences. The most marked was the higher proportion of women who reported being 'already active' as the reason for removal which was approximately twice that in men (10.3 *vs.* 5.7%). Nevertheless, the small numbers and relatively large proportion of removals for whom the reason was unknown (No Contacts), restrict the generalisations that can be made.

Table 12.3 Reason for removal from scheme by age group

Reason for removal	<49 yrs		≥50 yrs		Total	
	n=	%	n=	%	n=	%
Psychosocial	**73**	**66.36**	**81**	**51.92**	**154**	**57.89**
Family and time-related	20	18.18	18	11.54	38	14.29
Practical	29	26.36	35	22.44	64	24.10
Already active	15	13.64	23	14.74	38	14.30
Other (mostly 'not interested')	9	8.18	5	3.21	14	5.26
No Contact	**9**	**8.18**	**3**	**1.92**	**12**	**4.5**
Medical	**28**	**25.45**	**72**	**46.15**	**100**	**37.59**
Total	**110**		**156**		**266**	

Note: *266 not 548 because of missing age data

Fifty years was chosen as the cut-point by which to define younger and older age groups for two reasons. Firstly, numbers were insufficient to further divide the subsample by age. Secondly, out of all the age groups, self-removal at this stage was least prominent in those aged fifty to sixty-nine years (Figure 12.1). As might have been expected given age-related health deterioration (Section 2.2.1), the proportion of over-fifties removed by the Project Worker for medical reasons was higher than in the younger age group (25.5 *vs.* 46.2%). Accordingly, a higher proportion of the younger age group removed themselves for psychosocial reasons (66.4 *vs.* 51.9%). However, despite a marked difference in the same direction, for the proportions of 'No Contacts', age data were missing for most of this group (177 out of 195), again limiting how much it was possible to learn about this group. Nevertheless, in keeping with aforementioned age patterns in physical activity barriers (Section 3.3.4), those relating to family commitments and other time constraints were more common in the younger age-group (18.9 *vs.* 11.5%), which will be referred to subsequently (Section 12.3.1).

Median Townsend deprivation scores were calculated for each group of removals (Table 12.4). As a result of the small number of participants within each category and relatively large variance in deprivation scores (indicated by Interquartile range) meaningful statistical comparisons were not possible. Differences between median deprivation scores were generally small. There were trends towards higher deprivation in those who ignored the Project Worker's attempts to contact them ('No Contacts' 0.69) compared with 'medical removals' (-0.17) and 'psychosocial removals' (-0.38). The group who removed themselves for 'other' reasons (most commonly a lack of interest) had the highest median deprivation scores (2.32) compared with the 'already active' (-1.71) or those restricted by family and other time constraints (-1.07).

Table 12.4 Median Townsend deprivation score by reason for removal from scheme

Reason for removal	n=	Townsend score	
		Median	Interquartile Range
Psychosocial	**189**	**-0.38**	**3.94**
Family and time-related	52	-1.07	3.13
Practical	68	0.38	3.78
Already active	45	-1.71	4.07
Other (mostly 'not interested')	24	1.45	5.49
No Contact	**195**	**0.69**	**5.00**
Medical	**164**	**-0.17**	**4.74**
Total	**548**	**0.14**	**4.44**

From the results of Model 1, it was posited that factors such as finance and access to facilities (real and perceived) could explain why residents of deprived and rural areas were more likely to remove themselves from the scheme prior to attaining a referral to the leisure provider. However, the group specifically citing such 'practical' barriers was relatively small (finance n=40; transport n=18; venue location n=10). The median deprivation score in this group was higher than the average for all psychosocial removals (0.38 *vs*. -0.38), although the small numbers and high variance are again a limitation. Nevertheless, it is possible that such factors were responsible for the lack of response in some of the 'No Contact' group. In the absence of more information on this group, however, this remains speculation (Section 13.4.2 discusses this as an area for future research).

When the reasons for removal given by urban and rural dwellers were compared, similar proportions cited 'practical' reasons (12.3 *vs*. 12.5). This does not support the notion that physical accessibility was instrumental in the early exit of rural dwellers. Indeed, the only notable differences between urban and rural residents were that in urban areas, there was a higher proportion of 'No Contacts' (41.5 *vs*. 31.5%), a lower proportion of 'already active' participants (4.7 *vs*. 11.2), and a generally lower number of people removed at this stage in the scheme (295 *vs*. 254). The latter supports the negative influence of rural residents on progression as this first stage within the ProActive scheme.

Table 12.5 Reason for removal from scheme by urban-rural residence

Reason for removal	Urban		Rural		Total	
	n=	%	n=	%	n=	%
Psychosocial	**75**	**29.64**	**114**	**38.64**	**189**	**34.49**
Family and time-related	18	7.11	34	11.53	52	9.49
Practical	31	12.25	37	12.54	68	12.41
Already active	12	4.74	33	11.19	45	8.21
Other (mostly 'not interested')	14	5.53	10	3.39	24	4.40
No Contact	**105**	**41.50**	**90**	**30.51**	**195**	**35.58**
Medical	**73**	**28.85**	**91**	**30.85**	**164**	**29.93**
Total	**253**	**46.17**	**295**	**53.83**	**548**	

The relatively small numbers and lack of information on those uncontactable self-removals greatly restrict what we can be learnt from these data. Nevertheless, some of the trends described will be referred to in subsequent sections in relation to further progression through the scheme. At the very least, this subsection has highlighted the need to gain further information on the 'No Contact' group who comprise a substantial proportion of participants lost early on from PARS and about whom we know the least.

Summary

Overall, deprived and remote rural environments apparently present too many barriers to participation for some people referred to ProActive. Deprivation and rurality by no means explained all of the variance in the likelihood of self-removal. Although other factors were clearly at work, this should not necessarily be interpreted as an indication that socio-economic and urban-rural context are relatively unimportant. Just as important individual risk factors often only explain a small proportion of the total variation in health (Stafford, Cummins, Macintyre et al., 2005), other physical activity studies have found that while proximity and perceived accessibility are important contributors, they alone could not explain facility use (Corti, Donovan and Holman, 1996; Sallis et al., 1990). In the present study, ProActive participants were typically inactive adults, often with health problem(s), many of whom were in middle-to-old age and could have been sedentary for many years. It is, therefore, possible that there was further variation at the level of the individual. Indeed, findings from a current parallel evaluation of ProActive have since indicated that the reason for referral could be a important in relation to early self-removal and uptake (Sidford, 2006).

12.3.2 Model 2: self-removal *vs*. uptake of referral

Model 2 was used to explore the likelihood of different participant groups removing themselves prior to attendance at the leisure provider. The results indicated that being younger, living in more deprived and rural areas (villages in particular), were all independently associated with small but significant increases in the likelihood of failing to take up referral (Table 10.5). Again, there was no evidence of a gender effect.

Age

The positive relationship between age and attendance appears to reflect the low proportion of fifty-to-seventy year olds and high proportion of under-thirties who did not take up referral (Figure 12.2). This may be attributable to several factors that relate to themes highlighted previously (Section 2.2.1, 3.3.4 and 11.4.1). Time constraints as a barrier to participation are less likely to have been an issue for adults in late-middle-age onwards, compared with younger adults they should be less restricted by dependent offspring and possibly work. Indeed, semi-retired or retired participants should not only have more leisure time but also greater flexibility to attend ProActive sessions during the day, when most took place (Section 8.2.3). Differential motivation by health is another potential factor. Middle-age is a period in life associated with increased health awareness and related concern (Section 3.8.2). Because the perception of a serious threat to health can improve compliance with physical activity interventions, for example in cardiac rehabilitation programmes (Friedman, Williams and Levine, 1997), such concern could provide the necessary motivation for those approaching middle-age and beyond to take up referral. Conversely, younger and relatively healthy individuals are less likely to perceive an immediate threat to their health and might, therefore, be less motivated to take up a ProActive referral, particularly if they perceive PARS as not befitting a younger person (discussed further in relation to differential completion rates by age 12.3.4).

At some point, however, serious health issues can become a barrier rather than an incentive to participation, the likelihood of which increases with age (Section 3.4.3) and, which concurs with the slightly higher proportion of self-removals in the over-seventies. As discussed in Section 3.3.4, older people often define their health through what they are able to do. Therefore, inactive older adults who are likely to be less functionally able than those who have maintained active lifestyles are more likely to perceive health barriers to making a positive behaviour change.

Other barriers to physical activity in older adults that might have contributed towards the increasing proportion of the over-seventies age-group who removed themselves prior to uptake (Figure 12.2), include limitations in mobility and transport, lacking knowledge of how to get involved and access to places to be active. As described in relation to low activity (Section 3.3.4), exercise self-efficacy is more likely to be a problem for older age groups through personal inexperience of activity, the behaviour of peers (social norms), and possible perceptions that exercise is for younger people. Although PARS are designed to overcome such issues by providing a safe and supervised exercise environment, these kinds of social influences are likely to have had a detrimental effect on the efficacy of some older adults to undertake a ProActive referral.

In addition, because older adults normally receive prescriptions free of charge, the realisation that this did not apply to ProActive participation could have prompted removal. Those who removed themselves citing financial reasons, combined with the researcher's personal experience indicate that some individuals are not informed of the cost at the point of referral. This could also have been true in Model 1 (refer to Figure 12.1) but missing age data on a large proportion of self-removals prevented the inclusion of age in the regression model.

With these factors in mind, self-removals at this stage might be reduced if the health professional were able to convey the nature of the exercise interventions in sufficient detail, possibly giving patients adequate opportunity to decline the referral. The actions of the health professional at the point of referral once again emerge as a potentially important determinant; this might be especially important in older people who tend to hold GPs in high esteem therefore greater intervention at the point of referral might have a more lasting effect to promote uptake of referral and attendance, rather than dropout following referral.

Area deprivation

Increasing area deprivation was negatively associated with uptake of ProActive referrals. The only study with which findings can be directly compared reported no such relationship (Harrison et al., 2005a). However, this could be attributed to a number of methodological differences, which provide reason to believe the effect observed in the present study was genuine. First, to measure deprivation, Harrison et al (2005a) used the Index of Multiple Deprivation 2000 (DETR, 2000: Section 7.7.2). The IMD was a composite score that attempted to capture all aspects of deprivation including relative access to services and differences in health. Consequently, it comprised more than thirty indicators of social and material deprivation. As described in Section 7.7.1, this approach can create conceptual confusion regarding exactly what the index represents. Moreover, the IMD was subsequently replaced by the IMD 2004 (ODPM, 2004: Appendix 8).

The Townsend score (Townsend et al., 1988: Section 7.7.1), which was the primary socio-economic variable in the present study, is not without its critics. It is, however, conceptually robust. It was designed to be, and is widely considered to be, a good measure of relative material disadvantage (Section 7.7.2). Using evidence of the social implications of material disadvantage (Section 2.4.3) the Townsend score can still be used to consider both material and social consequences of relative disadvantage (as in the present study) but importantly, this is achieved without compromising the validity of socio-economic measurement. Moreover, the Townsend Score has been widely used in health research and epidemiology, and has fared well when compared with the IMD (Hoare, 2003; Jordan et al., 2004b).

Nevertheless, in recognition that ProActive is a 'real life' working scheme and that certain bodies (e.g. Health and Local Authorities) often favour the most recent IMD (HSNAG, 2004; Martin et al., 2000), supporting analyses were conducted using the revised IMD 2004 in place of the Townsend score. The overall effects for age, rurality and deprivation on referral uptake were again evident and importantly, this ensured that findings from the present study were accessible to the broadest possible audience, in both academia and in practice.

A second fundamental difference between the present study and that of Harrison et al (2005a) was in the level or scale of the area data. As described in Section 7.4.2, the present study used Output Areas with typical population sizes of approximately three hundred residents (or 125 households). Harrison et al (2005a) analysed ward-level data. Because wards are much larger than Output Areas, data are typically aggregated from information on between five and six thousand residents. Working at this level is less sensitive; it reduces the ability to detect more subtle area variation, thus increasing the likelihood of Type 2 statistical error; i.e. failing to detect an effect when one is really present (Hinton, 1995). The IMD 2004 data used for supporting analyses in the present study were available at Super Output Area level only (typically comprising 1500 residents). The census variables used in calculation of the Townsend score (Section 7.7.2) were available at Output Area level, which further justifies the approach taken in the present study. Moreover, unlike wards, both Output Areas and Super Output Areas correspond with postcode boundaries and were designed to maximise population homogeneity. Therefore, misclassification should have been minimised in the present study.

Thirdly, the logistic regression models in the present study focused on socio-demographic influences, with particular emphasis on the socio-economic environment. The primary objective of this was to enable inference regarding social and physical environmental influences on progression through the ProActive scheme, including referral uptake. Indeed, socio-economic measurement was researched in detail (Chapter 7) to ensure that this was undertaken rigorously. In contrast, Harrison et al (2005a) included age, gender and deprivation as confounding variables, instead focusing on the influence of participants' reasons for referral (e.g. cardiovascular disease; overweight; mental health). It is possible that their lack of an association between area deprivation and uptake of referral was attributable in part, to clustering of diseases in deprived areas. Historically, and in developing countries, infectious disease and disease resulting from an inadequate standard of living (e.g. poor shelter; nutrition) cluster in lower socio-economic groups. In developed countries, however, lifestyle-related diseases represent the more important public health issue (Booth et al., 2000a). Although lifestyle diseases are more prevalent in disadvantaged sections of the population

(Section 2.4.1), they pose the most serious threat to health across the social strata. With this in mind, it seems more plausible that a deprivation effect was masked as a result of ward-level analyses in the study by Harrison et al (2005a), rather than certain diseases clustering in deprived areas. Indeed, the area deprivation effect observed in the present study was in the same direction and of similar magnitude in Models 1-3, and was evident in supporting analyses, including regression using the IMD 2004 (Section 10.2.5). This consistency would imply that the effect was genuine.

Possible explanations for the socio-economic effect are common to those discussed in relation to Model 1 (Section 12.3.1) and will be referred to again in the discussion of Model 3 Section (12.3.3). They are, therefore, not repeated here.

Rural residency and uptake of referral

No previous PARS evaluations or RCTs have considered relative urbanicity or rurality of participant area of residence, which prevented comparisons with findings regarding uptake (or attendance) in the ProActive scheme. Location of previously evaluated PARS in predominantly urban areas provides some explanation for this omission (Dugdill and Graham, 2004; Harrison et al., 2005a; Lord and Green, 1995). However, as described in Section 12.3.1 it was important to consider the impact of rural residency on ProActive participants.

Rural residents were least likely to take up referral. Again, the most likely explanations relate to poor leisure provider access in rural areas (Section 12.3.1), despite post-hoc analysis failing to confirm this. In Model 2 there was, however, a slightly different outcome (compared with Model 1) in the supporting regression analysis that involved the settlement type variable (1 urban and 3 rural area-types; Table 10.8). The reduced likelihood of rural residents taking up referral remained significant overall. Yet when each settlement-type was looked at individually, the effect remained significant for residents of 'villages' only (p=0.001). The absence of a significant effect for those living in 'hamlets and isolated dwellings' (p=0.308) could be an indication that people in the *most* remote rural areas (i.e. hamlets and isolated dwellings), who were going to remove themselves from the scheme as a result, had already done so by this point.

Summary

Overall, socio-demographic patterns were roughly similar in Models 1 and 2 indicating that a deprived and rural environment, and being younger are associated with a reduced likelihood of progressing past the first and second 'hurdles' following referral to the ProActive scheme (referral to the leisure provider and uptake of referral, respectively).

12.3.3 Model 3: attendance *vs.* failing-to-attend

The third logistic regression model explored the likelihood of those participants who were referred to leisure providers, attending at least one exercise session. Analysis excluded individuals who removed themselves from the scheme immediately after being referred by the health professional or as a result of their conversation with the ProActive Project Worker.

In contrast to Models 1 and 2, urban-rural area of residence was not a significant influence. This further supports the notion that most participants for whom geographical access to leisure facilities was a barrier, removed themselves from the scheme once made fully aware of what participation entailed and of the location of recognised leisure providers.

Positive influences on the likelihood of attendance of both increasing age (especially late middle-to-retirement age: Figure 12.3) and residency in less deprived areas were again evident. Therefore, barriers faced disproportionately by younger adults (e.g. time constraints; less motivated by health), older adults (e.g. ill-health; fear of the unknown; low exercise self efficacy; social norms), and lower socio-economic groups (e.g. financial constraints; perceived facility access barriers; negative attitude towards physical activity) that were discussed in relation to Models 1 and 2 (Section 12.3.1 and 12.3.2), are again applicable.

Differences between analyses in Models 2 and 3 raise several points worth highlighting. Through a reluctance to admit financial constraints to both the health professional and the ProActive Project Worker, some residents of deprived areas may have progressed to this stage of the scheme despite financial barriers that ultimately resulted in their eventual self-removal. Alternatively, feelings of obligation and social desirability (discussed in relation to referring health professionals; Section 11.4.2) might have prompted acceptance of referrals to the leisure provider, in the absence of a genuine intention to participate. It seems possible that the only difference between this behaviour and that of a 'No Contact' was that participants were at home to receive the telephone call from the Project Worker and, therefore, were not given the option of initiating contact with the ProActive scheme. As a result of personal experience working on the scheme, this is quite plausible. When speaking with some participants, despite their agreement to participate, the nature of the response does little to instil belief in their intention to participate. The role of the CRM Project Worker was to help participants overcome perceived barriers and increase their 'readiness to change' to increase the likelihood of attendance. In reality, this is not always the case. The reasons why and implications, are considered in Section 13.5.4. Finally, the reality of what participation in the ProActive scheme entailed and the difficulties this presented might not have manifested in participant self-removal until this point. It is possible that various barriers to referral uptake in residents of deprived areas, younger people and the oldest age groups (Section 12.2 and 12.3) were operating, and that receiving contact from leisure providers to arrange the initial assessment provided the necessary catalyst for participants to opt out at this stage.

Summary

It appeared that rural residents (who would be most likely to remove themselves for geographical reasons) tended to do so either following the health professionals initial referral, or as a result of speaking with the ProActive Project Worker. Nevertheless, being in middle-to-retirement age and living in the least deprived areas were again positively associated with progression within the ProActive scheme; in this case, by increasing the likelihood of commencing a physical activity programme once referred to a leisure provider.

12.3.4 Model 4: failure-to-complete *vs.* completion

In order to determine which socio-demographic factors influenced the likelihood of successful completion of ProActive physical activity programmes, the fourth regression model used only data from participants who attended the leisure provider at least once. The results of the regression analysis indicated that age-gender characteristics, not socio-economic or urban-rural context, were the significant influences (Table 10.4). Men and older adults were most likely to complete exercise programmes.

As noted for the disappearance of the rural effect in Model 3, the absence of a socio-economic effect in Model 4 suggested that many residents from deprived areas, for whom participation presented too many barriers, had removed themselves from the scheme prior to attending. This said, the median Townsend scores of participants who failed-to-complete was higher than completers (-0.39 *vs.* -0.85; Appendix 34), suggesting a trend (non-significant) towards higher completion by residents of less deprived areas. The absence of a socio-economic effect concurs with the findings of Taylor et al (1998). However, the lack of clarity and detail regarding socio-economic measurement in the earlier RCT (Section 5.5.3) prevents meaningful comparison with findings from Model 4.

Self-removal prior to being referred to leisure providers (Model 1; Section 12.3.1) and prior to attendance (Models 2-3; Section 12.3.2-12.3.3) appeared to be influenced by factors related to both the social and physical environment of the participants (e.g. financial constraints; proximity of leisure providers; behaviour of peers) once removed from the direct influence of the health professional. However, socio-economic and urban-rural effects were not evident in Model 4. It is, therefore, possible that the continued attendance of participants who progressed far enough within the scheme to begin a physical activity programme was more susceptible to the influences of the leisure provider environment and less dependent on the environment of the participant. This is considered in relation to the observed age and gender effects.

Gender

There is a wealth of literature relating to the deep-rooted gendering of roles in society (Aitchison, 2003; Bartley et al., 1999; Crespi, 2004). A fundamental theme that emerges and one which is pertinent to the present discussion, is the potentially detrimental effect on physical activity participation, of the multiple social roles of women. As discussed in the Section 3.3.5, despite marked societal changes in recent years, women remain responsible for most domestic responsibilities as home-makers and child-carers, often in addition to full-time employment (Kar et al., 1999; Mackey Jones and McKenna, 2002). Women are also more likely to be carers for other family members (Maher and Green, 2000). The resultant conflict between competing time commitments, usually home and work life, means that women tend to prioritise others over themselves, with detrimental consequences for health (Section 2.2.3) and physical activity (Section 3.3.5). Indeed, this lack of self-prioritisation, thought to explain (at least in part) why women are less active than men could have resulted in women being less likely than men to allow themselves sufficient time for successful completion of a two or three-month physical activity programme, even if the initial motivation was high. Therefore, despite more women being referred to ProActive, the prospects for effecting sustained behaviour change in women, even for several weeks, were less positive than in men.

Another consequence of gendered roles is that women might not receive or perceive sufficient social support to complete the physical activity programme, either inside or outside of the exercise environment. This is particularly important as social support is a correlate of physical activity considered especially important in women (Section 3.3.5). An imbalance of social support in the home environment emerges from the literature, with women often acting as primary providers of support for the rest of the family (McMunn et al., 2006). Social support provided by women is thought to benefit men's health, yet women receive no such reciprocal benefit (Glynn, Christenfeld and Gerin, 1999). Within the exercise environment, once ProActive participants attended exercise sessions at leisure providers, the sharing of the experience might have generated feelings of support (Stevens, Bult, de Greef et al., 1999). This is especially likely if aided by a social environment in which participants feel comfortable because they conform to the social norm; i.e. with other ProActive participants of a similar age, who are also new to exercise and with possible health problems. This could promote continued attendance. By running exercise sessions specifically for ProActive participants, leisure providers make an attempt to do this. Nevertheless, even if women feel supported within the exercise environment, inadequate social support at home in addition to greater family responsibilities could both have contributed towards the reduced likelihood of them completing ProActive programmes.

Section 3.3.5 also described the greater importance of physical self-perception for physical activity in women, possibly as a result of greater societal emphasis on body appearance for women (Matlin, 1993). On the one hand women are more likely to be motivated into activity by factors relating to appearance. Yet by the same token, greater susceptibility to negative physical self-perception and the perceptions of others could have been detrimental to continued attendance by women in the ProActive scheme. Again, to some extent this is likely to depend on the leisure providers' exercise environment and again relates back to the notion of social norms. For example, an overweight middle-aged woman might be unlikely to continue with a physical activity programme unless exercising in the company of similar others (Hardcastle and Taylor, 2001). Again, provision of ProActive-specific sessions should reduce the likelihood of an exclusive exercise environment but this cannot be guaranteed and, therefore, remains a potential contributor to lower completion rates in women.

Finally, self-efficacy, also discussed previously (Section 3.3.5), provides another possible explanation for gender differences in programme completion despite similar propensity to take up referral. The main source of self-efficacy is past experience (Bandura, 1986), and its influence on physical activity behaviour tends to be stronger in men (Section 3.3.5). Therefore, out of those participants who began a ProActive programme, it would follow that resultant increases in confidence would promote completion in men more than women. Conversely, women are less likely to be similarly motivated to continue for this reason, in addition to being more deterred by the other factors described in this subsection.

In summary, although performance-related factors might be more important for men's continued attendance, other aspects of the social environment are likely to be necessary to promote completion in women. Realistically, although the roles of men and women in society are evolving, differences remain (Section 2.2.3). Therefore, changes to the PARS exercise environments are needed to tailor the exercise environment to help reduce gender differences in completion rate. For men, it is more likely to be important that exercise professionals appropriately tailor physical activity programmes to engender confidence at an early stage. Higher rates of male completion suggest that this is already happening to a certain extent. It is known that exercise professionals are influential in creating a social network and culture, and providing social support; all of which are conducive to positive experiences and, therefore, an increased likelihood of continued attendance (Crone, Smith and Gough, 2005). Yet, to further improve rates of completion in women, measures might include providing more group-based activities to encourage social support in the exercise environment, ensuring that the exercise environment is not male-dominated and be less likely to provoke discontinuation through feeling too self-conscious among other users. These factors have been detailed previously in research which has investigated adherence (Singh, 1997), older women's participant experiences of exercise (Hardcastle and Taylor, 2001), and mental health improvements (Crone et al., 2005). This emergence in the present context further highlights the complexity regarding effectiveness of PARS because of the multifactorial influences on participant uptake, attendance and completion.

Age

As illustrated in Figure 12.4 (data given in Appendix 298), there was a positive relationship between age and the likelihood of completion. The youngest age groups were least likely to complete (10-29 years). With one exception (40-49 year age group), this difference narrowed around middle-age (30-39 years) and then reversed such that older participants who attended one or more sessions were more likely to complete their programme (60-79 years). Unlike the patterns observed in Models 2 and 3, the positive effect of age was also evident in those aged over seventy.

Failure of younger people to complete programmes following uptake of referral could be the result of aforementioned time constraints that tend to reduce with age (Section 3.3.4). This is supported to some extent by the higher proportion of participants under the age of fifty who reported family commitments and time constraints as a reason for removal from ProActive (Table 12.3). Moreover, the pattern of younger women being least likely to complete and older men being most likely to complete concurs with the previously described notion of gender differences in domestic responsibility. Time constraints might be more of an issue in *younger* women who are at the age during which family and childbearing duties are most likely.

It is possible that over-representation of certain population groups on ProActive created a social environment within the ProActive exercise sessions, which suited certain age-gender profiles. This was not apparent for gender because men were more likely to complete despite more women being referred. However, it might have contributed towards the age-related patterns observed in Model 4. Over-referral of adults in middle- and early old-age was evident (Figure 10.1). The effect on the social environment at the leisure provider could have excluded those who felt that they did not conform to it. For example, it is quite possible that many younger people who start attending leisure providers could find themselves in the company of older participants, some of whom have serious medical conditions. This could create perceptions in younger participants that the ProActive scheme is not appropriate for younger, possibly healthier people, causing them to discontinue. It is also possible that people in this age group might perceive alternative means of becoming active, whereas older people are more likely to lack knowledge regarding how to become involved (Section 3.3.4). By the same token, the importance of physical activity as a means of socialisation and social contact as primary motivator in older people would mean that ProActive-specific exercise sessions in which regular attenders might form social networks could have increased the likelihood of completion in this age group (Section 3.3.4).

Presumably, older people who began physical activity programmes were not sufficiently inhibited by ill-health to prevent attendance. Therefore, as described in relation to participants' initial consent to referral (Section 11.2.1) and subsequent uptake (Section 12.3.2), existing health problems and associated concern might provide motivation for ProActive participation. This could help to explain the higher completion rates in those aged between sixty and seventy-nine years (Figure 12.4). Conversely, such incentives are less likely in younger, healthier individuals.

Summary

In summary, modifications to the exercise environment and attempting to broaden the age profile of those referred to the ProActive scheme (i.e. reduce the average age) might be the most feasible approach to improve completion rates in women and younger people, respectively. Time constraints are a likely a barrier to completion, especially in these groups. Ways to address this might include increasing the number of exercise sessions (especially those outside of work hours), extending provision of childcare facilities, and parent-child (or even grandparent-child) joint sessions. To explore this further, it may be necessary to gather information from these participants who fail-to-attend and complete regarding the reasons why through, for example, qualitative methodology (refer to Section 13.3 for implications for practice).

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Chapter 13

The final chapter of the thesis brings together the issues raised in Chapters 11 and 12 to consider the implications for practice and future research, within the context of current health policy. There is also some discussion of study limitations and a reflection on how the researcher's background and experience were important in shaping the thesis.

Chapter 13: Implications of findings and researcher's reflection

13.1 Introduction

The purpose of this chapter is to bring together themes that have emerged from the discussion in Chapters 11 and 12, to outline the implications for ProActive and PARS, and for physical activity promotion in the context of wider Government policy. The implications for future research are then considered before reflecting on how the researcher influenced, and was influenced by, the research. First, the overall conclusions are summarised.

13.2 Conclusions from Research Questions 1 and 2

Out of all the possible influences considered as explanations for the over-representation of women, adults between middle and retirement-age, and those residing in areas of above average deprivation, differential GP consultation rates and the influence of the referring health professional emerge as the most likely contributors. These groups are more likely to consult primary care (compared with younger, male, less deprived counterparts). However, higher rates of subsequent self-removal in younger people and residents of more deprived areas suggested that the social and physical environmental factors expected to reduce the propensity of different groups to accept a physical activity referral were in effect; yet, at the point of referral, these influences were secondary to that of the referring health professional.

The NQAF for PARS cites the recommendations of the Department of Health, that schemes should be 'more widely available' (Department of Health, 2001b: p.6). Although a socio-demographic range was evident within the ProActive Sample (i.e. age range 9 to 92 yrs, Townsend deprivation score range -5.67 to +12.97), certain population groups were clearly over-represented. On the one hand, over-representation of groups who tend to be least active and/or experience the poorest health (i.e. women, older people and lower socio-economic groups) suggests that through primary care, PARS can reach those most in need. On the other hand, differential progress and success of different socio-demographic groups raises serious questions about the public health role of PARS in their current format in terms of disease prevention and reducing socio-economic health inequalities. In the context of the reviewed literature, the present findings support the influence of social and physical environmental factors related to participant socio-demographics. Socio-economic circumstances, urban-rural environment, and age appear to have a significant influence on participants' propensity to take up a physical activity referral. High attendance levels throughout physical activity programmes, however, appear more likely to vary according to how well the intervention and exercise environment suit the age-gender profile of participants. Therefore, although primary care might provide a means by which to access certain priority groups, PARS are unlikely to be able to overcome certain physical and social environmental barriers associated with deprivation and geographical location, and social influences that differ by age and gender.

The following section considers implications for practice that came out of the present research. As a direct result of this and findings from the parallel investigation (Sidford, 2006), several changes to the scheme have been implemented or are currently in progress. These are outlined in relation to the consequences anticipated on the basis of the present study findings, with some suggestion for further refinements.

13.3 Implications for practice

13.3.1 Suggestions for improvements to ProActive: January 2006 (Kweatowski, 2005; 2006)[41]

The most substantial improvement to the ProActive scheme is increasing the localisation of the scheme. The countywide Central Referral Mechanism (CRM) has been replaced with five local referral mechanisms; one in each of the District Council areas (similar to that operating in West Somerset, Section 8.2.3). Rather than employing a single ProActive Project Worker to coordinate the whole scheme, each District Council now has (or will have) an Active Lifestyles Officer. They will fulfil the same function as the Project Worker (Section 8.2.2) but be better positioned to find and link up with additional activities in the local area. This was not possible on a county level. In relation to the present findings, increasing the range of options

[41] Much of the information regarding the progress of implemented changes that are reported in this section was obtained through personal communication with the Health Promotion Manager for CHD

available to participants should help to overcome some of the factors posited as reasons for certain groups being more likely to remove themselves. For example: residents of more remote rural areas might be more inclined to take up referral if not required to travel to larger towns to access facilities; those living in deprived areas could be offered activities that are less conflicting with behavioural norms; availability of non-gym-based activities might be more appealing to older adults; younger people and women should be better able to find activities that can be scheduled around work and family commitments.

Nevertheless, it is possible that this development to the existing setup will not greatly alter the socio-demographic profile of those referred to ProActive. To do so might require providing referring health professionals with a specific remit to target certain under-represented groups, such as younger men. Further still, to broaden the age profile of ProActive participants it might be necessary to look outside the primary care setting (refer to Section 13.3.3 for further discussion). One possible method would be raising the profile of the scheme locally; for example, through local media and worksite promotion. Some countywide and localised promotion of ProActive has taken place over the years. Leisure providers are currently responsible for scheme promotion and might be reluctant to extend this because of already heavy workloads restricting their ability, not only to undertake additional promotion, but also to cope with any subsequent increases in the user base. If attempted, initial marketing must be frequent and strategically planned, ideally using social marketing techniques to reach the target audience (Cavill and Bauman, 2004). This has so far been missing.

One of the main reasons behind localisation of ProActive was to reduce participant self-removal and to improve rates of uptake and completion. Reasons that emerged as likely candidates to explain self-removal prior to uptake (Models 1 and 2: Sections 12.3.1-12.3.2) included time constraints (younger people) and perceived or real barriers to accessing leisure providers (deprived and rural residents). By increasing the range of activities and locations, greater flexibility should be afforded to suit personal time restrictions in younger adults. Lack of motivation through health concern might remain a barrier. Barriers relating to geographical access for rural dwellers should again be reduced, but will still depend upon the remoteness of their location and the options available locally. Perceived barriers to accessing facilities in residents of more deprived areas could be lessened. However, evidence would suggest that a disadvantaged environment will inevitably have a negative impact on participation (Section 3.4.3). Indeed, the social influences associated with socio-economic disadvantage (e.g. social modelling; lower social support) will remain likely determinants of self-removal or uptake. Without widespread change in the activity culture of the British public across the population (Smith and Bird, 2004), physical activity interventions such as PARS are unlikely to be able to break the perpetuation of health-damaging attitudes and behaviours in lower socio-economic groups (described in Section 3.4.3) or to overcome barriers to participation that differ according to age (Section 3.3.4).

Considerable time was spent in the present study, retrieving data for incomplete participant records. Data were usually missing because client records (Appendix 12) were either inadequately completed at the time of attendance, or were not returned to the Project Worker at the time causing problems in locating records that could be up to three years old. This resulted in the exclusion of more than one hundred and fifty participants from analysis (Figure 10.5). Therefore, in terms of future evaluation, a further benefit of localising the scheme should be improved contacts and relationships between the leisure provider and Project Worker (or Active Lifestyles Officer), which should facilitate more prompt and accurate maintenance and return of participant records. Furthermore, because there is a history of evaluation within ProActive, it might be considered more 'normal' to give greater thought to completion of paperwork.

Additional changes to reduce the number of self-removals include modification of the referral form (Appendix 10). When completing forms, health professionals are now required to confirm that the patient is not contraindicated for exercise (according to criteria listed in Appendix 9), and is sufficiently motivated to undertake a structured programme of physical activity. This was intended to achieve two things. Firstly, to encourage health professionals to consider the likelihood of their patient's successful attendance. Secondly, this is intended to promote a more honest exchange between health professional and patient. If patients are more willing to voice apprehensions and perceived barriers, this could either prevent their inappropriate referral or provoke an attempt by the health professional to resolve such issues. The effectiveness of such modifications will depend very much on the actions of health professional.

The importance of using evidence to underpin practice is widely accepted (Department of Health, 1999b; South and Tilford, 2000). These changes are, therefore, encouraging because they demonstrate SPAG's continued commitment to developing evidence-based practice. Moreover, they are an example of the practical benefits of undertaking quality research in an applied setting rather than relying on inferences from experimental research or insufficiently rigorous applied research. The major obstacle to implementing changes that follow recommendations from research has proved to be funding. Indeed, in the current climate of NHS job cuts and problems with hospital funding, it is perhaps unrealistic to expect further investment into PARS. This is especially true in light of the NICE recommendations, which effectively advise against further investment by health promoters except for in controlled trials of scheme effectiveness (NICE, 2006).

13.3.2 Further possible improvements in the context of PARS

Within the PARS format, there is little that can be done to change the socio-demographic characteristics of those who consult in primary care. Aforementioned promotion of schemes outside of the primary care setting is one feasible approach that might broaden the socio-demographic profile of PARS referrals. The need for this kind of action was recognised in the recent Government *physical activity action plan* (Department of Health, 2005b: discussed in Section 13.3.3). Further modifications might include increasing referrals from a wider range of health professionals (e.g. community-based referrals from smoking cessation counsellors).

In response to the apparent problem of schemes being more suited to, and successful for, certain population groups (i.e. middle to retirement aged residents of affluent urban areas) there are two potential approaches. Firstly, to reduce the referral of patients most likely to remove themselves despite giving their consent to the health professional. Secondly, to modify the scheme to reduce barriers that disproportionately impact upon certain population groups. The potential benefit of the former approach would be a reduction in the time and resources directed towards participants least likely to attend and complete physical activity programmes. However, although the effects in the present study were highly significant, their predictive value was relatively low. For example, it is not possible to predict with certainty that an individual living in a particular area will fail to take-up referral. Therefore, the exclusion of individuals on the basis of socio-demographic characteristics alone would be unjust and likely to discriminate against members of a priority group, whose health and physical activity needs are greatest (e.g. lower socio-economic groups). Moreover, within the modern NHS this would be unacceptable as it does not represent equitable health care (Goddard and Smith, 2001; Gulliford et al., 2001). A more ethical means of achieving a similar outcome would be for health professionals to provide sufficient information at the point of referral to enable individuals to make more informed and honest decisions. Better still, exercise counsellors could be introduced in primary care to increase social support and reduce perceived barriers at the point of referral.

In practice, the former begins to shift more responsibility back to the health professional, which is problematic for reasons discussed in Section 4.3.3; the same reasons thought to prompt the development of PARS-style interventions (Taylor, 1999). The latter would require funding, which inevitably create barriers to widespread implementation. Again, considering the recent NICE recommendations, this seems unlikely (NICE, 2006). Within the context of PARS, the overall approach of reducing the referral of those least likely to succeed would increase scheme efficiency; yet it essentially ignores rather than addresses barriers and problems faced by these population groups.

The second alternative would be to modify physical activity interventions, to make them more conducive to younger adults and those living in deprived and rural areas. This will require further research to explore why these groups remove themselves from PARS, and base changes on this evidence. As detailed previously (Section 13.3.1), increasing the range of alternatives through scheme localisation should help by incorporating some less facility-orientated activities (e.g. walking groups). An increase in the number of leisure providers offering interventions to benefit claimants free of charge might also contribute (Kweatowski, 2006), although evidence for the effectiveness of financial incentives to increase attendance is not convincing (Harland et al., 1999; Jackson et al., 1998; Munro, 1997). Realistically, unless there is widespread change in people's attitudes towards physical activity (i.e. activity culture), it is likely that participation in such interventions will simply present too many barriers for some groups.

Thus, from the present findings PARS appear to be a suitable strategy for some but not all of the population. It is, therefore, perhaps wiser to direct resources into alternative strategies that better address, for example, the wider influences of an adverse socio-economic environment which extend far beyond immediate financial constraint (refer to Section 13.3.3 for further discussion).

From a public health perspective, the observations in the present research have implications that reach beyond the setting of the ProActive scheme. As a large-scale, well-run physical activity intervention, ProActive could be used as a marker for what might be achievable through similar types of physical activity promotion. The following section, therefore, consider findings in the context of related policy to discuss whether social and physical environmental factors that differentially influence the physical activity behaviour of different socio-demographic groups are being adequately addressed.

13.3.3 Wider practical implications and current policy

As discussed in Section 4.2, in recent years physical activity promotion has become increasingly prominent within public health and several priority groups have been identified: children and young adults, women, people with disabilities, older people, and lower socio-economic groups (DCMS, 2002; Department of Health, 2004b; 2005b). The NQAF sets out that PARS have a part to play in the overall public health programme (Department of Health, 2001b). Yet there has so far been a lack of understanding regarding their differential effect according to age, gender, social status and ethnicity. Nor has there been any wider consideration of the possible contribution that such schemes could make to public health. Therefore, throughout the remainder of this section particular attention is given to consider the implications of the current findings for physical activity promotion in relation to two important public health problems that were introduced earlier (Section 1.1). These are the potential public health crisis from increasing lifestyle diseases within an ageing British population, and the use of physical activity to tackle socio-economic health inequalities (Section 2.4).

Hard-to-reach population groups

In the present study, the apparent lack of active patient targeting by referring health professionals provided useful information regarding the limitations of primary care as the setting from which to promote physical activity. The Government's physical activity action plan referred to taking advantage of being able to access a large proportion of the public through the health service (Department of Health, 2005b). However, as this access is not equal across the population (i.e. predominantly women, referrals increase with age), it has both positive and negative implications. On the one hand it implicates primary care-based interventions as potential useful tools; firstly in helping to redress the lower physical activity levels in women (Section 3.3.1); secondly, to reduce age-related declines in physical activity levels (Section 3.3.2) and health (Section 2.2.1), thus reducing the public health impact of the ageing British population (Section 1.1). On the other hand, it raises serious questions about the role of primary care-based physical activity promotion in a preventive capacity, especially in men.

From a long-term public health perspective, if physical activity interventions such as PARS are to retard (and eventually reverse) the growth of lifestyle diseases, targeting younger people prior to the establishment of disease must be a priority (DCMS, 2002; Department of Health, 2005b). The problem with this setting is that people generally visit primary care regarding an existing malady, the likelihood of which increases with age. To some extent this undermines the usefulness of primary care for preventive physical activity promotion.

As suggested earlier, further promotion of primary care-based interventions (such as ProActive) in alternative settings could raise the profile of such schemes in the local community or even nationally. This could not only extend their reach but might lower the age profile and reduce the gender imbalance observed in the present study. The need for such action was recognised in the Government physical activity delivery plan (Department of Health, 2005b). On their own such measures are unlikely to be successful because they fail to address motivation through health concern that can be lacking in younger people (Section 3.3.4) and the lower susceptibility of men to health promotion messages (Doyal, 2001). This kind of promotion could, however, have a role in providing local support for larger scale physical activity promotion strategies that address inactivity on a societal and environmental level (Cavill and Bauman, 2004;

Smith, 2004). Unless this is the case, increasing physical activity in a preventive capacity will be limited.

Overall, although the NHS has been given some of the responsibility for taking forward the health improvement agenda, which includes physical activity promotion (Department of Health, 2005b), affecting substantial change in physical activity for prevention would appear problematic.

The appropriateness of primary care-based physical activity interventions for different groups

As described in Section 13.2, although primary care might provide a means by which to access certain priority groups to promote physical activity, there are barriers associated with deprivation, rural location, being young and being female, all of which reduce the likelihood of a sustained, favourable response following initial contact with participants. Moreover, the nature of interventions that can feasibly be delivered through primary care limits modifications that could deal with these issues. Those delivered by health professionals will always be restricted by time and resources (Section 4.3.3). Furthermore, the present findings suggest that health professional referrals to a PARS, even a large well-run scheme such as ProActive, are more appropriate for some population groups than others.

In relation to age, if likely social influences and health status are considered, it appears that physical activity interventions (such as PARS) can be appropriate for individuals at an age when they are likely to be motivated by the threat of ill-health, but not impeded by serious health issues, and perceive sufficient time to participate. This effectively precludes many younger adults who feel more constrained by time and less motivated by health. It also rules out older adults (>70 yrs) for whom ill-health, low exercise self-efficacy, and perceived social norms are likely deterrents. Again, the suggestion is that such interventions can form only part of an overall strategy by reinforcing the broader messages and environmental changes within certain population groups that require individual-level support.

The same principle applies to residents of deprived areas. Although primary care appeared to be an effective means of achieving initial contact, the negative influence of socio-economic disadvantage was in keeping with patterns of lower physical activity (Section 3.4.3) and under-representation of less educated, lower socio-economic groups in physical activity research (Hillsdon et al., 2005). Almost without exception, health and physical activity promotion strategies advocate prioritising the most socio-economically disadvantaged groups (Sections 2.5 and 4.2). The recently published NICE guidelines on physical activity promotion methods (including PARS) recognised the gap in the evidence base regarding the differential effect of interventions according to the target group's age, gender, SEP and ethnicity. Yet both these guidelines and the earlier NQAF have failed to specify the need to determine the level of equity in access to PARS and effectiveness in different socio-demographic groups (Department of Health, 2001b; NICE, 2006).

The present study demonstrated inequity within a large-scale PARS, which can serve as a marker for differential success of other types of intervention in different socio-economic groups. Greater variety and choice in terms of the setting and type of physical activity intervention might help to increase participation of some people in disadvantaged areas, but it is likely that underlying attitudes and adverse social influences will severely impede any progress.

In order to break down barriers to physical activity participation across socio-demographic groups, a widespread change in activity culture is required. Physical activity must become a normal part of daily life, not an additional requirement that competes for time, or one that conflicts with environmental influences (physical and social). This equates to changes in the drink drive and seatbelt culture that have been driven by legislation and financial investment. In modern Britain sedentary behaviour is strongly reinforced (Section 1.1). Therefore, engendering change in activity culture across the social strata might only be achievable through similar multifaceted policy-led changes to create a society in which physical activity (both recreational and non-recreational) is an integral part. Mass media campaigns and social marketing techniques have been identified as 'essential first steps' in this process (Cavill and Bauman, 2004: p.772). Within the context of these changes, interventions like PARS can provide additional support and reinforcement for *some* population groups and thus play some part in the overall physical activity promotion strategy.

Strategies used to promote smoking cessation provide a good model (Section 4.3.1). Individual and community-level interventions are used in conjunction with national media campaigns to increase awareness and policy-led intervention. It is the latter which hold most promise for having a substantial impact. For smoking cessation, these include bans on cigarette advertising, smoking in the workplace and many public places (most recently in all pubs and restaurants). By reducing exposure to smoking behaviour and increasing the difficulty and inconvenience of maintaining the habit, these represent health promoting changes to the social and physical environment. In the long-term, it should continue to engender change in public attitudes and acceptable social norms. As discussed in Section 4.3.2, this type of approach can be unpopular and difficult to evaluate. The greatest effect may still occur in the well-educated middle classes. Nevertheless, it is possible that a sustained approach of this nature could help to break down the perpetuating cycle of negative attitudes and social modelling of physical inactivity within disadvantaged groups.

With respect to gender differences in physical activity and participation in physical activity interventions, a cultural shift would have a positive impact on men and women. Primary care provides an effective means of targeting women (than men), who appear willing to participate in physical activity interventions. However, for primary care-based (and similar) physical activity interventions to be successful, greater sensitivity to personal time constraints, childcare requirements and the importance of creating a socially supportive exercise environment might be necessary.

The impact of geographical location, specifically lower physical activity participation in residents of rural areas, also presents specific challenges to physical activity promoters. In the present study, the negative influence of rural residency is likely to be symptomatic of the requirement to attend specific leisure facilities, which tend to be built in urban areas. If so, this would support the conclusions of others who have advocated promotion of free-living activities as a more viable alternative (e.g. Hillsdon, 1998; Hillsdon and Thorogood, 1996; Hillsdon et al., 1999). However, as discussed in Section 3.5, rural environments can also be less conducive to free-living, non-recreational activities such as walking and cycling because of the lower street connectivity, fewer pavements, and so on. Therefore, physical activity messages might need to take into account such barriers to activity in rural communities. Indeed, greater difficulty in performing non-recreational and recreational activities (because of reduced access to facilities) might mean that more work is required at a local level to provide a range of physical activity opportunities. Unfortunately, as with any service in rural areas the lower number of people and subsequent lower level of use is problematic for financial viability, which is likely to restrict such efforts.

13.3.4 Summary

Within the PARS format, ProActive provides a good model for practice (Crone et al., 2004), especially following recent changes were driven by outcomes from this and Sidford's (2006) research. Nevertheless, it is unrealistic to expect PARS or other primary care-based physical activity promotion interventions to suit all population groups. Some weaknesses of the ProActive scheme are to a certain extent unavoidable given the practical constraints on time and resources. These include:

- The referral of inappropriate participants who are not sufficiently motivated to take up referral or successfully attend;
- Difficulties in implementing preventive strategies from a primary care setting;
- Problems of addressing different barriers faced by different socio-demographic groups, especially younger adults and residents of deprived or rural areas.

Overall, the PARS-model appears more suited to those aged between forty and seventy years old living in less deprived, urban areas. Considering who visits primary care most frequently and differential susceptibility to physical activity promotion, similar patterns might be expected in other types of primary care-based intervention.

Clearly, it cannot be assumed that attendance at eighty *per* cent of exercise sessions necessarily resulted in sustained changes to participant lifestyle behaviour. However, it serves as a useful marker for intention to increase physical activity, the types of barrier differentially encountered by different population groups and, therefore, potential ways to overcome these within physical activity promotion.

In their current format, PARS are useful for some groups but not all. Given their prevalence, PARS might currently be viewed by some health professionals as *the* physical activity promotion alternative (within their surgery, PCT, etc), to which all insufficiently active people should be referred. The present findings do not support this. Yet neither do they support the recommendations of NICE, which could result in many schemes being shut down. Physical Activity Referral Schemes would benefit from greater targeting towards those population groups for whom they are most suited. Simple exclusion on the basis of age or area of residence is ethically questionable but greater information provision by the health professional and a brief honest exchange with the patient could help to target referral more appropriately.

In today's society in which sedentary behaviour is strongly reinforced, PARS are unlikely to make a substantial contribution to the overall effort to tackle socio-economic health inequalities. Nor are they likely to be able to effectively target younger, sedentary adults in a preventive capacity. However, they can fulfil a role by providing local support for some members of the population who requirea safe, supervised exercise environment.

The need for physical activity (and health) promotion programmes with a preventive remit that focuses on both personal and environmental conditions is apparent from the present findings and has been recognised elsewhere (Yen and Syme, 1999; Zunft et al., 1999). As others have suggested, this is likely to require policy-led changes to the social and physical environment; for example, urban planning to encourage active transport, making travel by car more expensive, greater investment in cycle paths, and so on (Smith and Bird, 2004). Some of these changes might be unpopular and perceived as politically dangerous. Moreover, they will require substantial investment from central Government, which for physical activity, unlike smoking cessation (Department of Health, 1998) and dietary behaviour promotion (Department of Health, 2005a), has so far been lacking. However, unless attempts are made to engender long-term change in public attitude (and therefore behaviour) through such measures, continued attempts to promote recreational activity through primary care-based interventions will continue to fail certain population groups.

13.4 Limitations and future research

13.4.1 Study limitations

The present research had several advantages over existing PARS research. Specifically, it used data from a 'real life' PARS that was established in 1993 near the beginning of the PARS proliferation and has been developed ever since. For the present research, one of the primary benefits of this development was the implementation of data collection processes that enabled participant progress to be monitored from the point of referral. Nevertheless, there were several limitations to be considered.

Firstly, the study population was essentially a convenience sample. Access to ProActive participants was an integral part of the ProActive Project Worker role fulfilled by the researcher (Section 13.5.4). Focusing on one sample of participants from one PARS, albeit a large sample from a countywide scheme, inevitably places some restriction on generalisability. It could be argued that basing a study of socio-economic bias in a county of above average affluence and a high proportion of rural residents is not representative. Nevertheless, the findings can be applied more generally because of the importance of relative rather than absolute SEP. As described in Section 2.4.1, health differences appear to occur (as a consequences of various factors including health behaviour) as a result of relative position within the social strata and the psychosocial implications. Therefore, although more severe deprivation might be experienced in other parts of the country such as some inner-city areas in London or Glasgow,[42] relative differences in deprivation are the source of inequalities in health and health behaviour. Moreover, the urban-rural contrast has not before been explored in previous PARS evaluations (Section 5.5), nor has it been well explored in physical activity research. Therefore, using a Somerset-based scheme and study population enabled a unique insight and consideration of some of the different issues faced by people living in areas of differing urbanicity-rurality.

The second point relates to participant attendance records and the subsequent use of the eighty *per* cent completion criterion. Although using leisure provider records of attendance was preferable to relying on participants' self-reported attendance or

[42] Somerset does contain pockets of extreme deprivation but there are more extreme examples in other parts of the country

physical activity levels, it would be unrealistic to treat them as objective records of attendance. From incomplete participant attendance records and knowledge that some leisure providers accumulate backlogs of outstanding paperwork to return to the CRM (from researcher's personal experience: Section 13.5.4), it was clear that some attendance records were completed retrospectively. They could not, therefore, be assumed entirely accurate. To confer greater confidence in the accuracy of attendance data for future evaluations, leisure providers could implement processes that record when each participant uses facilities, ideally electronically and backed up with paper records. Indeed, this could be introduced as a requirement necessary for leisure providers to achieve ProActive recognition (Section 8.2).

In the present study, if attendance records could have been assumed accurate a continuous attendance variable would have provided a more sensitive outcome than the dichotomous, complete versus fail-to-complete comparison (Model 4). However, this was not the case and to help reduce the impact of inaccuracies, the eighty *per* cent completion criterion was employed to define success. Eighty *per* cent is essentially an arbitrary figure but gives a more informed picture of compliance with physical activity programmes than simply measuring attendance at final assessment as used elsewhere (Dugdill and Graham, 2004; Hammond et al., 1997; Jackson et al., 1998; Lord and Green, 1995). It is also more stringent than others (Taylor et al., 1998) and if anything, would lead to underestimation of successful completion compared with other schemes. The real benefit of using this particular definition of 'completion' was that it had been in operation since the earlier ProActive evaluation of referrals between 1995 and 1997 (Grant, 1999). As a result of its longstanding application, leisure providers who failed to record attendance of a participant at each exercise session could use the criteria to retrospectively classify them as 'Completers' or otherwise, with greater reliability than if based entirely on their own judgement. It would, therefore, have been unwise to modify the existing criterion for the purposes of the present study.

A further drawback associated with reliance on attendance is that it was not possible to account for differences in physical activity away from leisure facilities. This effectively relied on the assumption that participants who were identified as sedentary by health professionals and who were referred to ProActive but then failed to complete a physical activity programme, were not motivated to undertake alternative forms of activity.

Although this may have been true for many participants, it is a limitation and one that could be addressed through future research (Section 13.4.2).

A third limitation relates to the sole reliance on area-level socio-economic data. Potential problems associated with this were discussed in Section 7.4.1. The primary criticism is the problem of *ecological fallacy*: the assumption that all people living in deprived areas are deprived (Martin et al., 2000). However, this is only a limiting factor when using area-level data to make inferences about individuals. The present findings were considered primarily in terms of the area or contextual effects (Shouls et al., 1996) and how the socio-economic environment might have influenced the behaviour of ProActive participants. Consequently, this is not an issue in the present study. Such data were conceptually and practically appropriate in this context (Section 9.4), although supporting individual-level data would have strengthened the study (refer to Section 13.4.2 and 13.5.3).

A specific problem did, however, arise from using area-level data to make statistical comparisons between the socio-economic characteristics of participants' areas of residence and the Somerset average. As described in Section 9.4, it was not possible to conduct analysis using data for Somerset Output Areas (OA) that were weighted for differences in OA population sizes. Despite considerable research into possible solutions (described in Appendix 16), a satisfactory alternative was not found. As a consequence, and given the small effect that weighting OA data had on mean values for socio-economic variables (Table 9.6), running tests on unweighted data was deemed the most satisfactory course of action. This provided a best impression of the direction, magnitude and significance of any differences.

A fourth limitation of the present study was the substantial reliance on data from other sources. As applied public health research in the context of a PARS that was undertaken from a social-ecological perspective (Section 1.3), this research was unique. An unfortunate but inevitable consequence was the limited amount of existing evidence with which direct comparisons could be made. In order to enable an informed discussion of findings it was necessary to draw upon a wide range of literature to provide as much context as possible in which to understand and explain the observed patterns. The resultant speculative nature of the discussion was in some ways limiting (Section 13.5.4). Nevertheless, the originality of the approach, which effectively imposed this limitation, is also its strength and the present findings can be used to inform future research to further explore some of the issues raised.

13.4.2 Future research

The recent NICE recommendations advised against further PARS endorsement unless as part of controlled studies of effectiveness (NICE, 2006). However, the present study serves as an advocate of applied research by not only making an original contribution to knowledge but also having a direct and demonstrable impact on practice. This adds to the considerable and growing number of researchers who argue in favour of this kind of research to evaluate this type of human intervention (Section 4.3.3). It has also highlighted several areas for further research. Although the present study was relatively rich in information relating to participant socio-demographics and data on those who removed themselves from PARS (compared with previous research), further information is required to elucidate and confirm why different groups removed themselves or progressed further than others. In particular, this refers to the elusive 'No Contact' group. Post-hoc analysis reported in Section 12.3.1 involved a reasonable number of participants who were removed from the scheme following a health professional referral (n=548). Yet, out of those who removed themselves (n=384), the reason for removal was unknown in more than half (n=195); the group who the Project Worker was unable to contact. The dearth of information on this group is certainly an area deserving of further investigation, possibly qualitative, but obtaining information will be challenging as they represent participants expected to be the least compliant.

There is much scope for collecting data to confirm and develop the inferences and suppositions that have been made throughout the discussion regarding environmental influences on behaviour in different socio-demographic groups; for example, what proportion of residents of deprived and rural areas did actually remove themselves as a result of perceived access issues and how these compare with real access (measured objectively). Again, conducting such research retrospectively will be hampered by response bias. For the study of the physical environment, there is a strong case to follow the example of an increasing number of physical activity researchers using Geographical Information Systems to make objective measurements (Foster, Hillsdon and Grundy, 2002; Giles-Corti and Donovan, 2002b; Pikora, Bull, Jamrozik et al., 2002;

Troped, Saunders, Pate et al., 2001). For the present study the decision was made to focus measurement more narrowly but do so with rigour, looking to existing data and literature to provide further context (refer to Section 13.5.3). This was a reflection of the researcher's interests and background, the influence of which are considered in the following section.

Future research in PARS and physical activity in general must pay more attention to appropriate socioeconomic measurement. Ideally, data would be collected at both individual and area-levels to enable inferences about the influence of individual socio-economic circumstances as well as the socio-economic environment. As discussed in Section 8.4.1, research that attempts to do so retrospectively will inevitably be impaired by response bias. Implementing data collection processes within schemes is the only realistic way to overcome this in future evaluations. However, even if this is not possible as in the present study, researchers should be aware of the implications of their approach to socio-economic measurement. It is relatively simple to blindly include socio-economic variables because SEP is recognised as a major correlate of physical activity. Although preferable to their omission, authors often make no attempt to justify their inclusion of various socio-economic variables and fail to recognise the implications of choosing one socio-economic variable over another.

Attendance of physical activity programmes was used to define success of participants on ProActive, the justification for which was provided in Section 5.4. However, as detailed in the previous section, this does not provide any information regarding overall physical activity levels. Other evaluations of PARS have involved pre-post physical activity measurements, some with follow-ups of several months (Grant, 1999; Morgan, 2005). Undoubtedly, longitudinal data regarding sustained behaviour change is valuable but the issues of response bias and inaccuracy of self-reported physical activity are problematic (Section 3.2). The ProActive scheme routinely sends out six-month follow-up questionnaires to enquire about participants physical activity levels. Data from these were not included because of the inevitable response bias and inadequacy of the physical activity measurement at baseline and follow-up. Therefore, attempting to use an objective physical activity measure, such as accelerometers, to gather longitudinal data on PARS participants represents at the very least, a step in the right direction. For reasons discussed previously (Section 3.2), this is rarely feasible on a large-scale (Hillsdon et al., 2002; Tudor-Locke et al., 2004). Despite this, with the exception of using pedometers as a physical activity intervention, recently published NICE guidelines make no specific reference to the need for objective physical activity measurement (NICE, 2006). Nevertheless, there has been some improvement in this area (Janssen et al., 2006) and it would be a logical progression within PARS research.

In summary, the present research represents progress in this area but is open to a certain amount of criticism. There were weaknesses as a result of compromises made through constraints on time and resources, or through methodological choices or omissions made that would be different if the research was repeated. The positive outcome of this has been enabling the identification of opportunities to build on this work.

13.5 Researcher's reflections[43]

13.5.1 Introduction

Given the somewhat unorthodox nature of the thesis, it is important to attempt to convey how my background, interests, insight from working as the ProActive Project Worker and experiences influenced the thesis.

> *'One thing is for sure, there can be no going back for any researcher, whatever his or her paradigmatic persuasion to the cosy self-deluded days when texts were neutral and innocent representations of the realities of others......... all of us, as positioned authors, are clearly implicated in the construction of our texts and this needs to be acknowledged' (Sparkes, 1995: p.189).*

Sparkes (1995) and others (Ghaye and Lillyman, 1997) have recognised the importance to acknowledge the influence and biases of the researcher in research. Reflective practice is increasingly recognised as an important process (Ghaye, 2000), even within the context of PARS (Department of Health, 2001b). The present section draws on this and aims to acknowledge myself and my representation within this study. Although the inclusion of a reflective section in a quantitative positivist thesis such as this is not necessarily standard practice or something I would have envisaged writing one or two

[43] As a reflection of the researcher's influence on the research, and how the research has developed as a result of the doctoral process, this section is written in the first person.

years ago it is, I believe, a necessary inclusion. This final section of the thesis is, therefore, a reflection on my background, interests and experiences as important determinants of the specific focus and approach to the research; further, ways in which the process has influenced my outlook and research interests are also considered. In contrast to the preceding chapters and sections, this section is written in the first person.

13.5.2 The approach to data collection and analysis

The quantitative nature of my previous research experience is immediately evident. Accuracy and conceptual clarity were fundamental in my previous work in physical activity measurement. Early on I recognised that, like physical activity measurement, socio-economic measurement is a controversial area of research that is easy to criticise and impossible to perfect. I therefore invested a substantial amount of time and energy into ensuring that my approach to socio-economic measurement was rigorous and conceptually robust.

The availability of participant postcode data from the CRM naturally lent itself towards using area-level census data. Although advised that this was a valid approach, I was very conscious of condemnation by some researchers, of using area-level data out of convenience rather than on the basis of sound theoretical underpinnings. As noted earlier in the thesis (Section 8.4.2), plans were made to distribute a questionnaire to gather individual-level data, to strengthen socio-economic census data. Indeed, questionnaires were designed and piloted locally. Ethical approval was already in place and arrangements were made for distribution through a university mailshot. However, in a moment of clarity during a discussion with my supervisors the futility of the exercise became apparent. It promised to yield little more than a discussion about poor response rate and bias undermining the usefulness of any resulting data. On this basis, the questionnaires were aborted. Moreover, as I became further immersed in socio-economic measurement and the specific limitations of relying on area-level data, it became increasingly apparent that to pursue my particular line of inquiry regarding contextual effects, I was justified in using such data. This experience made me realise even further that this research (like any other) was a compromise. The best laid plans will always be thwarted to some extent by practical limitations, especially in research of human behaviour. However, it gave me faith that even at doctoral level, as long as there is honesty regarding limitations, and acknowledgement of the constraints these impose on the inferences that can be made, then the approach is justifiable; i.e. my approach could not be considered 'wrong'.

Selection of the most appropriate socio-economic variables to represent differences in socio-economic context also required careful consideration. In my view, failure to select a method that I could defend would have been the undoing of much of the research. Again the literature indicated that all methods had respective strengths and weaknesses, and advice I received was conflicting. Those based in Health Informatics who work and produce health-related statistics for Taunton Deane PCT (formerly Somerset Health Authority) recommended the most recent deprivation indices (IMD) thought most appropriate for rural areas, in addition to the aforementioned HSNAG indices designed specifically for Somerset (Section 8.4.2). However, I found that this was not supported by the literature; nor was it consistent with advice from Dr Alex Smith (Epidemiologist, University of Leeds), whose expertise along with that of Charlie Foster (University of Oxford) was enlisted to ensure that the approach taken was defendable outside of physical activity research.

The countless hours of reading and reviewing, numerous meetings and discussions with both advisers, attendance at related workshops (ESRC, 2004a; 2004b), and personal communications with individuals involved in census data organisation and dissemination (Hayes, 2004a; Martin, 2004a), eventually resulted in the use of the Townsend score. In some ways I feel that, on the surface, using a single socio-economic variable does not reflect the substantial personal investment and external expertise that underpinned the selection process. However, I take solace in my confidence in defending the chosen approach and that such rigour in socio-economic measurement is unique in the context of PARS and rare in physical activity research. Indeed, that it was necessary to look outside of my own department and institution to seek invaluable epidemiological expertise (Dr Alex Smith, University of Leeds; Charlie Foster, University of Oxford) was a further reflection that physical activity researchers in general are not well-informed in epidemiological techniques and methods. Moreover, the multidisciplinary nature of my research meant that I required expertise from other areas and I now feel more confident in recognising this and identifying a knowledgeable source.

To ensure that the rigour in measurement was supported by appropriate statistical analysis it was also deemed necessary to seek statistical consultation. Determining the most appropriate statistical approach to answer Research Question 2 proved a time-consuming process, involving consultations with numerous researchers[44] and several meetings with a statistician (Professor Clare Morris, University of Gloucestershire). The aforementioned difficulties in making statistical comparisons between those referred to the ProActive scheme and the Somerset average (Section 9.4) also provided a lengthy internal debate. However, as with socio-economic measurement I can be confident that my chosen approach was born out of considering all possible alternatives and expert consultation. This experience has taught me that being thorough is an essential component of good research. At times it would have been easier to ignore the nagging doubts and continue in the hope that things work out. But now, at the end of the process, being able to say that I considered all the alternatives that myself and various others with far superior knowledge and expertise could suggest, I feel more comfortable in claiming that the research was rigorous.

Not only did the thoroughness to ensure that rigorous and accountable methods were used demand consulting a wide literature (in addition to external experts), but in order to provide the broader context to inform the discussion of findings, it was necessary to draw upon a broad range of literature.

13.5.3 Review of literature and discussion

A substantial proportion of my time was devoted to the undertaking of two systematic reviews for publication. At the time this felt like distraction from the PhD but I have since come to realise that as original contributions to the field, they represent a fundamental part of the thesis. Indeed, the focus on literature relating specifically to PARS and the SEP-physical activity relationship for these reviews, in some ways was at the expense of the wider literature review. Consequently, when I came to discuss my findings in the context of other research, I found myself consulting new literature that I soon realised belonged earlier in the thesis. As such, my attentions turned back to the literature review which grew in length and scope. Again, this seemed unorthodox and

[44] Dr David James and Dr Dan Woods, University of Gloucestershire; Dr Alex Smith, University of Leeds; Charlie Foster, University of Oxford

was a source of doubt. However, I believe it was necessary to provide adequate context, without which, the results alone (although original) would have been less informative.

The heavy reliance on existing evidence to provide this context and to help explain and understand my findings, at times felt constraining. In the absence of data beyond the socio-demographic variables reported, the discussion was necessarily speculative and this led me to question my work. Indeed, it was difficult to accept and feel comfortable about this in the knowledge that my research relies much on context provided by the findings of others. It was important to keep reminding myself that this was a consequence of undertaking research that transverses several disciplines (physical activity research, public health and health services research, epidemiology and sociology), and of the need to consider a broad range of social and physical environmental factors.

This was an important lesson to learn because it is central to the way in which the thesis was formed. It would not have been possible to adequately capture all of those discussed. If attempted through questionnaires, the aforementioned response-related problems would have arisen. If attempted through interview, sufficient numbers would have been required to cover socio-demographic range that were considered (e.g. men and women, young-middle-older adults, high and low deprivation, urban and rural). This was unrealistic given the available time and resources but is certainly a possible area for future research. However, if I were to repeat the research I would include the use of Geographical Information Systems to make objective measurements of the physical environment. This was investigated during the planning phase and consciously omitted in order to focus on the socio-economic measurement and the related literature. Despite this, in order to understand the possible consequences of rural residency fully it was necessary to engage with the literature regarding physical activity and the physical environment and, therefore, the inclusion of such measurement would have added greatly to the discussion.

As indicated in the introduction, at times conscious efforts were required to stop myself being drawn too deeply into the psychology of behaviour and behaviour change. The abundance of literature and reference to constructs such as 'self efficacy' and 'barriers' in the present research provided opportunities to deviate from the focus on the "bigger picture" and be taken down the individualistic road of thought. It was necessary to engage with some of the literature and ideas but only in relation to different influences of participants environments as reflected by socio-demographic characteristics.

This challenge was another important lesson in accepting that all possibilities cannot be considered. I realised it was more important to carefully define my research focus and that I was justified in attempting not to deviate too far from this. In research, it is highly unlikely that all possible variables can be adequately accounted for and, therefore, it is important to be aware that other factors will inevitably contribute to observed patterns. However, this again comes back to research being a compromise; I believe that it is better to investigate one aspect from a well-defined and consistent perspective with rigour, rather than attempt to consider all possible alternatives and do so poorly.

Throughout the thesis, particularly when discussing findings, it was possible to give a somewhat judgmental account of participant behaviour through judging success on the basis of attendance and completion. To explain this it is worth considering the distinct concepts of *adherence* and *compliance.* Compliance implies a passive following of demands and, therefore, sustained physical activity behaviour change would be unlikely if attempted through passive compliance with an activity programme in the absence of individual will. Adherence on the other hand involves active participation through collaboration with those prescribing the activity (i.e. health professional, Project Worker and exercise professional). The latter requires motivation on the part of the individual and is therefore more closely linked with the notion of PARS participation. Although 'successful' participants were identified on the basis of attendance and completion of programmes, it should not be forgotten that those who did not attend/complete were simply exercising their free will. It is not possible to say that these people were 'wrong' or were 'worse' than completers but rather, that the scheme was not appropriate for them. This perspective naturally leads to the conclusion that alternative strategies are required for these groups. Out of the possible alternatives, environmental and policy approaches to create environments that foster physical activity emerge as most promising. They do not require active participation or adherence with programmes but aim to engender activity through making greater habitual physical activity part of every day life. It was my intention to portray this perspective throughout the discussion. I hope that my involvement with the scheme did not inadvertently create an impression of judgement against participants who did not complete the ProActive scheme.

Finally, it was perhaps not until writing the discussion that I became fully aware of the value of my experience in post as the ProActive Project Worker. This is considered in the remaining section.

13.5.4 Experience working as the ProActive Project Worker

Although I am now able to look upon my time in post as the Project Worker as a positive experience, it was at first challenging, then became somewhat routine, and was at all times time-consuming. Indeed, the balance of a two-month on, two-month off job share situation, whilst attempting to complete the present research finally took its toll and resulted in my stepping down from the post. An attempt to secure external funding to finance my replacement failed. Therefore, even though this meant rescinding my bursary, I felt it was a necessary decision because both the job and research were suffering as a result of the circumstances.

In retrospect, I feel this decision was correct and timely. I have since been free to complete the research with the required commitment and dedication; yet almost two years in post provided me with valuable experience and insight into the practicalities of running a PARS. Also, through links to those involved with this scheme that were established during my employment I was able to learn about current and future changes to the ProActive scheme and practical barriers to implementing recommendations from research described earlier (Section 13.3.1).

Moreover, this experience conferred a degree of understanding of the types of viewpoints and attitudes of different people involved with the scheme; i.e. referring health professionals, exercise professionals, and participants who varied widely in their apparent enthusiasm and motivation for the scheme. Although this is not quantifiable, I feel that this acquired understanding informed the discussion in ways that could not be replicated by an external researcher. For example, without presenting supporting data it might sound speculative to suggest that some people referred to the scheme consent to the initial referral and to the secondary referral by the Project Worker without any intention of participating, and that some simply consented because their GP said so. However, from speaking with hundreds of participants referred to the ProActive scheme (between June 2003 and March 2005), I can claim with some confidence that this is the case. Although I can make no claims regarding the socio-demographic characteristics of such individuals, this kind of insight combined with evidence from the literature was important in informing the discussion.

The example described also provides a good illustration of how my time in post ensured that I practiced caution when considering the implications for practice. Rather than describing the ideal PARS setup to cater for all population groups, an attempt was made to restrict the discussion to changes within the ProActive scheme that I believed were feasible and practicable, given the limited resources and already substantial workloads of all those involved in the scheme's operation.

Theoretically, in the situation (described above), of participants agreeing to the referral in the absence of genuine intention to participate, the Project Worker would intervene. Indeed, this is why the CRM Project Worker was originally introduced; to use behaviour change counselling techniques to help participants see how they could overcome barriers and to increase their 'readiness to change'. Alternatively, the telephone consultation could be used to make individuals aware that agreeing to participate without genuine intention is not helpful and remove them from the scheme at this point. In reality, this was often not the case for two reasons. Firstly, as a keen advocate of physical activity, I was reluctant to take away the opportunity for anybody to become more active. Secondly, the success of ProActive and subsequent volume of referrals meant that as the central coordinator it was often difficult to cope with the workload. Therefore, participants' consent was often sufficient for the referral to be processed. Such actions effectively compromise scheme efficiency, and ultimately the purpose of the Project Worker. However, they are one example of how in practice, people cannot be assumed to be following ideal procedure; just as leisure providers were not assumed to be completing participant records as intended.

In summary, I do not believe that the conclusions I reached or suggestions for practice are particularly surprising or revolutionary but they are informed by unique and rigorous empirical research, and by knowledge of practice and associated practical and human limitations. This is a fundamental advantage that I believe greatly strengthens the present thesis.

13.5.5 My journey as a researcher

When I began the PhD and Project Worker role, although my research interest was based in promoting physical activity for public health, I had been focused on the measurement of physical activity. With the present research, I took the opportunity to fill an important gap in the literature and evidence base for practice that culminated in this thesis. It has greatly broadened, not only my knowledge, but also my research interests and appreciation of the broader context, thus extending beyond the boundaries of physical activity research. I now feel better placed to understand the wider social and physical environmental determinants of health, health-related behaviour and health help-seeking behaviour; to understand the role of physical activity within this "bigger picture" in a way that I had not previously been able to, or even attempted. Ultimately it has made me realise the importance of changing activity culture through policy-led social intervention and changes in the physical environment, rather than relying on increasing recreational physical activity, which has thus far proved inadequate to reverse the tide of habitual physical inactivity.

References

Acheson, D. (1990). *Variations in hospital referrals*. London: Office of Health Economics.

Acheson, D. (1998). *Independent inquiry into inequalities in health*. London: The Stationery Office.

Adams, J. and White, M. (2003). Are activity promotion interventions based on the transtheoretical model effective? A critical review. *British Journal of Sports Medicine,* **37**: 106-114.

Adams, J. and White, M. (2004). Is the inverse care law no longer operating? *Journal of Epidemiology and Community Health,* **58**: 802.

Adams, J. and White, M. (2005). Socio-economic deprivation is associated with increased proximity to general practices in England: an ecological analysis. *Journal of Public Health,* **27**: 80-81.

Ainsworth, B. E., Wilcox, S., Thompson, W. W., Richter, D. L. and Henderson, K. A. (2003). Personal, social and physical correlates of physical activity in African-American women in South Carolina. *American Journal of Preventive Medicine,* **25**(3Si): 23-29.

Aitchison, C. (2003). *Gender and leisure: social and cultural perspectives*. London: Routledge.

Allied Dunbar, Health Education Authority and Sports Council. (1992). *Allied Dunbar National Fitness Survey*. London: HEA and Sports Council.

American College of Sports Medicine. (1990). The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness in healthy adults. *Medicine and Science in Sports and Exercise,* **2**: 265-274.

American College of Sports Medicine. (1998). The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness, and flexibility in healthy adults. June 1998, Position Stand. *Medicine and Science in Sports and Exercise,* **30**(6).

Aneshensel, C. S. (1992). Social stress: theory and research. *Annual Review of Psychology,* **18**: 15-38.

Annandale, E. and Hunt, K. (2000). *Gender inequalities in health*. Buckingham: Open University Press.

Aoun, S., Donovan, R. J., Johnson, L. and Egger, G. (2003). Preventive care in the context of men's health. *Journal of Health Psychology,* **7**(3): 1359-1053.

Arber, S. and Cooper, H. (1999). Gender differences in health in later life: the new paradox? *Social Science and Medicine,* **48**: 61-76.

Bandura, A. (1986). *Social foundations of thought and action.* Englewood Cliffs, NJ: Prentice-Hall.

Barnett, S., Roderick, P., Martin, D. and Diamond, I. (2001). A multilevel analysis of the effects of rurality and social deprivation on premature limiting long term illness. *Journal of Epidemiology and Community Health,* **55**: 44-51.

Barnett, S., Roderick, P., Martin, D., Diamond, I. and Wrigley, H. (2002). Interrelations between three proxies of health care need at the small area level: an urban/rural comparison. *Journal of Epidemiology and Community Health,* **56**: 754-761.

Barreto, M. L. (2005). Efficacy, effectiveness, and the evaluation of public health interventions. *Journal of Epidemiology and Community Health,* **59**(5): 345-346.

Bartley, M. and Blane, D. (1994). Commentary: appropriateness of deprivation indices must be ensured. *British Medical Journal,* **309**: 1479.

Bartley, M., Ferrie, J. and Montgomery, S. M. (2006). Health and labour market disadvantage: unemployment, non-employment, and job insecurity. In: *Social determinants of health: second edition* (edited by Marmot, M. and Wilkinson, R. G.). Oxford: Oxford University Press.

Bartley, M., Martikainen, P., Shipley, M. and Marmot, M. (2004). Gender differences in the relationship of partner's social class to behavioural factors and social support in the Whitehall II study. *Social Science and Medicine,* **59**: 1925-1936.

Bartley, M., Sacker, A., Firth, D. and Fitzpatrick, R. (1999). Social position, social roles and women's health in England: changing relationships in 1984-1993. *Social Science and Medicine,* **48**: 99-115.

Bassett Jr, D. R. (2000). Validity and reliability issues in objective monitoring of physical activity. *Research Quarterly for Exercise and Sport,* **71**(2): 30-36.

Baum, F. E., Bush, R. A., Modra, C. C., Murray, C. J., Cox, E. M., Alexander, K. M. and Potter, R. C. (2000). Epidemiology of participation: an Australian community study. *Journal of Epidemiology and Community Health,* **54**: 414-423.

Bauman, A. (2005). The physical environment and physical activity: moving from ecological associations to intervention evidence. *Journal of Epidemiology and Community Health,* **59**: 535-536.

Bauman, A. E., Sallis, J. F., Dzewaltowski, D. A. and Owen, N. (2002). Toward a better understanding of the influences on physical activity: the role of determinants, correlates, causal variables, mediators, moderators, and confounders. *American Journal of Preventive Medicine,* **23**(2S): 5-14.

Beier, M. E. and Ackerman, P. L. (2003). Determinants of health knowledge: an investigation of age, gender, abilities, personality, and interests. *Journal of Personality and Social Psychology,* **84**: 439-448.

Bennett, P. and Murphy, S. (1997). *Psychology and health promotion.* Buckingham: Open University Press.

Ben-Shlomo, Y. (1999). Commentary: socioeconomic position should be measured accurately. *British Medical Journal,* **318**: 844-845.

Ben-Shlomo, Y., White, I. and McKeigue, P. M. (1992). Prediction of general practice workload from census based social deprivation scores. *Journal of Epidemiology and Community Health,* **46**(5): 532-536.

Bentham, G., Hinton, J., Haynes, R., Lovett, A. and Bestwick, C. (1995). Factors affecting nonresponse to cervical cytology screening in Norfolk, England. *Social Science and Medicine,* **40**(1): 131-135.

Bergman, M. M. and Joye, D. (2001) SIDOS, Neuchatel and University of Cambridge, Cambridge.

Berkman, L. F. and MacIntyre, S. (1997). The measurement of social class in health studies: old measures and new formulations. In: *Social Inequalities and Cancer* (edited by Kogevinas, M., Pearce, N., Susser, M. and Boffeta, P.). Lyon, France: International Agency for Research on Cancer.

Berrigan, D. and Troiano, R. (2002). The association between urban form and physical activity in U.S. adults. *American Journal of Preventive Medicine,* **23**(2S): 74-79.

Bertrais, S., Preziosi, P., Mennen, L., Galan, P., Hercberg, S. and Oppert, J. (2004). Sociodemographic and geographic correlates of meeting current recommendations for physical activity in middle-aged French adults: the supplementation en Vitamines et Minereaux Antioxydants (SUVIMAX) study. *American Journal of Public Health,* **94**(9): 1560-1566.

Bibby, P. and Shepherd, J. (2004). *Developing a new classification of urban and rural areas for policy purposes: the methodology.* London: DEFRA ODPM ONS Welsh Assembly Government and The Countryside Agency.

Biddle, S. J. H., Fox, K. R. and Boutcher, S. H. (2000). *Physical activity and psychological well-being.* London: Routledge.

Biddle, S. J. H. and Mutrie, N. (2001). *Psychology of physical activity: determinants, well-being and interventions*. London: Routledge.

Bingham, S. A. (1991). Limitations of the various methods for collecting dietary intake data. *Annals of Nutrition and Metabolism,* **35**: 117-127.

Blair, S. N. (2001). Foreword. In: *Psychology of physical activity: determinants, well-being and interventions* (edited by Biddle, S. J. H. and Mutrie, N.). London: Routledge.

Blair, S. N., Cheng, Y. and Holder, J. H. (2001a). Is physical activity or physical fitness more important in defining health benefits? *Medicine and Science in Sports and Exercise,* **33**(6): S379-S399.

Blair, S. N., Cheng, Y. and Holder, S. J. (2001b). Is physical activity or physical fitness more important in defining health benefits? *Medicine and Science in Sports and Exercise,* **33**(6 Suppl.): S379-S399.

Blair, S. N. and Connelly, J. (1996). How much physical activity should we do? The case for moderate amounts and intensities of physical activity. *Research Quarterly for Exercise and Sport,* **67**(2): 193-205.

Blair, S. N., Kohl, H. W. and Gordon, N. F. (1992). How much physical activity is good for health? *Annual Review of Public Health,* **13**: 99-126.

Blamey, A. and Mutrie, N. (2004). Changing the individual to promote health enhancing physical activity: the difficulties of producing evidence and translating it into practice. *Journal of Sports Sciences,* **22**(8): 741-754.

Blane, D. (2001). Commentary: socioeconomic health differentials. *International Journal of Epidemiology,* **30**: 292-293.

Blane, D. (2006). The life course, the social gradient, and health. In: *Social determinants of health: second edition* (edited by Marmot, M. and Wilkinson, R. G.). Oxford: Oxford University Press.

Bock, B. C., Marcus, B. H., Pinto, B. M. and Forsyth, L. H. (2001). Maintenance of physical activity following an individualized motivationally tailored intervention. *Annals of Behavioural Medicine,* **23**(2): 79-87.

Boniface, D. R., Cottee, M. J. and Skinner, A. (2001). Social and demographic factors predictive of change over seven years in CHD-related behaviours in men aged 18-49 years. *Public Health,* **115**: 246-252.

Booth, F. W., Gordon, S. E., Carlton, C. J. and Hamilton, M. T. (2000a). Waging war on modern chronic diseases: primary prevention through exercise biology. *Journal of Applied Physiology,* **88**: 774-787.

Booth, M. L., Owen, N., Bauman, A., Ornella, C. and Leslie, E. (2000b). Social-cognitive and perceived environment influences associated with physical activity in older Australians. *Preventive Medicine,* **31**: 15-22.

Boreham, C. and Riddoch, C. (2003). Physical activity and health through the lifespan. In: *Perspectives on Health and Exercise* (edited by McKenna, J. and Riddoch, C.). Basingstoke: Palgrave Macmillan.

Bosma, H., Marmot, M. G., Hemingway, H., Nicholson, A., Brunner, E. J. and Stansfeld, S. (1997). Low job control and risk of coronary heart disease in the Whitehall II (prospective cohort) study. *British Medical Journal,* **314**: 558-565.

Bouchard, C. and Rankinen, T. (2006). Are people physically inactive because of their genes? *Journal of Physical Activity and Health,* **3**(3): 335.

Bowling, A. (2005). Just one question: if one question works, why ask several? *Journal of Epidemiology and Community Health,* **59**(5): 342-345.

Briggs, D. J. and Elliott, P. (1995). The use of geographical information systems in studies on environment and health. *World Health Statistics Quarterly,* **48**: 85-94.

Briscoe, M. (1987). Why do people go to the doctor? Sex differences in the correlates of GP consultations. *Social Science and Medicine,* **25**(5): 507-513.

Brownson, R. C., Baker, E. A., Housemann, R. A., Brennan, L. K. and Bacak, S. J. (2001). Environmental and policy determinants of physical activity in the United States. *American Journal of Public Health,* **91**(12): 1995-2003.

Brunner, E. and Marmot, M. (2006). Social organisation, stress and health. In: *Social determinants of health: second edition* (edited by Marmot, M. and Wilkinson, R. G.). Oxford: Oxford University Press.

Burton, N. W. and Turrell, G. (2000). Occupation, hours worked, and leisure-time physical activity. *Preventive Medicine,* **31**(6): 673-681.

Burton, N. W., Turrell, G. and Oldenburg, B. (2003). Participation in recreational physical activity: why do socio-economic groups differ? *Health Education and Behaviour,* **30**(2): 225-244.

Campbell, S. M. and Roland, M. O. (1996). Why do people consult the doctor? *Family Practice,* **13**(1): 75-83.

Carlisle, R., Avery, A. J. and Marsh, P. (2002). Primary care teams work harder in deprived areas. *Journal of Public Health Medicine,* **24**(1): 43-48.

Carlisle, S. (2001). Inequalities in health: contested explanations, shifting discourses and ambiguous policies. *Critical Public Health,* **11**(3): 267-281.

Carr-Hill, R. and Chalmers-Dixon, P. (2002). *A review of methods for monitoring and measuring social inequality, deprivation and health inequality.* York: Centre for Health Economics, University of York.

Carr-Hill, R. and Rice, N. (1995). Is enumeration district level an improvement on ward level analysis in studies of deprivation and health? *Journal of Epidemiology and Community Health,* **49**(Suppl 2): S28-S29.

Carr-Hill, R., Rice, N. and Roland, M. (1996). Socioeconomic determinants of rates of consultation in general practice based on fourth national morbidity survey of general practices. *British Medical Journal,* **312**: 1008-1013.

Carstairs, V. and Morris, R. (1989). Deprivation: explaining differences in mortality between Scotland, and England and Wales. *British Medical Journal,* **299**: 886-889.

Cash, T. F., Novy, P. L. and Grant, J. R. (1994). Why do women exercise? Factor analysis and further validation of the Reasons for Exercise Inventory. *Perception and Motor Skills,* **78**(2): 539-544.

Casweb (2004) *Casweb: web interface to Census aggregate outputs and digital boundary data.* http://www.census.ac.uk/casweb: accessed 2004-2005.

Cavill, N. and Bauman, A. (2004). Changing the way people think about health enhancing physical activity: do mass media campaigns have a role? *Journal of Sports Sciences,* **22**: 771-790.

Chambers, R., Chambers, C. and Campbell, I. (2000). Exercise promotion for patients with significant medical problems. *Health Education Journal,* **59**: 90-98.

Chaturvedi, N. and Ben-Shlomo, Y. (1995). From the surgery to the surgeon: does deprivation influence consultation and operation rates? *British Journal of General Practice,* **45**: 127-131.

Chinn, D. J., White, M., Harland, J., Drinkwater, C. and Raybould, S. (1999). Barriers to physical activity and socioeconomic position: implications for health promotion. *Journal of Epidemiology and Community Health,* **53**: 191-192.

Christie, S. M. L. and Fone, D. L. (2003). Does car ownership reflect socio-economic disadvantage in rural areas? A cross-sectional geographic study in Wales, UK. *Public Health,* **117**(2): 112-116.

Clark, D. O. (1995). Racial and educational differences in physical activity among older adults. *The Gerontologist,* **35**(4): 472-480.

Clark, D. O. (1999). Physical activity and its correlates among urban primary care patients aged 55 years or older. *Journal of Gerontology,* **54**(1): S41-S48.

Clark, D. O. and Nothwehr, F. (1999). Exercise self-efficacy and its correlates among socioeconomically disadvantaged older adults. *Health Education & Behaviour,* **26**(4): 535-546.

Clark, D. O., Patrick, D. L., Grembowski, D. and Durham, M. L. (1995). Socio-economic status and exercise self-efficacy in later life. *Journal of Behavioural Medicine,* **18**: 355-376.

Coggins, A., Swanston, D. and Crombie, H. (1999). *Physical activity and inequalities: a briefing paper.* London: Health Education Authority.

Collins, M. (2004). Sport, physical activity and social exclusion. *Journal of Sports Sciences,* **22**: 727-740.

Conn, V. S. (1998). Older adults and exercise: path analysis of self-efficacy related constructs. *Nursing Research,* **47**(3): 180-189.

Connelly, J. (2002). The Behaviour Change Consortium studies: missed opportunities-individual focus with inadequate engagement with personhood and socio-economic realities. *Health Education Research,* **17**(6): 691-695.

Cook, P. A. (2001). Knowing the risk: relationships between risk behaviour and health-knowledge. *Public Health,* **115**: 54-61.

Cooper, A. (2003). Objective measurement of physical activity. In: *Perspectives on Health and Exercise* (edited by McKenna, J. and Riddoch, C.). Basingstoke: Palgrave Macmillan.

Corti, B., Donovan, R. J. and Holman, D. A. C. (1996). Factors influencing the use of physical activity facilities: results from qualitative research. *Health Promotion Journal of Australia,* **6**(1): 16-21.

Courtenay, W. H., McCreary, D. R. and Merighi, J. R. (2002). Gender and ethnic differences in health beliefs and behaviours. *Journal of Health Psychology,* **7**: 219-213.

Cox, J. (1998). Poverty in rural areas: is more hidden but no less real than in urban areas. *British Medical Journal,* **316**(7133): 722.

Craig, C. L., Brownson, R. C., Cragg, S. E. and Dunn, A. L. (2002). Exploring the effect of the environment on physical activity. *American Journal of Preventive Medicine,* **23**((2S)): 36-43.

Crespi, I. (2004). Socialization and Gender Roles within the Family: a Study on Adolescents and their Parents in Great Britain. *The Annals of the Marie Curie Fellowship Association,* **3**.

Crespo, C. J., Ainsworth, B. E., Keteyian, S., Heath, G. and Smit, E. (1999). Prevalence of physical inactivity and its relation to social class in US adults: results from the Third National Health and Nutrition Examination Survey, 1988-1994. *Medicine and Science in Sports and Exercise,* **31**(12): 1821-1827.

Crespo, C. J., Smith, E., Andersen, R. E., Carter-Pokras, O. and Ainsworth, B. E. (2000). Race/ethnicity, social class and their relation to physical inactivity during leisure time: results from the Third National Health and Nutrition Examination Survey, 1988-1994. *American Journal of Preventive Medicine,* **18**(1): 46-53.

Crombie, I. K., Irvine, L., Williams, B., R, M. A., Slane, P. W., M, A. E. and McMurdo, M. T. (2004). Why older people do not participate in leisure time physical activity: a survey of activity levels, beliefs and deterrents. *Age and Ageing,* **33**: 287-292.

Crone, D., Johnston, L. and Grant, T. (2004). Maintaining quality in exercise referral schemes: a case study of professional practice. *Primary Health Care Research and Development,* **5**(5): 96-103.

Crone, D., Smith, A. and Gough, B. (2005). ' I feel totally at one, totally alive and totally happy': a psycho-social explanation of the physical activity and mental health relationship. *Health Education Research,* **20**(5): 600-611.

Davey, R. C. (2003). The obesity epidemic: too much food for thought? *British Journal of Sports Medicine,* **38**: 360-363.

Davey Smith, G. and Egger, M. (1992). Socioeconomic differences in mortality in Britain and the United States. *American Journal of Public Health,* **82**: 1079-1081.

Day, F. and Nettleton, B. (2001). The Scottish Borders general practitioners exercise referral scheme (GPERS). *Health Bulletin,* **59**(5): 343-6.

De Bourdeaudhuij, I., Sallis, J. and Saelens, B. E. (2003). Environmental correlates of physical activity in a sample of Belgian adults. *American Journal of Health Promotion,* **18**(1): 83-92.

Deaton, A. (2002). Policy implications of the gradient of health and wealth. *Health Affairs,* **March/April**: 13-30.

Deaville, J., Earp, A., Jones, L., Davies, P., Parry, J., MacKenzie, G. and Gillon, N. (2004). *Health data - a health check: a technical research report funded by DEFRA*. London: The Stationery Office.

Department for Environment Food and Rural Affairs. (2000). *Our Countryside: the future - a fair deal for rural England*. London: DEFRA.

Department of Culture Media and Sport. (2002). *Game Plan: a strategy for delivering Government's sport and physical activity objectives*. London: Cabinet Office.

Department of Health. (1992). *The Health of the Nation*. London: The Stationery Office.

Department of Health. (1998). *Smoking kills: a White Paper on tobacco*. London: The Stationery Office.

Department of Health. (1999a). *Mental Health National Service Framework: modern standards and service models*. London: The Stationery Office.

Department of Health. (1999b). *Saving Lives: Our Healthier Nation*. London: The Stationery Office.

Department of Health. (2000a). *Coronary Heart Disease National Service Framework: modern standards and service models*. London: The Stationery Office.

Department of Health. (2000b). *Health Survey for England 1998*. London: The Stationery Office.

Department of Health. (2001a). *Diabetes National Service Framework: modern standards and service models*. London: The Stationery Office.

Department of Health. (2001b). *Exercise referral systems: a national quality assurance framework*. London: The Stationery Office.

Department of Health. (2001c). *Older people National Service Framework: modern standards and service models*. London: The Stationery Office.

Department of Health. (2003a). *Health survey for England 2003 Volume 1: Cardiovascular disease*. London: The Stationery Office.

Department of Health. (2003b). *Health survey for England 2003 Volume 2: Risk factors for cardiovascular disease*. London: The Stationery Office.

Department of Health. (2004a). *At least five a week: evidence on the impact of physical activity and its relationship to health*. London: The Stationery Office.

Department of Health. (2004b). *Choosing health? Choosing activity: a consultation on how to increase physical activity*. London: The Stationery Office.

Department of Health. (2005a). *Choosing a better diet: a food and health action plan*. London: The Stationery Office.

Department of Health. (2005b). *Choosing activity: a physical activity action plan*. London: The Stationery Office.

Department of Health and Social Security. (1980). *Inequalities in health: report of a working group chaired by Sir Douglas Black.* London: DHSS.

Department of the Environment Transport and the Regions (2000) DETR, London.

Devereaux Melillo, K., Crocker Houde, S., Williamson, E. and Futrell, M. (2000). Perceptions of nurse practitioners regarding their roles in physical activity and exercise prescription for older adults. *Clinical Excellence for Nurse Practitioners,* 4(2): 108-116.

Dishman, R. K. (1994). Motivating older adults to exercise. *Southern Medical Journal,* **87**: S79-S82.

Dishman, R. K. and Sallis, J. F. (1994). Determinants and interventions for physical activity and exercise. In: *Physical activity, fitness, and health: international proceedings and consensus statement* (edited by Bouchard, C., Shephard, R. J. and Stephens, T.). Champaign, IL: Human kinetics.

Doran, T., Drever, F. and Whitehead, M. (2004). Is there a north-south divide in social class inequalities in health in Great Britain? Cross sectional study using data from the 2001 census. *British Medical Journal,* **328**: 1043-1045.

Dowda, M., Ainsworth, B. E., Addy, C. L., Saunders, R. P. and Riner, W. (2003). Correlates of physical activity among U.S. young adults, 18 to 30 years of age, from NHANES III. *Annals of Behavioural Medicine,* **26**(1): 15-23.

Dowell, A. C., Ochera, J. J., Hilton, S. R., Bland, J. M., Harris, T., Jones, D. R. and Katbamna, S. (1996). Prevention in practice: results of a 2-year follow-up of routine health promotion interventions in general practice. *Family Practice,* **13**(4): 357-362.

Doyal, L. (2001). Sex, gender, and health: the need for a new approach. *British Medical Journal,* **323**: 1061-1063.

Droomers, M., Schrivers, C. and Machenback, J. (2001). Educational level and decreases in leisure-time physical activity: predictors from the longitudinal GLOBE study. *Journal of Epidemiology and Community Health,* **55**: 562-568.

Droomers, M., Schrivers, C., Van de Mheen, H. and Mackenbach, J. (1998). Educational differences in leisure-time physical inactivity: a descriptive explanatory study. *Social Science and Medicine,* **47**(11): 1665-1676.

Dugdill, L. and Graham, R. (2004). Promoting physical activity: building sustainable interventions. In: *Exercise in the prevention and treatment of disease* (edited by Gormley, J. and Hussey, J.). Oxford: Blackwell.

Duncan, G. E., Sydeman, S. J., Perri, M. G., Limacher, M. C. and Martin, A. D. (2001). Can sedentary adults accurately recall the intensity of their physical activity? *Preventive Medicine,* **33**: 18-26.

Dunn, A. L. (1996). Getting started - a review of physical activity adoption studies. *British Journal of Sports Medicine,* **30**(3): 193-9.

Dunn, J. R. (2002). Housing and inequalities in health: a study of socio-economic dimensions of housing and self-reported help from a survey of Vancouver residents. *Journal of Epidemiology and Community Health,* **57**: 671-681.

Eachus, J., Williams, M., Chan, P., Smith, G. D., Grainge, M., Donovan, J. and Frankel, S. (1996). Deprivation and cause specific morbidity: evidence from the Somerset and Avon survey of health. *BMJ,* **312**(7026): 287-292.

Eakin, E. G., Glasgow, R. E. and Riley, K. M. (2000). Review of primary care-based physical activity intervention studies. *The Journal of Family Practice,* **49**(2): 158-168.

Eaton, C. B. and Menard, L. M. (1998). A systematic review of physical activity promotion in primary care office settings. *British Journal of Sports Medicine,* **32**: 11-16.

Ecob, R. and Jones, K. (1998). Mortality variations in England and Wales between types of place: an analysis of the ONS longitudinal study. *Social Science and Medicine,* **47**(12): 2055-2066.

Economic & Social Research Council (2000) *Background to 2001 census geography.* http://.geog.soton.ac.uk/research/oa2001/background.htm: accessed 26th January, 2004.

Economic & Social Research Council (2004a) 2001 census of population program. *Census programme workshop,* 7th January, London School of Hygiene & Tropical Medicine.

Economic & Social Research Council (2004b) Social classification: the making of the NS-SEC. *Royal Statistical Society,* June, London.

Ellaway, A., Anderson, A. and MacIntyre, S. (1997). Does area of residence affect body size and shape? *International Journal of Obesity and Related Metabolic Disorders,* **21**(4): 304-308.

Ellaway, A., MacIntyre, K. and McKay, L. (2003). The historical specificity of early life car ownership as an indicator of socioeconomic position. *Journal of Epidemiology and Community Health,* **57**: 277-278.

Elley, R., Kerse, N. M. and Arroll, B. (2003). Why target sedentary adults in primary care? Baseline results from the Waikato Heart, Heart, and Activity Study. *Preventive Medicine*, **37**: 342-348.

Emslie, C., Hunt, K. and MacIntyre, S. (1999). Problematizing gender, work and health: the relationship between gender, occupational grade, working conditions and minor morbidity in full-time bank employees. *Social Science and Medicine*, **48**: 33-48.

Epstein, L. H. (1998). Integrating theoretical approaches to promote physical activity. *American Journal of Preventive Medicine*, **15**(4): 257-265.

Estabrooks, P. A. and Gyurcsik, N. C. (2003). Evaluating the impact of behavioural interventions that target physical activity: issues of generalizability and public health. *Psychology of Sport and Exercise*, **4**: 41-55.

Estabrooks, P. A., Lee, R. E. and Gyurcsik, N. C. (2003). Resources for physical activity participation: does availability and accessibility differ by neighbourhood socioeconomic status? *Annals of Behavioural Medicine*, **25**(2): 100-104.

Ewing, R. (2005). Building environment to promote health. *Journal of Epidemiology and Community Health*, **59**: 536-537.

Ewing, R., Schmid, T. L., Killingsworth, R., Zlot, A. and Raudenbush, S. (2003). Relationship between urban sprawl and physical activity, obesity, and morbidity. *American Journal of Health Promotion*, **18**(1): 47-57.

Eyler, A. A. (2003). Personal, social, and environmental correlates of physical activity in rural Midwestern white women. *American Journal of Preventive Medicine*, **25**(3Si): 86-92.

Farmer, J. C., Baird, G. A. and Iversen, L. (2001). Rural deprivation: reflecting reality. *British Journal of General Practice*, **51**: 486-491.

Fielder, H., Shorney, S. and Wright, D. (1995). Lessons from a pilot study on prescribing exercise. *Health Education Journal*, **54**(4): 445-452.

Filakti, H. and Fox, J. (1995). Differences in mortality by housing tenure and by car access from the OPCS Longitudinal Study. *Population Trends*, **81**: 27-30.

Finkenberg, M. E., DiNucci, J., McCune, S. L. and McCune, E. D. (1994). Analysis of course type, gender, and personal incentives to exercise. *Perception and Motor Skills*, **78**(1): 155-159.

Fogelman, Y., Bloch, B. and Kahan, E. (2004). Assessment of participation in physical activities and relationship to socio-economic and health factors - the controversial value of self perception. *Patient Education and Counselling,* **53**(1): 95-99.

Forbes, A. and Wainwright, S. (2001). On the methodological, theoretical and philosophical context of health inequalities research: a critique. *Social Science and Medicine,* **53**: 801-816.

Ford, E. S., Merritt, R. K., Heath, G. W., Powell, K. E., Washburn, R. A., Kriska, A. and Haile, G. (1991). Physical activity behaviours in lower and higher socioeconomic status populations. *American Journal of Epidemiology,* **133**(12): 1246-1256.

Foster, C. and Hillsdon, M. (2004). Changing the environment to promote health-enhancing physical activity. *Journal of Sports Sciences,* **22**(8): 755-769.

Foster, C., Hillsdon, M. and Grundy, C. (2002). Understanding environmental determinants for physical activity - What can G.I.S offer? Presented at The Cooper Institute Conference Series "Innovative Approaches to Understanding and Influencing Physical Activity", October 4-6, Dallas.

Foster, C., Hillsdon, M. and Thorogood, M. (2004). Environmental perceptions and walking in English adults. *Journal of Epidemiology and Community Health,* **58**: 924-928.

Fox, K., Biddle, S., Edmunds, L., Bowler, I. and Killoran, A. (1997). Physical activity promotion through primary health care in England. *British Journal of General Practice,* **47**: 367-369.

Friedman, D. B., Williams, A. N. and Levine, B. D. (1997). Compliance and efficacy of cardiac rehabilitation and risk factor modification in the medically indigent. *American Journal of Cardiology,* **79**: 281-285.

Furnham, A. and Kirkcaldy, B. (1997). Age and sex differences in health beliefs and behaviours. *Psychology Reports,* **80**: 63-66.

Galdas, P. M., Cheater, F. and Marshall, P. (2005). Men and health help-seeking behaviour: literature review. *Journal of Advanced Nursing,* 49(6): 616-623.

Galobardes, B., Shaw, M., Lawlor, D. A., Lynch, J. W. and Davey Smith, G. (2006). Indicators of socioeconomic position (part 1). *Journal of Epidemiology and Community Health,* **60**: 7-12.

Garman, S. (2005). The social context of health promotion in a globalising world. In: *Promoting health: global perspectives* (edited by Scriven, A. and Garman, S.). Basingstoke: Palgrave Macmillan.

Gatrell, A., Garnett, S., Rigby, J., Maddocks, A. and Kirwan, M. (1998). Uptake of screening for breast cancer in South Lancashire. *Public Health,* **112**(5): 297-301.

Geronimus, A. T. and Bound, J. (1998). Use of census-based aggregate variables to proxy for socioeconomic group: evidence from national samples. *American Journal of Epidemiology,* **148**(5): 475-486.

Ghaye, T. (2000). Into the reflective mode: brigding the stagnant moat. *Reflective Practice,* **1**(1): 5-9.

Ghaye, T. and Lillyman, S. (1997). *Learning journals and critical incidents: reflective practice for health care professionals.* Dinton: Quay Books.

Gidlow, C., Johnston, L., Crone, D., Ellis, N. and James, D. (in press). A systematic review of evidence of the relationship between socio-economic position and physical activity. *Health Education Journal.*

Gidlow, C., Johnston, L., Crone, D. and James, D. (2005). Attendance of exercise referral schemes in the UK: a systematic review. *Health Education Journal,* **64**(2): 168-186.

Giles-Corti, B. and Donovan, R. J. (2002a). The relative influence of individual, social and physical environment determinants of physical activity. *Social Science and Medicine,* **54**: 1793-1812.

Giles-Corti, B. and Donovan, R. J. (2002b). Socioeconomic status differences in recreational physical activity levels and real and perceived access to a supportive physical environment. *Preventive Medicine,* **35**: 601-611.

Gill, D. L. (2002). Gender and sport behaviour. In: *Advances in sports psychology: second edition* (edited by Horn, T.). Leeds: Human Kinetics Publishers, Inc.

Gillespie, L. D., Gillespie, W. J., Robertson, M. C., Lamb, S. E., Cumming, R. G. and Rowe, B. H. (2004). Interventions for preventing falls in elderly people [Cochrane review]. *The Cochrane library,* **Issue 1**: Oxford: Update Software.

Gilthorpe, M. S. and Wilson, R. C. (2003). Rural/urban differences in the association between deprivation and healthcare utilisation. *Social Science and Medicine,* **57**: 2055-2063.

Glynn, L. M., Christenfeld, N. and Gerin, W. (1999). Gender, social support, and cardiovascular response to stress. *Psychosomatic Medicine,* **61**: 234-242.

Goddard, M. and Smith, P. (2001). Equity of access to health care services: theory and evidence from the UK. *Social Science and Medicine,* **53**: 1149-1162.

Godin, G. and Shephard, R. J. (1983). Physical fitness promotion programmes: effectiveness in modifying exercise behaviour. *Canadian Journal of Applied Sports Science,* **8**: 2.

Goldman, N. (2001). Social inequalities in health: disentangling the underlying mechanisms. *Annals New York Academy of Sciences,* **94**: 118-139.

Goldthorpe, J. H. (1997). The 'Goldthorpe' class schema: some observations on conceptual issues in relation to the ESRC review of government social classifications. In: *Constructing classes: towards a new social classification for the UK* (edited by Rose, D. and O'Reilly, K.). Swindon: ESRC/ONS.

Gordon, D. (1995). Weighting and validation of census based indices. *Journal of Epidemiology and Community Health,* **49**(Suppl.2): S39-S44.

Gottfredson, L. S. (2004). Intelligence: is it the epidemiologists' elusive " fundamental cause" of social class inequalities in health? *Journal of Personality and Social Psychology,* **86**(1): 174-199.

Gould, M. M., Thorogood, M., Iliffe, S. and Morris, J. N. (1995). Promoting physical activity in primary care: measuring the knowledge gap. *Health Education Journal,* **54**: 304-311.

Graham, R. C., Dugdill, L. and Cable, T. (2005). Health practitioner perspectives in exercise referral: implications for the referral process. *Ergonomics,* **48**(11): 1411-1422.

Grant, T. (1999). *ProActive: increasing physical activity through a community-based intervention: a study to assess the effectiveness of the Somerset Physical Activity Referral Scheme. Unpublished report.* Somerset: Somerset Health Authority.

Grembowski, D., Patrick, D., Diehr, P., Durham, M., Beresford, S., Kay, E. and Hecht, J. (1993). Self-efficacy and health behaviour among older adults. *Journal of Health and Social Behaviour,* **34**(June): 89-104.

Gribben, B., Goodyear-Smith, F., Grobbelaar, M., O'Neill, D. and Walker, S. (2000). The early experience of general practitioners using Green Prescription. *New Zealand Medical Journal,* **113**(1117): 372-3.

Grzywacz, J. G. and Marks, N. F. (2001). Social inequalities and exercise during adulthood: toward an ecological perspective. *Journal of Health and Social Behaviour,* **42**(June): 202-220.

Gulliford, M., Morgan, M., Hughes, D., Beech, R., Figeroa-Munoz, J., Gibson, B., Hudson, M., Arumugam, C., Connell, P., Mohiddin, A. and Sedgwick, J. (2001). *Access to Health Care Report of a Scoping Exercise for the National Co-*

ordinating Centre for NHS Service Delivery and Organisation R & D (NCCSDO) 26 February 2001: The Public Health and Health Services Research Group, Department of Public Health Sciences, King's College London.

Guthrie, C. (2001). Prevention of type 2 diabetes: health promotion helps no one. *British Medical Journal,* **323**(7319): 997.

Hammond, J. M., Brodie, D. A. and Bundred, P. E. (1997). Exercise on prescription: Guidelines for health professionals. *Health Promotion International,* **12**(1): 33-41.

Hardcastle, J. D., Chamberlain, J. O., Robinson, M. H., Moss, S. M., Amar, S. S., Balfour, T. W., James, P. D. and Mangham, C. M. (1996). Randomised controlled trial of faecal-occult-blood screening for colorectal cancer. *The Lancet,* **348**(9040): 1472-1477.

Hardcastle, S. and Taylor, A. H. (2001). Looking for more than weight loss and fitness gain: Psychosocial dimensions among older women in a primary-care exercise-referral program. *Journal of Aging & Physical Activity,* **9**(3): 313-328.

Hardman, A. E. (1999). Physical activity intervention studies with health-related outcomes: some issues. *Journal of Sports Sciences,* **17**: 685-687.

Harland, J., White, M., Drinkwater, C., Chinn, D., Farr, L. and Howel, D. (1999). The Newcastle exercise project: a randomised controlled trial of methods to promote physical activity in primary care. *British Medical Journal,* **319**: 828-832.

Harris, T., Cook, D. G., Shah, S., Victor, C. R., DeWilde, S., Beighton, C. and Rink, E. (2002). Mammography uptake predictors in older women. *Family Practice,* **19**(6): 661-664.

Harrison, R. A., McNair, F. and Dugdill, L. (2005a). Access to exercise referral schemes - a population based analysis. *Journal of Public Health Medicine,* **27**(4): 326-330.

Harrison, R. A., Roberts, C. and Elton, P. J. (2005b). Does primary care referral to an exercise programme increase physical activity one year later? A randomised controlled trial. *Journal of Public Health,* **27**(1): 25-32.

Harvey, J., Erdos, G., Challinor, S., Drew, S., Taylor, S., Ash, R., Gibson, C., Scarr, C., Dixon, F., Hinde, A. and Moffat, C. (2001). The relationship between attitudes, demographic factors and perceived consumption of meats and other proteins in relation to the BSE crisis: a regional study in the United Kingdom. *Health, Risk & Society,* **3**(2): 181-196.

Hayes, J., Availability of the Census Area Statistics from 2001 Census, Census Dissemination Unit, University of Manchester (personal communication). To: Gidlow, C., March 2004a.

Hayes, J., Census Aggregate Statistics. Census Programme Workshop, London School of Hygiene and Tropical Medicine, (personal communication). To: 7th January 2004 2004b.

Haynes, R. and Gale, S. (2000). Deprivation and poor health in rural areas: inequalities hidden by averages. *Health and Place,* **6**: 275-285.

Head, J., Kivimaki, M., Martikainen, P., Vahtera, J., Ferrie, J. E. and Marmot, M. G. (2006). Influence of change in psychosocial work characteristics on sickness absence: the Whitehall II study. *Journal of Epidemiology and Community Health,* **60**: 55-61.

Health and Social Needs Analysis Group. (2004). *Health and social needs in Somerset 2004: third report.* Somerset: HSNAG.

Health Development Agency. (2004). *The effectiveness of public health interventions for increasing physical activity among adults: a review of reviews. Evidence briefing: first edition.* London: HDA.

Health Education Authority. (1994). *Helping people change: health promotion in primary health care.* London: HEA.

Hennekens, C. H. and Buring, J. E. (1987). *Epidemiology in Medicine.* Philadelphia: Lippincott Williams & Wilkins.

Higgs, G. and White, S. D. (1997). Changes in service provision in rural areas. Part 1: the use of GIS in analysing accessibility to services in rural deprivation research. *Journal of Rural Studies,* **13**(4): 441-450.

Hillsdon, M. (1998). Promoting physical activity: issues in primary health care. *International Journal of Obesity,* **22**(Suppl 2): S52-S54.

Hillsdon, M., Cavill, N., Nanchalal, K., Diamond, I. and White, I. R. (2001). National level promotion of physical activity: results from England's *ACTIVE* for LIFE campaign. *Journal of Epidemiology and Community Health,* **55**: 755-761.

Hillsdon, M., Foster, C. and Thorogood, M. (2005). Interventions for promoting physical activity. *The Cochrane Database of Systematic Reviews*(Issue 1): Art. No.: CD003180.pub2. DOI: 10.1002/14651858.CD003180.pub2.

Hillsdon, M. and Thorogood, M. (1996). A systematic review of physical activity promotion strategies. *British Journal of Sports Medicine,* **30**: 84-89.

Hillsdon, M., Thorogood, M. and Foster, C. (1999). A systematic review of strategies to promote physical activity. In: *Benefits and hazards of exercise. Volume 1, pp25-46* (edited by McAuley, D.). London: BMJ Publishing.

Hillsdon, M., Thorogood, M., White, I. and Foster, C. (2002). Advising people to take more exercise is ineffective: a randomised controlled trial of physical activity promotion in primary care. *International Journal of Epidemiology,* **32**: 808-815.

Hinton, P. R. (1995). *Statistics explained: a guide for social scientists.* London: Routledge.

Hippisley-Cox, J., Hardy, C., Pringle, M., Carlisle, R., Fielding, K. and Chilvers, C. (1997a). Effect of deprivation on general practitioners referral rates: author's reply. *British Medical Journal,* **315**(7112): 883.

Hippisley-Cox, J., Hardy, C., Pringle, M., Fielding, K., Carlisle, R. and Chilvers, C. (1997b). The effect of deprivation on variations in general practitioner's referral rates: a cross-sectional study of computerised data on new medical and surgical outpatient referrals in Nottinghamshire. *British Medical Journal,* **314**: 1458-1461.

Hoare, J. (2003). Comparison of area-based inequality measures and disease morbidity in England, 1994-1998. *National Statistics Quarterly,* **18**: 18-24.

Hoggart, K., Buller, H. and Black, R. (1995). *Rural Europe: identity and change.* London: Arnold.

Hope, S., Lewis, M., Bird, S., Elliot, J. and Ball, A. (2002) *Powys Exercise on Prescription Scheme: two and four year follow up.* http://healthcare.powys.org.uk/eopexecsumm.htm: accessed 14th October 2003,

Howden-Chapman, P. (2004). Housing standards: a glossary of housing and health. *Journal of Epidemiology and Community Health,* **58**: 162-168.

Huggins, A., Somerford, P. and Rouse, I. (1996). *A report on men's health: Western Australia 1996.* Western Australia: School of Public Health, Curtin University, in collaboration with Epidemiology Branch, Health Information Centre, Health Department of Western Australia.

Hunt, K. and Annandale, E. (1999). Relocating gender and morbidity: examining men's and women's health in contemporary western societies. Introduction to special issue on gender and health. *Social Science and Medicine,* **48**: 1-5.

Imperial Cancer Research fund OXCHECK study group. (1995). Effectiveness of health checks conducted by nurses in primary care: final results of the OXCHECK study. *British Medical Journal,* **310**: 1099-1104.

Jackson, C. (1997) North Yorkshire Specialist Health Promotion Service, Harrogate.

Jackson, C., Bell, F., Smith, R. A. and Dixey, R. (1998). Do adherers and non-adherers to a GP exercise referral scheme differ in their long-term physical activity levels? (conference communication). *Journal of Sports Sciences,* **16**(1): 84.

Jakes, R. W. and Wareham, N. J. (2003). Epidemiology of activity and physical health. In: *Perspectives on Health and Exercise* (edited by McKenna, J. and Riddoch, C.). Basingstoke: Palgrave Macmillan.

Janssen, I., Boyce, W. F., Simpson, K. and Pickett, W. (2006). Influence of individual- and area-level measures of socio-economic status on obesity, unhealthy eating, and physical inactivity in the Canadian adolescents. *American Journal of Clinical Nutrition,* **83**(1): 139-145.

Jarman, B. (1983). Identification of underprivileged areas. *British Medical Journal,* **286**: 1705-1708.

Jarman, B. (1984). Underprivileged areas: validation and distribution of scores. *British Medical Journal,* **289**: 1287-1592.

Jarvis, M. J. and Wardle, J. (2006). Social patterning of individual health behaviours: the case of cigarette smoking. In: *Social determinants of health: second edition* (edited by Marmot, M. and Wilkinson, R. G.). Oxford: Oxford University Press.

Johnston, L. H., Warwick, J., De Ste Croix, M., Crone, D. and Sidford, A. (2005). The nature of all 'inappropriate referrals' made to a countywide physical activity referral scheme: implications for practice. *Health Education Journal,* 64(1): 58-69.

Jollife, J. A., Rees, K., Taylor, R., Thompson, D., Oldridge, N. and Ebrahim, S. (2000). Exercise based cardiac rehab for CHD (Cochrane review). *Cochrane library 4, 2000.*

Jones, I. G. and Cameron, D. (1984). Social class analysis - an embarrassment to epidemiology. *Community Medicine,* 6(1): 37-46.

Jordan, H., Roderick, P., Martin, D. and Barnett, S. (2004a). Distance, rurality and the need for care: access to health services in South West England. *International Journal of Health Geographics,* **3**: 21-29.

Jordan, J. H., Roderick, P. and Martin, D. (2004b). The Index of Multiple Deprivation 2000 and accessibility effects on health. *Journal of Epidemiology and Community Health,* **58**: 250-257.

Jorgensen, O. D., Kronberg, O. and Fenger, C. A. (2002). A randomised study of screening for colorectal cancer using faecal occult blood testing: results after 13 years and seven biennial screening rounds. *Gut,* **50**: 29-32.

Kahn, E. B., Ramsey, L. T., Brownson, R. C., Heath, G. W., Howze, E. H., Powell, K. E., Stone, E. J., Rajab, M. W., Corso, P. and Task Force on Community Preventive Services. (2002). The effectiveness of interventions to increase physical activity: a systematic review. *American Journal of Preventive Medicine,* **22**(4S): 73-107.

Kaplan, G. A. and Keil, J. E. (1993). Socio-economic factors and cardiovascular disease: a review of the literature. *Circulation,* **88**(4): 1964-1972.

Kaplan, G. A. and Lazarus, N. B. (1991). Psychosocial factors in the natural history of physical activity. *American Journal of Preventive Medicine,* **7**: 12-17.

Kaplan, G. A., Pamuk, E. R., Lynch, J. W., Cohen, R. D. and Balfour, J. L. (1996). Inequality in income and immortality in the United States: analysis of mortality and potential pathways. *British Medical Journal,* **312**: 999-1003.

Kaplan, M. S., Newsom, J. T., McFarland, B. H. and Lu, L. (2001). Demographic and psychosocial correlates of physical activity in late life. *American Journal of Preventive Medicine,* **21**(4): 306-312.

Kapur, N., Hunt, I., Lunt, M., Mcbeth, J., Creed, F. and MacFarlane, G. (2005). Primary-care consultation predictors in men and women: a cohort study. *British Journal of General Practice,* **55**: 108-113.

Kar, S. B., Pascual, C. A. and Chickering, K. L. (1999). Empowerment of women for health promotion: a meta-analysis. *Social Science and Medicine,* **49**: 1431-1460.

Kavanagh, A. M., Goller, J. L., King, T., Jolley, D., Crawford, D. and Turrell, G. (2005). Urban area disadvantage and physical activity: a multilevel study in Melbourne, Australia. *Journal of Epidemiology and Community Health,* **59**: 934-940.

Keene, J. and Li, X. (2005). Age and gender differences in health service utilisation. *Journal of Public Health,* **27**(1): 74-79.

Kelly, L. P., Reilly, J. J., Fisher, A., Montgomery, C., Williamson, A., McColl, J. H., Paton, J. Y. and Grant, S. (2005). Effect of socio-economic status on objectively measured physical activity. *Archives of Disease Childhood,* **Published online 20 Oct 2005. doi:10.1136/adc.2005.080275.**

Kendig, H., Browning, C. and Teshuva, K. (1998). Health actions and social class among older Australians. *Australian and New Zealand Journal of Public Health,* **22**: 808-813.

Kerr, J., Eves, F. and Carroll, D. (2003). The environment: the greatest barrier? In: *Perspectives on Health and Exercise* (edited by McKenna, J. and Riddoch, C.). Basingstoke: Palgrave Macmillan.

Kim, S., Symons, M. and Popkin, B. M. (2004). Contrasting socioeconomic profiles related to healthier lifestyles in China and the United States. *American Journal of Epidemiology,* **159**(2): 184-191.

King, A. C. (1994). Clinical and community interventions to promote and support physical activity participation. In: *Advances in exercises adherence* (edited by Dishman, R. K.). Champaigne, IL: Human Kinetics.

King, A. C. (1999). Environmental and policy approaches to the promotion of physical activity. In: *Lifestyle Medicine* (edited by Rippe, J. M.). Norwalk: CT Blackwell Science.

King, A. C. (2000). Role of exercise counselling in health promotion. *British Journal of Sports Medicine,* **34**(2): 80-81.

King, A. C., Blair, S. N., Bild, D. E., Dishman, R. K., Dubbert, P. M., Marcus, B. H., Oldridge, N. B., Paffenbarger, R. S., Powell, K. E. and Yeager, K. K. (1992). Determinants of physical activity and interventions in adults. *Medicine and Science in Sports and Exercise,* **24**(6 Suppl.): S221-S236.

King, A. C., Jeffrey, R. W., Fridinger, F., Dusenbury, L., Provence, S., Hedlund, S. A. and Spangler, K. (1995). Environmental and policy approaches to cardiovascular disease prevention through physical activity: issues and opportunities. *Health Education Quarterly,* **22**(4): 499-511.

King, A. C., Rejeski, W. J. and Buchner, D. M. (1998). Physical activity interventions targeting older adults. *American Journal of Preventive Medicine,* **15**(4): 316-333.

Kirkwood, B. R. and Sterne, J. A. C. (2003). *Essential medical statistics: second edition.* Oxford: Blackwell Publishing Ltd.

Kirtland, K. A., Porter, D. E., Addy, C. L., Neet, M. J., Williams, J. E., Sharpe, P. A., Neff, L. J., Kimsey, D. J. and Ainsworth, B. E. (2003). Environmental measures of physical activity supports: perception versus reality. *American Journal of Preventive Medicine,* **24**(4): 323-331.

Kweatowski, I., Health Promotion Manager for CHD, Taunton Deane PCT and Somerset Physical Activity Group (personal communication). Physical activity promotion in Somerset, smoking cessation programmes, and the future of the ProActive scheme. To: Gidlow, C., 2nd December 2005.

Kweatowski, I., Health Promotion Manager for CHD, Taunton Deane PCT and Somerset Physical Activity Group (personal communication). Future of the ProActive scheme. To: Gidlow, C., 17th February 2006.

Laaksonen, M., Prattala, R., Helasoja, V., Uutela, A. and Lahelma, E. (2003). Income and health behaviour: evidence from monitoring surveys among Finnish adults. *Journal of Epidemiology and Community Health,* **57**(9): 711-717.

Lamb, S., Bartlett, H., Ashley, A. and Bird, W. (2002). Can lay-led walking programmes increase physical activity in middle-aged adults? *Journal of Epidemiology and Community Health,* **56**: 246-252.

Lantz, P. M., House, J. S., Lepowski, J. M., Williams, D. R., Mero, R. P. and Chen, J. (1998). Socioeconomic factors, health behaviours, and mortality: results from a nationally representative prospective study of US adults. *Journal of the American Medical Association,* **279**(21): 1703-1708.

Lawlor, D. A. and Hanratty, B. (2001). The effect of physical activity advice given in routine primary care consultations: a systematic review. *Journal of Public Health Medicine,* **23**(3): 219-226.

Leary, M. R. (1992). Self presentational processes in exercise and sport. *Journal of Sport and Exercise Psychology,* **14**: 339-351.

Lee, P. (1995). Regional socio-economic variations and deprivation indices. *Local Government Studies,* **21**(2): 284-292.

Leslie, E., Saelens, B., Frank, L., Owen, N., Bauman, A., Coffee, N. and Hugo, G. (2005). Resident perceptions of walk ability attributes in objectively different neighbourhoods: a pilot study. *Health and Place,* **11**(3): 227-236.

Lewis, S. F. and Jensen, N. D. (1996). Screening sigmoidoscopy. Factors associated with the utilisation. *Journal of General Internal Medicine,* **11**: 542-544.

Liberatos, P., Link, B. G. and Kelsey, J. L. (1988). The measurement of social class in epidemiology. *Epidemiologic Reviews,* **10**: 87-121.

Lim, K. and Taylor, L. (2005). Factors associated with physical activity among older people - a population-based study. *Preventive Medicine,* **40**(1): 33-40.

Lindstrom, M., Hason, B. S. and Ostergren, P.-O. (2001). Socio-economic differences in leisure-time physical activity: the role of social participation and social capital in shaping health related behaviour. *Social Science and Medicine,* **52**: 441-451.

Linenger, J. M., Chesson, C. V. and Nice, S. D. (1991). Physical fitness gain following simple environmental change. *American Journal of Preventive Medicine,* **7**(5): 298-310.

Lord, J. C. and Green, F. (1995). Exercise on prescription: does it work? *Health Education Journal,* **54**: 453-464.

Lovett, A., Haynes, R., Sunnenburg, G. and Gale, S. (2002). Car travel time and accessibility by bus to general practitioner services: a study using patient registers GIS. *Social Science and Medicine,* **55**: 97-111.

Lowther, M., Mutrie, N. and Scott, E. M. (2002). Promoting physical activity in a socially and economically deprived community: a 12 month randomized control trial of fitness assessment and exercise consultation. *Journal of Sports Sciences,* **20**: 577-588.

Lynch, J. W., Kaplan, G. A. and Salonen, J. T. (1997). Wide to poor people behave poorly? Variation in adult health behaviours and psychosocial characteristics by stages of the socio-economic life course. *Social Science and Medicine,* **44**(6): 809-819.

MacDougall, C., Cooke, R., Owen, N., Wilson, K. and Bauman, A. (1997). Relating physical activity to health status, social connections and community facilities. *Australian and New Zealand Journal of Public Health,* **21**: 631-637.

MacIntyre, S. (1997). The Black Report and beyond what are the issues? *Social Science and Medicine,* 44(6): 723-745.

MacIntyre, S., Ellaway, A., Der, G., Ford, G. and Hunt, K. (1998). Do housing tenure and car access predict health because they are simply markers of income or self esteem? A Scottish study. *Journal of Epidemiology and Community Health,* **52**: 657-664.

MacIntyre, S., Ford, G. and Hunt, K. (1999). Do women 'over-report' morbidity? Men's and women's responses to structured prompting on a standard question on longstanding illness. *Social Science and Medicine,* **48**: 89-98.

MacIntyre, S., Hiscock, R., Kearns, A. and Ellaway, A. (2001). Housing tenure and car access: further exploration of the nature of their relations with health in a UK setting. *Journal of Epidemiology and Community Health,* **55**: 330-331.

MacIntyre, S., Hunt, K. and Sweeting, H. (1996). Gender differences in health: are things are really as simple as the seem? *Social Science and Medicine*, **42**(For): 617-624.

MacIntyre, S., Maciver, S. and Sooman, A. (1993). Area, class and health: should we be focusing on places or people? *Journal of Social Policy*, **22**(2): 213-234.

Macintyre, S. and Mutrie, N. (2004). Socio-economic differences in cardiovascular disease and physical activity: stereotypes and reality. *The Journal of the Royal Society for the Promotion of Health*, **124**(2): 66-69.

Mackenzie, I. F., Nelder, R., Maconachie, M. and Radford, G. (1998). 'My ward is more deprived than yours'. *Journal of Public Health Medicine*, **20**(2): 186-190.

Mackey Jones, W. and McKenna, J. (2002). Women and work-home conflict: a dual paradigm approach. *Health Education*, **102**(5): 249-259.

Maher, J. and Green, H. (2000). *Carers 2000*. London: The Stationery Office.

Majeed, F. A., Cook, D. G., Anderson, H. R., Hilton, S., Bunn, S. and Stones, C. (1994). Using patient and general practice characteristics to explain the variations in cervical smear uptake rates. *British Medical Journal*, **308**: 1272-1276.

Majeed, F. A., Cook, D. G., Poloniecki, J. and Martin, D. (1995). Using data from the 1991 census. *BMJ*, **310**(6993): 1511-1514.

Malterud, K. and Okkes, I. (1998). Gender differences in general practice consultations: methodological challenges in epidemiological research. *Family Practice*, **15**(5): 404-410.

Marcus, B. H., Owen, N., Forsyth, L. H., Cavill, N. A. and Fridinger, F. (1998). Physical activity interventions using mass media, print media, and information technology. *American Journal of Preventive Medicine*, **15**(4): 362-378.

Marmot, M., Ryff, C. D., Bumpass, L. L., Shipley, M. and Marks, N. F. (1997). Social inequalities in health: next questions and converging evidence. *Social Science and Medicine*, 44(6): 901-910.

Marmot, M., Siegrist, J. and Tores, T. (2006). Health and the psychosocial environment and work. In: *Social determinants of health: second edition* (edited by Marmot, M. and Wilkinson, R. G.). Oxford: Oxford University Press.

Marmot, M. and Wilkinson, R. G. (2006). *Social determinants of health: second edition*. Oxford: Oxford University Press.

Marmot, M. G. and Shipley, M. J. (1996). To socioeconomic differences in mortality persist after retirement? 25 year follow up of civil servants from the first Whitehall study. *British Medical Journal,* **313**(7066): 1177-1180.

Martin, C. and Woolf-May, K. (1999). The retrospective evaluation of a general practitioner exercise prescription programme. *Journal of Human Nutrition & Dietetics,* **12**(Suppl. 1): 32-42.

Martin, D., Construction of the Townsend deprivation score using census 2001 data, (personal communication). To: Gidlow, C., February 2004a.

Martin, D. (2004b) Digital boundary data and UK borders. *2001 census of population program. Census programme workshop,* 7th January, London School of Hygiene & Tropical Medicine.

Martin, D., Brigham, P., Roderick, P., Barnett, S. and Diamond, I. (2000). The (mis)representation of rural deprivation. *Environment and Planning,* **32**: 735-751.

Martin, S. L., Kirkner, G. J., Mayo, K., Matthews, C. E., Durstine, J. L. and Hebert, J. R. (2005). Urban, rural, and regional variations in physical activity. *Journal of Rural Health,* **21**(3): 239-244.

Matlin, M. W. (1993). *The psychology of women: second edition.* Fort Worth, TX: Harcourt Brace Jovanovich.

Matthews, S., Manor, O. and Power, C. (1999). Social inequalities in health: their gender differences? *Social Science and Medicine,* **48**: 49-60.

McDaid, D. and Oliver, A. (2005). Inequalities in health: international patterns and trends. In: *Promoting health: global perspectives* (edited by Scriven, A. and Garman, S.). Basingstoke: Palgrave Macmillan.

McDermott, L. (2000). A qualitative assessment of the significance of body perception to women's physical activity experiences: revisiting discussions of physicalities. *Sociology of Sport Journal,* **17**(4): 331-363.

McDonough, P. and Walters, V. (2001). Gender and health: reassessing patterns and explanations. *Social Science and Medicine,* **52**: 547-559.

McKay, H. A., Macdonald, H., Reed, K. E. and Khan, K. M. (2003). Exercise interventions for health: time to focus on dimension, delivery, and dollars. *British Journal of Sports Medicine,* **37**(2): 98-99.

McKenna, J., Naylor, P.-J. and McDowell, N. (1998). Barriers to physical activity promotion by general practitioners and practice nurses. *British Journal of Sports Medicine,* **32**: 242-247.

McMunn, A., Breeze, E., Goodman, A., Nazroo, J. and Oldfield, Z. (2006). Social determinants of health in older age. In: *Social determinants of health: second edition* (edited by Marmot, M. and Wilkinson, R. G.). Oxford: Oxford University Press.

McNair, F., Graham, R. C., Dugdill, L., Cable, N. T., Harrison, R. and Eubank, M. (2005). Determining the indicators of success in Exercise Referral Schemes. *Journal of Sports Sciences,* **23**(part VIII): 222-223.

McTiernan, A., Stanford, J. L., Daling, J. R. and Viogt, L. F. (1998). Prevalence and correlates of recreational physical activity in women aged 50-64 years. *Menopause,* **5**: 95-101.

Michaels Miller, A. and Iris, M. (2002). Health promotion attitudes and strategies in older adults. *Health Education and Behaviour,* **29**(2): 249-267.

Millar, W. J. and Stephens, T. (1993). Social status and health risks in Canadian adults: 1985 and 1991. *Health Reports,* **5**(2): 143-156.

Miller, W. R. and Rollnick, S. (2002). *Motivational interviewing: preparing people for change, second edition.* New York: The Guildford Press.

Montoye, H. (2000). Introduction: evaluation of some measurements of physical activity and energy expenditure. *Medicine and Science in Sports and Exercise,* **32**(9 Suppl.): S439-S441.

Montoye, H., Kemper, H., Saris, W. and Washburn, R. (1996). *Measuring physical activity and energy expenditure.* Champaign, IL: Human Kinetics.

Morgan, K., Armstrong, G. K., Huppert, F. A., Brayne, C. and Solomou, W. (2000). Healthy ageing in urban and rural Britain: a comparison of exercise and diet. *Age and Ageing,* **29**: 341-348.

Morgan, O. (2005). Approaches to increase physical activity: reviewing the evidence for exercise-referral schemes. *Public-health,* **119**: 361-370.

Morris, J. N. (1994). Exercise in the prevention of coronary heart disease: today's best buy in public health. *Medicine and Science in Sports and Exercise,* **26**: 807-814.

Morris, R. and Carstairs, V. (1991). Which deprivation? A comparison of selected deprivation indexes. *Journal of Public Health Medicine,* **13**(4): 318-326.

Morris, S., Sutton, M. and Gravelle, H. (2005). Inequity and inequality in the use of health care in England: an empirical investigation. *Social Science and Medicine,* **60**: 1251-1266.

Mullineaux, D. R., Barnes, C. A. and Barnes, E. (2001). Factors affecting the likelihood to engage in adequate physical activity to promote health. *Journal of Sports Science,* **19**: 279-288.

Munley, G. A., McLoughlin, A. and Foster, J. J. (1999). Gender differences in health check attendance and intention in young adults: an application of the health belief model. *Behaviour Change,* **16**(4): 237-245.

Munro, J. (1997). A randomised controlled trial of exercise in over-65-year olds: Experience from the first year. In: *Proceedings of the 4th International Conference on Physical Activity, Ageing and Sports* (edited by Huber, G.). Hamburg: Health Promotion Publications.

Murali, V. and Oyebode, F. (2004). Poverty, social inequality and mental health. *Advances in Psychiatric Treatment,* **10**: 216-224.

Murray, C. J. L., Gakidou, E. E. and Frenk, J. (1999). Health inequalities and social group differences: what should we measure? *Bulletin of the World Health Organisation,* **77**(7): 537-543.

Mutrie, N. and Woods, C. (2003). Promoting physical activity: how can we get people to become more active? A problem waiting to be solved. In: *Perspectives on Health and Exercise* (edited by McKenna, J. and Riddoch, C.). Basingstoke: Palgrave Macmillan.

Naidoo, J. and Wills, J. (2000). *Health promotion: foundations for practice, second edition*. London: Bailliere Tindall.

National Institute for Health and Clinical Excellence. (2006). *Four commonly used methods to increase physical activity: brief interventions in primary care, exercise referral schemes, pedometers and community-based exercise programmes for walking and cycling: Public Health Intervention Guidance no. 2*. London: NICE.

National Institute of Health and National Heart Lung and Blood Institute. (1998). Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults. *Obesity Research,* **6**: 51S-209S.

Nazroo, J. Y. and Williams, D. R. (2006). The social determination of ethnic/racial inequalities in health. In: *Social determinants of health* (edited by Marmot, M. and Wilkinson, R. G.). Oxford: Oxford University Press.

NHS Centre for Reviews and Dissemination. (2001). *Undertaking systematic reviews of research on effectiveness. CRD report No.4. 2nd ed.* York: University of York.

Nies, M. and Kershaw, T. (2002). Psychosocial and environmental influences physical activity and health outcomes in sedentary women. *Journal of Nursing Scholarship*, 34(3): 243-249.

O'Donnell, C. A. (2000). Variation in GP referral rates: what can we learn from the literature? *Family Practice*, 17(6): 462-471.

Office for National Statistics. (2002). *The National Statistics Socio-economic Classification user manual. Version 1*. London: Stationery Office.

Office for National Statistics (2004) *Rural and urban area classification 2004.* http://www.statistics.gov.ik/geography/nrudp.asp: accessed 19th February, 2005.

Office for National Statistics (2005a) *Annual Survey of Hours and Earnings.* http://www.statistics.gov.uk/CCI/nugget.asp?ID=167&Pos=5&ColRank=2&Rank=352: accessed 14th January, 2006.

Office for National Statistics (2005b) *Chronic sickness: prevalence of reported limiting longstanding illness by sex, age, and economic activity status.* http://www.statistics.gov.uk/statbase/explorer.asp?CTG=3&SL=4612&E=4696#4696: accessed 7th November, 2005.

Office for National Statistics (2005c) *Chronic sickness: rate per 1000 reporting selected longstanding condition groups, by age and sex.* http://www.statistics.gov.uk/statbase/explorer.asp?CTG=3&SL=4612&E=4696#4696: accessed 7th November, 2005.

Office for National Statistics (2005d) *Out-patient referral rates per 1000 patient years at risk, by clinical specialty, age, sex and deprivation category: 1994-98. Taken from Key Health Statistics from General Practice 1998.* accessed 13th October, 2005.

Office for National Statistics (2005e) *Output Areas.* http://www.statistics.gov.uk/geography/census-geog.asp#oa: accessed 5th May, 2005.

Office for National Statistics (2005f) *Proportion of population reporting 'good' state of general health: by sex and age, 2000/01.* http://www.statistics.gov.uk/statbase/explorer.asp?CTG=3&SL=4612&E=4696#4696: accessed 7th November, 2005.

Office for National Statistics (2005g) *Super Output Areas.* http://www.statistics.gov.uk/geography/soa.asp: accessed 2005, 5th May.

Office of National Statistics. (2004). *Focus on social inequalities*. London: ONS.

Office of the Deputy Prime Minister. (2004). *The English Indices of Deprivation 2004 (revised).* London: The Stationery Office.

Owen, N., Humpel, N., Leslie, E., Bauman, A. and Sallis, J. F. (2004). Understanding environmental influences on walking: review and research agenda. *American Journal of Preventive Medicine,* 27(1): 67-76.

Owen, N., Leslie, E., Salmon, J. and Fotheringham, M. J. (2000). Environmental determinants of physical activity and sedentary behaviour. *Exercise and Sports Science Reviews,* 28(4): 153-158.

Owen, N., Spathonis, K. and Leslie, E. (2005) Understanding and influencing physical activity to improve health outcomes. *Walk21-VI "Everyday Walking Culture", The 6th International Conference on Walking in the 21st Century,* September 22-23, Zurich, Switzerland.

Panter-Brick, C. (2003). The anthropology of physical activity. In: *Perspectives on Health and Exercise* (edited by McKenna, J. and Riddoch, C.). Basingstoke: Palgrave Macmillan.

Papadopoulou, S. K., Papadopoulou, S. D., Zerva, A., Paraskevas, G., Dalkiranis, A., Ioannou, I. and Fahantidou, A. (2003). Health status and socioeconomic factors as determinants of physical activity level in the elderly. *Medical Science Monitor,* 9(2): CR79-CR83.

Parks, S. E., Housemann, R. A. and Brownson, R. C. (2003). Differential correlates of physical activity in urban and rural adults of various socioeconomic backgrounds in the United States. *Journal of Epidemiology and Community Health,* 27: 29-35.

Pate, R. R., Pratt, M., Blair, S. N., Haskell, W. L., Macera, C. A., Bouchard, C., Buchner, D., Ettinger, W., Heath, G. W., King, A. C., Kriska, A., Leon, A. S., Marcus, B. H., Morris, J., Paffenbarger, R. S., Patrick, K., Pollock, M. L., Rippe, J. M., Sallis, J. F. and Wilmore, J. H. (1995). Physical activity and public health: recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *Journal of the American Medical Association,* 273(5): 402-407.

Phillimore, P., Beattie, A. and Townsend, P. (1994). Widening inequality of health in northern England, 1981-1991. *British Medical Journal,* 308(6937): 1125-1128.

Phillimore, P. and Reading, R. (1992). A rural advantage? Urban-rural health differences in Northern England. *Journal of Public Health Medicine,* 14(3): 290-299.

Phillips, P. (2002). The rising cost of health care: can demand be reduced through more effective health promotion? *Journal of Evaluation in Clinical Practice,* **8**(4): 415-419.

Pickett, K. E. and Pearl, M. (2001). Multilevel analyses of neighbourhood socio-economic context and health outcomes: a critical review. *Journal of Epidemiology and Community Health,* **55**: 111-122.

Pikora, T. J., Bull, F. C. L., Jamrozik, K., Knuiman, M., Giles-Corti, B. and Donovan, R. J. (2002). Developing a reliable audit instrument to measure the physical environment for physical activity. *American Journal of Preventive Medicine,* **23**(3): 187-194.

Pincus, T., Esther, R. and DeWalt, D. A. (1998). Social conditions and self-management are more powerful determinants of health than access to care. *Annals of Internal Medicine,* **129**(5): 406-411.

Pitts, M. (1996). *The psychology of preventive health.* London: Routledge.

Pocock, S. J., Collier, T. J., Dandreo, K. J., de Stavola, B. L., Goldman, M. B., Kalish, L. A., Kaste, L. E. and McCormack, V. A. (2004). Issues in the reporting of epidemiological studies: a survey of recent practice. *British Medical Journal,* **329**(7471): 883-889.

Pomerleau, J., Pederson, L. L., Ostbye, T., Speechley, M. and Speechley, K. (1997). Health behaviours and socio-economic status in Ontario, Canada. *European Journal of Epidemiology,* **13**: 613-622.

Potvin, L., Hadda, S. and Frohlich, K. L. (2001). Beyond process and outcome evaluation: a comprehensive approach for evaluating health promotion programmes. WHO Regional Publications, European Series, No 92. In: *Evaluation in health promotion: principles and perspectives* (edited by Rootman, I., Goodstadt, M., Hyndman, B., McQueen, D., Potvin, L., Springett, J. and Ziglio, E.). Denmark: World Health Organization.

Prentice, A. M. and Jebb, S. A. (1995). Obesity in Britain: gluttony or sloth? *British Medical Journal,* **311**(7002): 437-439.

Puska, P. (2001). Commentary: physical activity promotion in primary care. *International Journal of Epidemiology,* **30**: 815-816.

Redman, S. (1996). Towards a research strategy to support public health programs for behaviour change. *Australian and New Zealand Journal of Public Health,* **20**(4): 352-358.

Reid, F. D. A., Cook, D. G. and Majeed, A. (1999). Explaining the variation in hospital admission rates between general practices: cross-sectional study. *British Medical Journal,* **319**: 98-103.

Resnick, B., Palmer, M. H., Jenkins, L. S. and Spellbring, A. M. (2000). Path analysis of efficacy expectations and exercise behaviour in older adults. *Journal of Advanced Nursing,* **31**(6): 1309-1315.

Rice, N. and Smith, P. C. (2001). Ethics and geographical equity in healthcare. *Journal of Medical Ethics,* **27**: 256-261.

Riddoch, C., Puig-Ribera, A. and Cooper, A. (1998). *Effectiveness of physical activity promotion schemes in primary care: a review.* London: Health Education Authority.

Ronalds, C., Kapur, N., Stone, K., Webb, S., Tomenson, B. and Creed, F. (2002). Determinants of consultation rate in patients with anxiety and depressive disorders in primary care. *Family Practice,* **19**(1): 23-28.

Rose, D. and O'Reilly, K. (1997). *Constructing classes: towards a new social classification for the UK.* Swindon: ESRC and ONS.

Rose, D. and O'Reilly, K. (1998) A joint publication from the ESRC and the Government Statistical Service.

Rosenbaum, J. E., Reynolds, L. and Deluca, S. (2002). How do places matter? The geography of opportunity, self-efficacy and a look inside the black box of residential mobility. *Housing Studies,* **17**(1): 71-82.

Rowland, T. W. (1994). On exercise physiology and the psyche. *Pediatric Exercise Science,* **6**: 111-113.

Ryan, R. M., Frederick, C. M., Lepes, D., Rubio, N. and Sheldon, K. M. (1997). Intrinsic motivation and exercise adherence. *International Journal of Sports Psychology,* **28**(4): 335-354.

Saelens, B. E., Sallis, J. F., Black, J. B. and Chen, D. (2003). Neighbourhood-based differences in physical activity: an environmental scale evaluation. *American Journal of Public Health,* **93**(9): 1552-1558.

Sallis, J. F., Bauman, A. and Pratt, M. (1998). Environmental and policy interventions to promote physical activity. *American Journal of Preventive Medicine,* **15**(4): 379-397.

Sallis, J. F., Hovell, M. F. and Hofstetter, R. C. (1992). Predictors of adoption and maintenance of vigorous physical activity in men and women. *Preventive Medicine,* **21**: 2237-251.

Sallis, J. F., Hovell, M. F., Hofstetter, R. C., Elder, J. P., Hackley, M., Caspersen, C. J. and Powell, K. E. (1990). Distance between homes and exercise facilities related to frequency of exercise among San Diego residents. *Public Health Reports,* **105**(2): 179-185.

Sallis, J. F., Johnson, M. F., Calfas, K. J., Caparosa, S. and Nichols, J. F. (1997). Assessing perceived physical environmental variables that may influence physical activity. *Research Quarterly for Exercise and Sport,* **68**(4): 345-351.

Sallis, J. F. and Owen, N. (1999). Determinants of physical activity. In: *Physical activity & behavioural medicine* (edited by Sallis, J. F. and Owen, N.). London: Sage Publications.

Sallis, J. F., Zakarin, J. M., Hovell, M. F. and Hofstetter, R. C. (1996). Ethnic, socioeconomic, and sex differences in physical activity among adolescents. *Journal of Clinical Epidemiology,* **49**(2): 125-134.

Salmon, J., Owen, N., Bauman, A., Kathryn, M., Schmitz, H. and Booth, M. (2000). Leisure-time, occupational, and household physical activity among professional, skilled, and less-skilled workers and homemakers. *Preventive Medicine,* **30**: 191-199.

Saul, C. and Payne, N. (1999). How does the prevalence of specific morbidities compare with measures of socio-economic status at small area level? *Journal of Public Health Medicine,* **21**(3): 340-347.

Schmid, T. L., Pratt, M. and Howze, E. H. (1995). Policy as intervention: Environmental and policy approaches to the prevention of cardiovascular disease. *American Journal of Public Health,* **85**(9): 1207-1211.

Shaw, M., Dorling, D. and Davey Smith, G. (2006). Poverty, social exclusion, and minorities. In: *Social determinants of health: second edition* (edited by Marmot, M. and Wilkinson, R. G.). Oxford: Oxford University Press.

Shaw, M., Dorling, D., Mitchell, R. and Davey Smith, G. (2005). Labour's "Black report" moment? *British Medical Journal,* **331**: 575.

Shelton, N. J. (2005). What not to eat: inequalities in healthy eating behaviour, evidence from the 1998 Scottish Health Survey. *Journal of Public Health,* **27**(1): 36-44.

Shephard, R. J. (2002). Limits to the measurement of habitual physical activity by questionnaires. *British Journal of Sports Medicine,* **37**: 197-206.

Sherwood, N. E. and Jeffrey, R. W. (2000). The behavioural determinants of exercise: implications for physical activity interventions. *Annual Review of Nutrition,* **20**: 21-44.

Shouls, S., Congdon, P. and Curtis, S. (1996). Modelling inequality in reported long-term illness in the UK: combining individual and area characteristics. *Journal of Epidemiology and Community Health,* **50**(3): 366-376.

Sidford, A., Doctoral student and former ProActive Project Worker (1999-2006), Sheffield Hallam University (personal communication). To: Gidlow, C., 6th January 2006.

Simons-Morton, D. G., Hogan, P., Dunn, A. L., Pruitt, L., King, A. C., Levine, B. D. and Miller, S. T. (2000). Characteristics of inactive primary care patients: baseline data from the Activity Counseling Trial. *Preventive Medicine,* **31**: 513-521.

Singh, S. (1997). Why are GP exercise schemes so successful (for those who attend)? Results from a pilot study. *Journal of Management in Medicine,* **11**(4): 233-7.

Sloggett, A. and Joshi, H. (1994). Higher mortality in deprived areas: community or personal disadvantage? *British Medical Journal,* **309**: 1470-1474.

Smith, A. (2004). Exercise and health-enhancing physical activity. *Journal of Sports Sciences,* **22**: 677-678.

Smith, A. (2005). What is exercise science? *Journal of Hospitality, Leisure, Sport and Tourism Education,* **3**(2): 5-14.

Smith, A. and Bird, S. (2004). From evidence to policy: reflections on emerging themes in health-enhancing activity. *Journal of Sports Sciences,* **22**: 791-799.

Smith, B. J., Bauman, A. E., Bull, F. C. L., Booth, M. L. and Harris, M. F. (2000). Promoting physical activity in general practice: a controlled trial of written advice and information materials. *British Journal of Sports Medicine,* **34**: 262-267.

Smith, P. A., Gould, M. M., Tai, S. S. and Iliffe, S. (1996). Exercise as therapy? Results from group interviews with general practice teams involved in an inner-London 'prescription for exercise' scheme. *Health Education Journal,* **55**: 439-446.

Smith, R. A. (1998). Health professionals' attitudes towards promoting physical activity. Communications of the Annual Conference of the British Association of Sports and Exercise Sciences (BASES), University College of Ripon and York. *Journal of sports Sciences,* **16**: 104.

South, J. and Tilford, S. (2000). Perceptions of research and evaluation in health promotion and influences on activity. *Health Education Research,* **15**(6): 729-741.

Sparkes, A. (1995). Writing people: reflections on the dual crises of representation and legitimisation in qualitative research. *Quest,* **47**: 158-195.

Sparling, P. B., Owen, N., Lambert, E. V. and Haskell, W. L. (2000). Promoting physical activity: the new imperative for public health. *Health Education Research,* **15**(3): 367-376.

Squire, P. (2001) Exercise referral schemes research project. *Presented at the 2nd Annual Wright Foundation National Seminar on Exercise Referral,* November, Daventry.

Stafford, M., Cummins, S., Macintyre, S., Ellaway, A. and Marmot, M. (2005). Gender differences in the associations between health and neighbourhood environment. *Social Science and Medicine,* **60**: 1681-1692.

Stafford, M. and Marmot, M. (2003). Neighbourhood deprivation and health: does it affect us all equally? *International Journal of Epidemiology,* **32**: 357-366.

Stathi, A., McKenna, J. and Fox, K. R. (2003). The experiences of older people participating in exercise referral schemes. *Journal of the Royal Society for the Promotion of Health,* **123**(1): 18-23.

Stephens, T. and Caspersen, C. (1994). The demography of physical activity. In: *Physical activity, fitness, and health* (edited by Bouchard, R. J., Shephard, R. J. and Stephens, T.). Champaign, IL: Human Kinetics.

Steptoe, A., Doherty, S., Kendrick, T., Rink, E. and Hilton, S. (1999). Attitudes to cardiovascular health promotion among GPs and practice nurses. *Family Practice,* **16**(2): 158-163.

Stevens, M., Bult, P., de Greef, M. H. G., Lemmink, K. A. P. M. and Rispens, P. (1999). Groningen Active Living Model (GALM): stimulating physical activity in sedentary older adults. *Preventive Medicine,* **29**: 267-276.

Stevens, W., Hillsdon, M., Thorogood, M. and McArdle, D. (1998). Cost-effectiveness of a primary care based physical activity intervention in 45-74 year old men and women: a randomized controlled trial. *British Journal of Sports Medicine,* **32**: 236-241.

Stronegger, W.-J., Freidl, W. and Rasky, E. (1997). Health behaviour and risk behaviour: socio-economic differences in an Austrian rural county. *Social Science and Medicine,* **44**(3): 423-426.

Stronks, K., Van de Mheen, H. and Looman, C. W. (1997). Cultural, material and psychosocial correlates of the socio-economic gradient in smoking behaviour among adults. *Preventive Medicine,* **26**: 754-766.

Tai, S. S., Gould, M. and Iliffe, S. (1997). Promoting healthy exercise among older people in general practice: issues in designing and evaluating therapeutic interventions. *British Journal of General Practice,* **47**: 119-122.

Taylor, A. (2003). The role of primary care in promoting physical activity. In: *Perspective on health and exercise* (edited by McKenna, J. and Riddoch, C.). Basingstoke: Palgrave Macmillan.

Taylor, A. H. (1999). Adherence in primary care exercise promotion schemes. In: *Adherence issues in support of exercise* (edited by Bull, S.). Chichester: J. Wiley.

Taylor, A. H., Cable, N. T., Faulkner, G., Hillsdon, M., Narici, M. and Van Der Bij, A. K. (2004). Physical activity and older adults: a review of health benefits and the effectiveness of interventions. *Journal of Sports Sciences,* **22**: 703-725.

Taylor, A. H., Doust, J. and Webborn, N. (1998). Randomised controlled trial to examine the effects of a GP exercise referral programme in Hailsham, East Sussex, on modifiable coronary heart disease risk factors. *Journal of Epidemiology and Community Health,* **52**: 595-601.

Tazi, M. A., Faivre, J., Daissonville, F., Lamour, J., Milan, C. and Durand, G. (1997). Participation in faecal occult blood screening for colorectal cancer in a well-defined French population: results of five screening rounds from 1988 to 1996. *Journal of Medical Screening,* **4**: 147-151.

Thorogood, M., Coulter, A., Jones, L., Yudkin, P., Muir, P. and Mant, D. (1993). Factors affecting response to an invitation to attend for a health check. *Journal of Epidemiology and Community Health,* **47**(3): 224-228.

Thunhurst, C. (1985). The analysis of small area statistics and planning for health. *The Statistician,* **34**: 93-106.

Torgerson, D. J. and Torgerson, C. J. (2003). Avoiding bias in randomised controlled trials in educational research. *British Journal of Educational Studies,* **51**(1): 36-45.

Torgerson, T. and Sibbald, B. (1998). Understanding controlled trials: what is a patient preference trial? *British Medical Journal,* **316**: 360.

Townsend, P. (1987). Deprivation. *Journal of Social Policy,* **16**(2): 125-146.

Townsend, P., Phillimore, P. and Beattie, A. (1988). *Health and deprivation.* Kent: Croom Helm Ltd.

Troped, P. J., Saunders, R. P., Pate, R. R., Reininger, B., Ureda, J. R. and Thompson, S. J. (2001). Associations between self-reported and objective physical environmental factors and use of a community rail-trail. *Preventive Medicine,* **32**: 191-200.

Trost, S. G., Owen, N., Bauman, A. E., Sallis, J. F. and Brown, W. (2002). Correlates of adults' participation in physical activity: review and update. *Medicine and Science in Sports and Exercise,* 34(12): 1886-2001.

Tudiver, H. and Talbot, Y. (1999). Why don't men seek help? Family physicians' perspectives on help-seeking behaviour in men. *Journal of Family Practice,* **48**(1): 47-52.

Tudor Hart, J. (1971). The inverse care law. *The Lancet,* **ii**: 405 -412.

Tudor-Locke, C., Ham, S. A., Macera, C. A., Ainsworth, B. E., Kirtland, K. A., Reis, J. P. and Kimsey, D. J. (2004). Descriptive epidemiology of the pedometer-determined physical activity. *Medicine and Science in Sports and Exercise,* 36(9): 1567-1573.

UK Flexible Sigmoidoscopy Trial Investigators. (2002). Single flexible sigmoidoscopy screening to prevent colorectal cancer: baseline findings of a UK multicentre randomised trial. *The Lancet,* **359**: 1291-1300.

Wagstaff, A. (2002). Poverty and health sector inequalities. *Bulletin of the World Health Organisation,* **80**(2): 97-105.

Wagstaff, A., Paci, P. and Van Doorslaer, E. (1991). On the measurement of inequalities in health. *Social Science and Medicine,* **33**(5): 545-557.

Walker, A. and Hoinville, E. (1995). *Physical activity matters across England - variations by region.* London: Health Education Authority.

Wanless, D. (2003). *Securing good health for the whole population: population health trends.* London: Stationery Office.

Wardle, J., McCaffery, K., Nadel, M. and Atkin, W. (2004). Socio-economic differences in cancer screening participation: comparing cognitive and psychosocial explanations. *Social Science and Medicine,* **59**: 249-261.

Wardle, J., Miles, A. and Atkin, W. (2005). Gender differences in the utilisation of colorectal cancer screening. *Journal of medical screening,* **12**: 20-27.

Wardle, J. and Steptoe, A. (2003). Socioeconomic differences in attitudes and beliefs about healthy lifestyles. *Journal of Epidemiology and Community Health,* **57**: 440-443.

Wareham, N. J. and Rennie, K. L. (1998). The assessment of physical activity in individuals and populations: why try to be more precise about how physical activity is assessed? *International Journal of Obesity,* **22**(Suppl.2): S30-S38.

Watts, B. G., Vernon, S. W., Myers, R. E. and Tilley, B. C. (2003). Intention to be screened overtime for colorectal cancer in male automotive workers. *Cancer Epidemiology, Biomarkers & Prevention,* **12**: 339-349.

Webb, D. (1999). Current approaches to gathering evidence. In: *Evidence-based health promotion* (edited by Perkins, E. R., Simnett, I. and Wright, L.). Chichester: John Wiley & Sons Ltd.

Weber, M. (1978). *Economy and society 1922*: Berkley.

White, I. R., Blane, D., Morris, J. N. and Mourouga, P. (1999). Educational attainment, deprivation-affluence and self reported health in Britain: a cross sectional study. *Journal of Epidemiology and Community Health,* **53**: 535-541.

Wilbur, J., Chandler, P. J., Dancy, B. and Lee, H. (2003). Correlates of physical activity in urban Midwestern African-American women. *American Journal of Preventive Medicine,* **25**(3Si): 45-52.

Wilcox, S., Castro, C., King, A. C., Housemann, R. A. and Brownson, R. C. (2000). Determinants of leisure time physical activity in rural compared with urban older and ethnically diverse women in the United States. *Journal of Epidemiology and Community Health,* **54**: 667-672.

Wilkinson, R. G. (1997). Socio-economic determinants of health: health inequalities: relative or absolute material standards? *British Medical Journal,* **314**: 591.

Wilkinson, R. G. (2006). Ourselves and others - for better or worse: social vulnerability and inequality. In: *Social determinants of health: second edition* (edited by Marmot, M. and Wilkinson, R. G.). Oxford: Oxford University Press.

Williams, T., Jackson, A., Turbitt, D., Scrivener, G., Lloyd, D., Sturdy, P., Pereira, F., Hull, S., Carter, Y., Naish, J., Harvey, C., Hippisley-Cox, J., Hardy, C., Pringle, M., Carlisle, R., Fielding, K. and Chilvers, C. (1997). Effect of deprivation on general practitioners' referral rates: study should have used deprivation index that is independent of age. *British Medical Journal,* **315**(7112): 882a.

Worrall, A., Rea, N. J. and Ben-Shlomo, Y. (1997). Counting the cost of social disadvantage in primary care: retrospective analysis of patient data. *British Medical Journal,* **314**: 38-42.

Yen, I. H. and Kaplan, G. A. (1998). Poverty area residence and change in physical activity level: evidence from the Alameda County Study. *American Journal of Public Health,* **88**(11): 1709-1712.

Yen, I. H. and Syme, S. L. (1999). The social environment and health: a discussion of the epidemiologic literature. *Annual Review of Public Health,* **20**: 287-308.

Yu, Z., Nissinen, A., Vartianen, E., Song, G., Guo, Z. and Tian, H. (2000). Changes in cardiovascular risk factors in different socioeconomic groups: seven year trends in a Chinese urban population. *Journal of Epidemiology and Community Health,* **54**: 692-696.

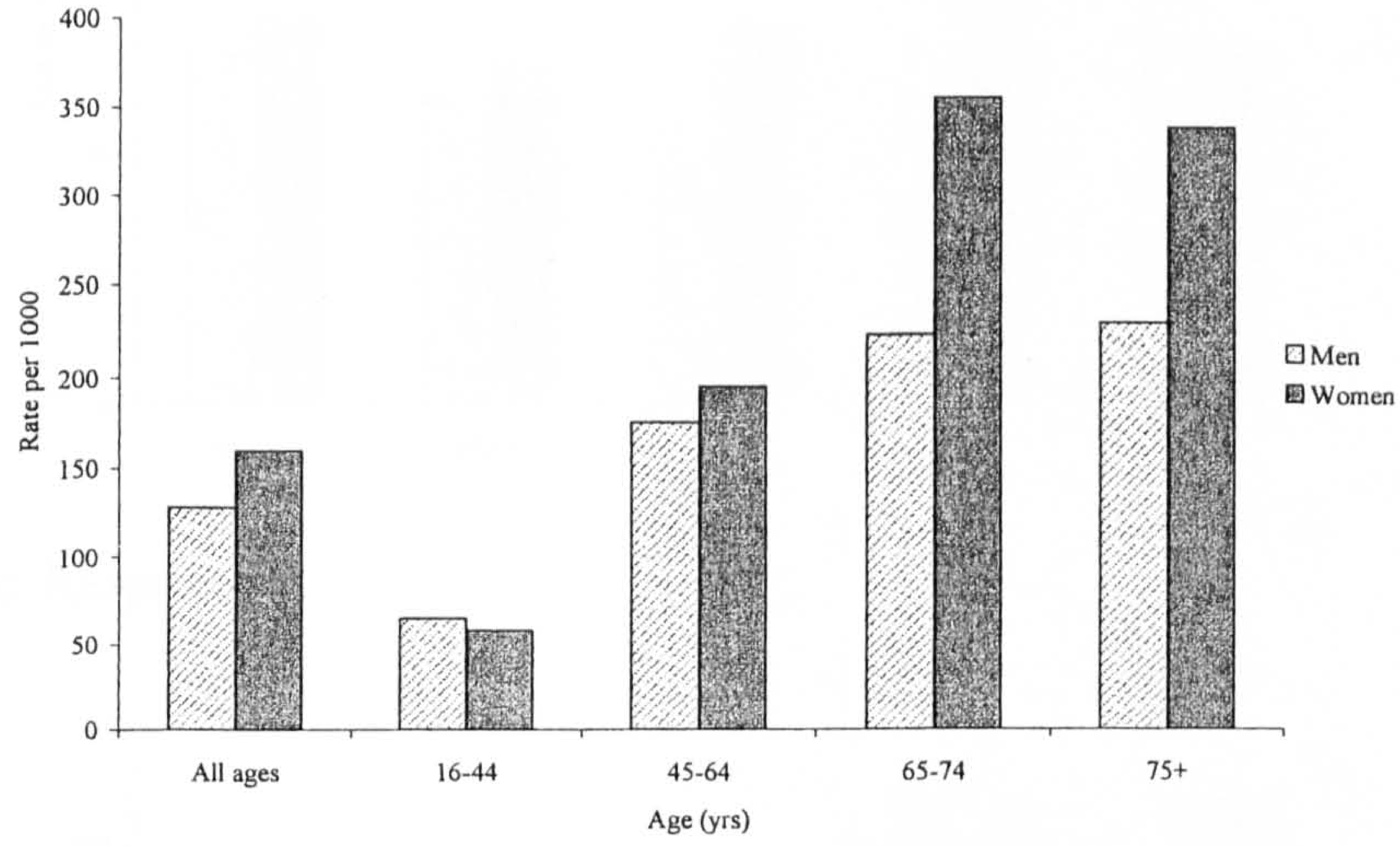
Zatinge, E. M., Verhaak, P. F. M. and Bensing, J. M. (2005). The workload of GPs: patients with psychological and somatic problems compared. *Family Practice,* **22**: 293-297.

Zunft, H.-J. F., Friebe, D., Seppelt, B., Widhalm, K., de Winter, A.-M. R., de Almeido, M. D. V., Kearney, J. M. and Gibney, M. (1999). Perceived benefits and barriers to physical activity in a nationally representative sample in the European Union. *Public Health Nutrition,* **2**(1a): 153-160.

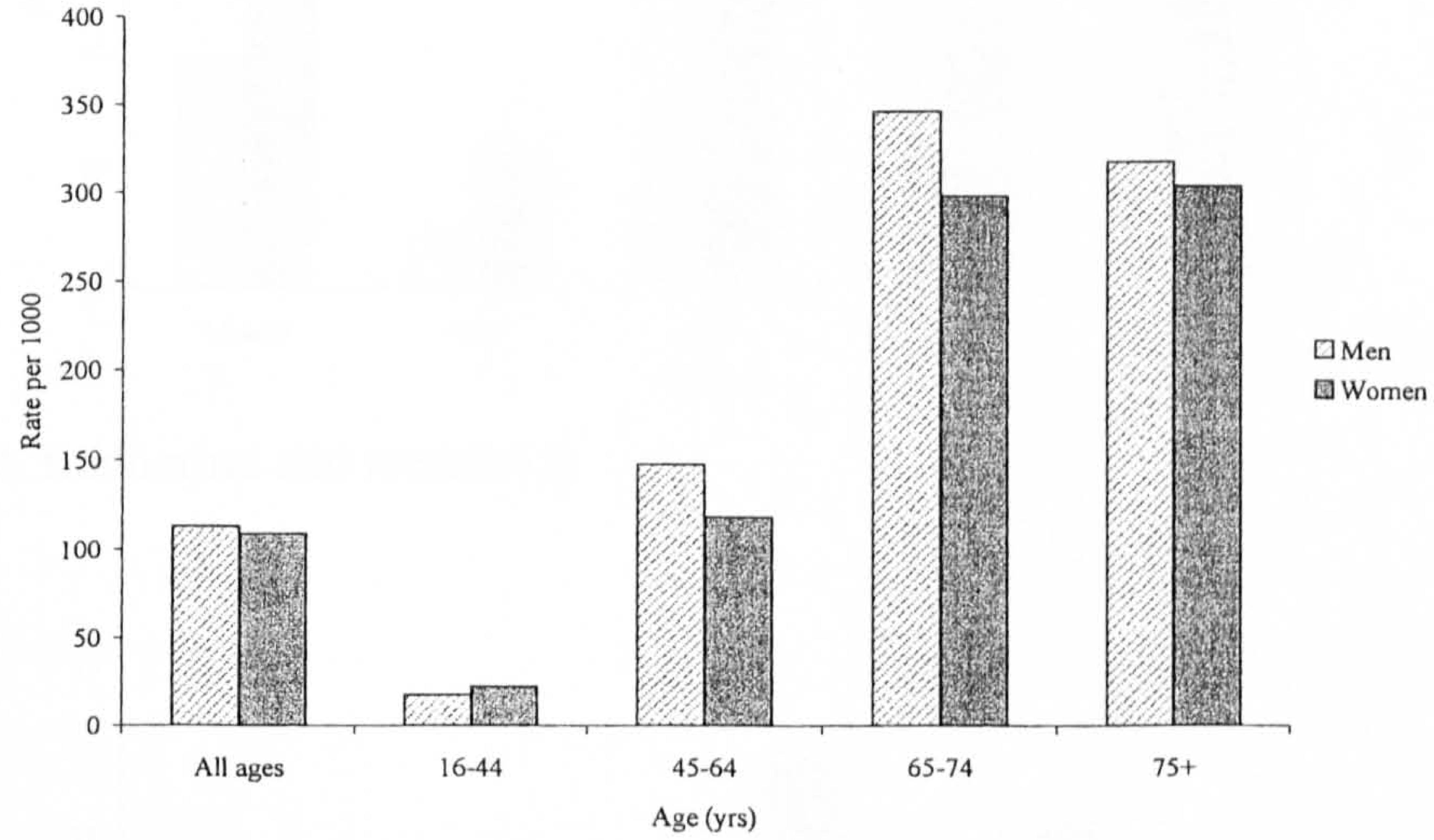
Appendix 1: Proportions of the English and British populations reporting health status as 'not good' or 'good/fairly good', and presence/absence of a long-term limiting illness in census 2001 (Casweb, 2004)

	Age	All people		Good or fairly good health			Not good health		
		LLI	No LLI	total	LLI	No LLI	total	LLI	No LLI
ENGLAND									
All	all	17.3	82.7	91.2	9.9	81.3	8.8	7.4	1.4
	0-15	4.2	95.8	98.9	3.5	95.3	1.1	0.7	0.4
	16-34	6.7	93.3	96.5	4.4	92.1	3.5	2.3	1.2
	35-49	12.4	87.6	92.4	6.7	85.7	7.6	5.7	1.9
	50-59	22.7	77.3	86.5	11.1	75.3	13.5	11.6	2.0
	60-64	33.8	66.2	82.6	18.1	64.6	17.4	15.7	1.7
	65-84	46.6	53.4	78.7	26.9	51.8	21.3	19.6	1.7
	>85	71.3	28.7	66.7	39.5	27.2	33.3	31.8	1.5
Men	all	16.6	83.4	91.8	9.7	82.1	8.2	7.0	1.2
	0-15	4.9	95.1	98.8	4.1	94.7	1.2	0.8	0.4
	16-34	6.9	93.1	96.8	4.7	92.1	3.2	2.2	1.0
	35-49	12.3	87.7	92.9	6.8	86.0	7.1	5.5	1.6
	50-59	22.1	77.9	86.8	10.8	76.0	13.2	11.3	1.9
	60-64	36.2	63.8	80.5	18.4	62.1	19.5	17.8	1.7
	65-84	46.3	53.7	79.5	27.3	52.1	20.5	19.0	1.6
	>85	66.7	33.3	69.1	37.4	31.7	30.9	29.3	1.6
Women	all	18.0	82.0	90.6	10.2	80.4	9.4	7.9	1.5
	0-15	3.6	96.4	98.9	2.9	96.0	1.1	0.7	0.4
	16-34	6.5	93.5	96.2	4.2	92.0	3.8	2.3	1.5
	35-49	12.5	87.5	91.9	6.5	85.4	8.1	6.0	2.1
	50-59	23.3	76.7	86.2	11.5	74.7	13.8	11.8	2.0
	60-64	31.4	68.6	84.6	17.7	66.9	15.4	13.7	1.7
	65-84	46.7	53.3	78.1	26.6	51.5	21.9	20.2	1.7
	>85	73.3	26.7	65.7	40.4	25.2	34.3	32.9	1.4
BRITAIN									
All	all	19.9	80.1	89.7	10.8	78.9	10.3	9.1	1.3
	0-15	4.8	95.2	98.7	3.9	94.8	1.3	0.9	0.4
	16-34	7.9	92.1	95.8	4.9	90.9	4.2	3.0	1.2
	35-49	15.2	84.8	90.5	7.4	83.1	9.5	7.7	1.8
	50-59	28.1	71.9	82.7	12.5	70.1	17.3	15.6	1.8
	60-64	40.4	59.6	78.6	20.4	58.2	21.4	20.0	1.4
	65-84	51.7	48.3	76.0	29.1	46.9	24.0	22.6	1.4
	>85	74.2	25.8	65.8	41.2	24.6	34.2	33.0	1.2
Men	all	19.0	81.0	90.4	10.5	79.8	9.6	8.5	1.1
	0-15	5.5	94.5	98.6	4.5	94.0	1.4	1.0	0.4
	16-34	8.0	92.0	96.1	5.1	91.0.	3.9	2.9	0.9
	35-49	14.8	85.2	91.2	7.5	83.6	8.8	7.3	1.5
	50-59	27.5	72.5	83.1	12.2	70.8	16.9	15.3	1.7
	60-64	43.8	56.2	76.0	21.2	54.9	24.0	22.6	1.3
	65-84	51.3	48.7	76.9	29.6	47.4	23.1	21.7	1.3
	>85	69.4	30.6	68.6	39.3	29.2	31.4	30.1	1.3
Women	all	20.6	79.4	89.0	11.0	78.0	11.0	9.6	1.4
	0-15	4.1	95.9	98.9	3.3	95.6	1.1	0.8	0.4
	16-34	7.8	92.2	95.4	4.7	90.7	4.6	3.1	1.5
	35-49	15.5	84.5	89.9	7.3	82.6	10.1	8.2	2.0
	50-59	28.7	71.3	82.3	12.8	69.5	17.7	15.9	1.8
	60-64	37.2	62.8	81.0	19.8	61.3	19.0	17.5	1.5
	65-84	51.9	48.1	75.3	28.7	46.6	24.7	23.2	1.5
	>85	76.2	23.8	64.6	42.0	22.6	35.4	34.3	1.2

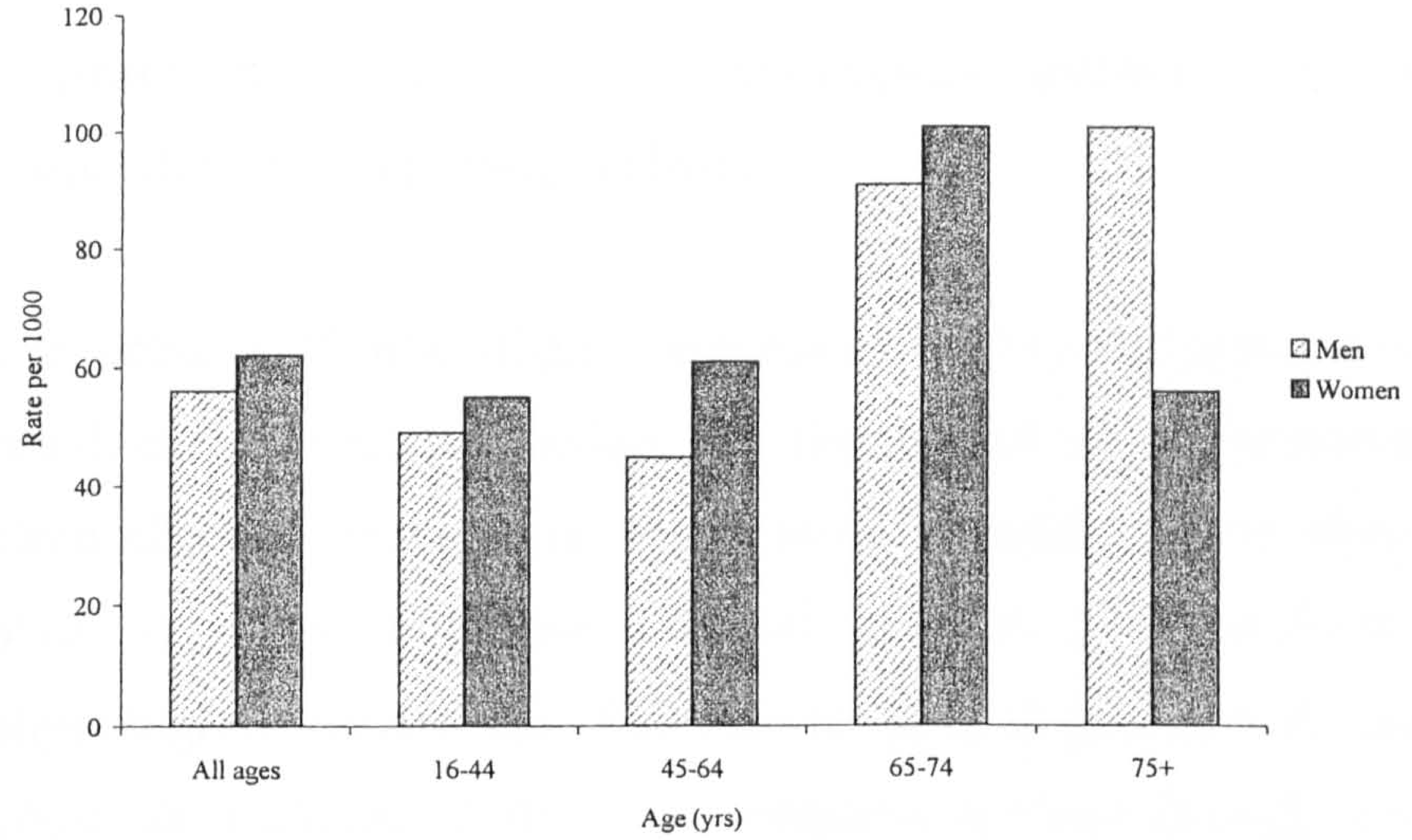
Appendix 2: Chronic sickness: rate per 1000 reporting selected longstanding condition groups, by age and sex. Data from the General Household Survey 2003 (ONS, 2005c)



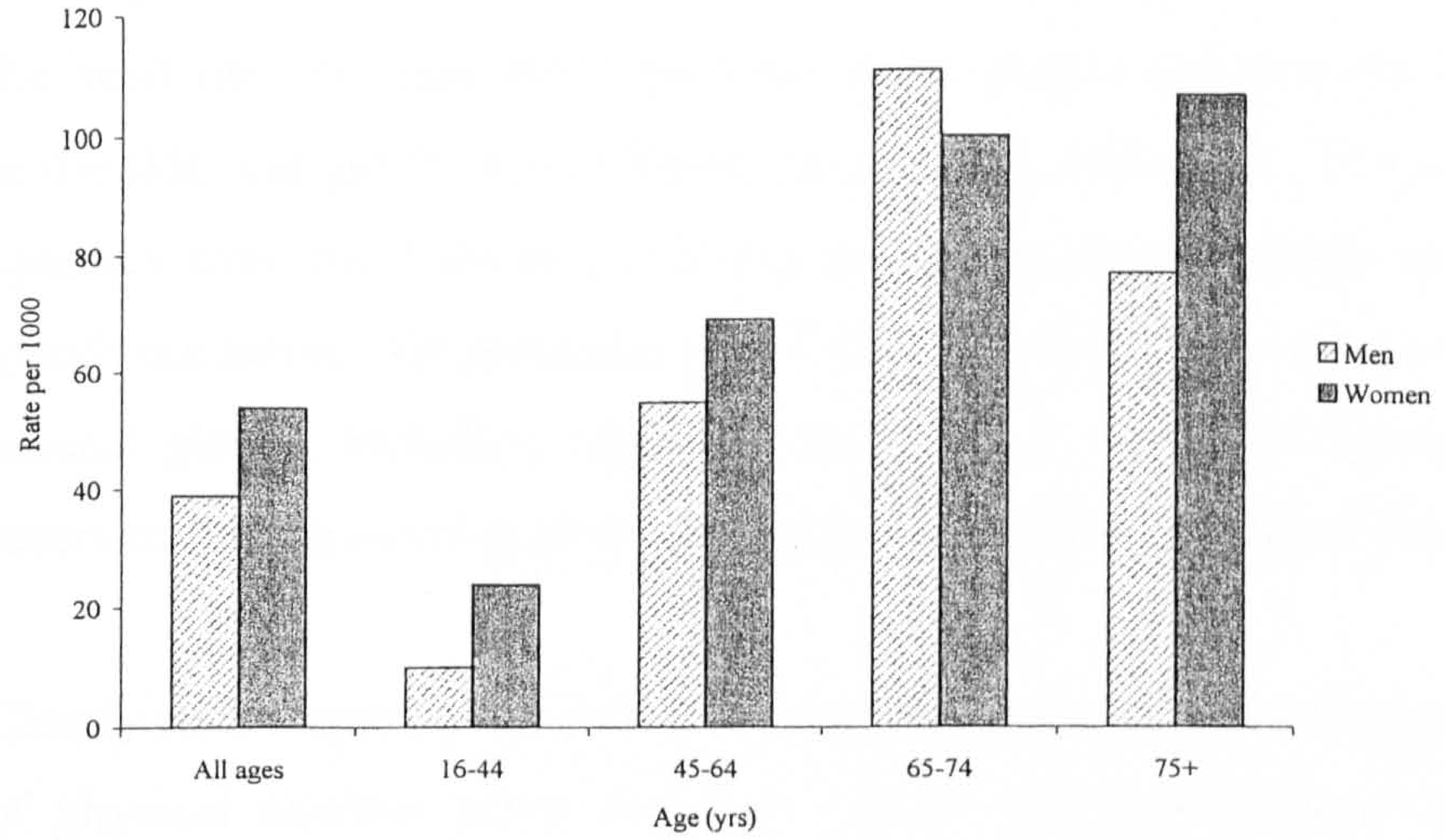
a. Musculoskeletal



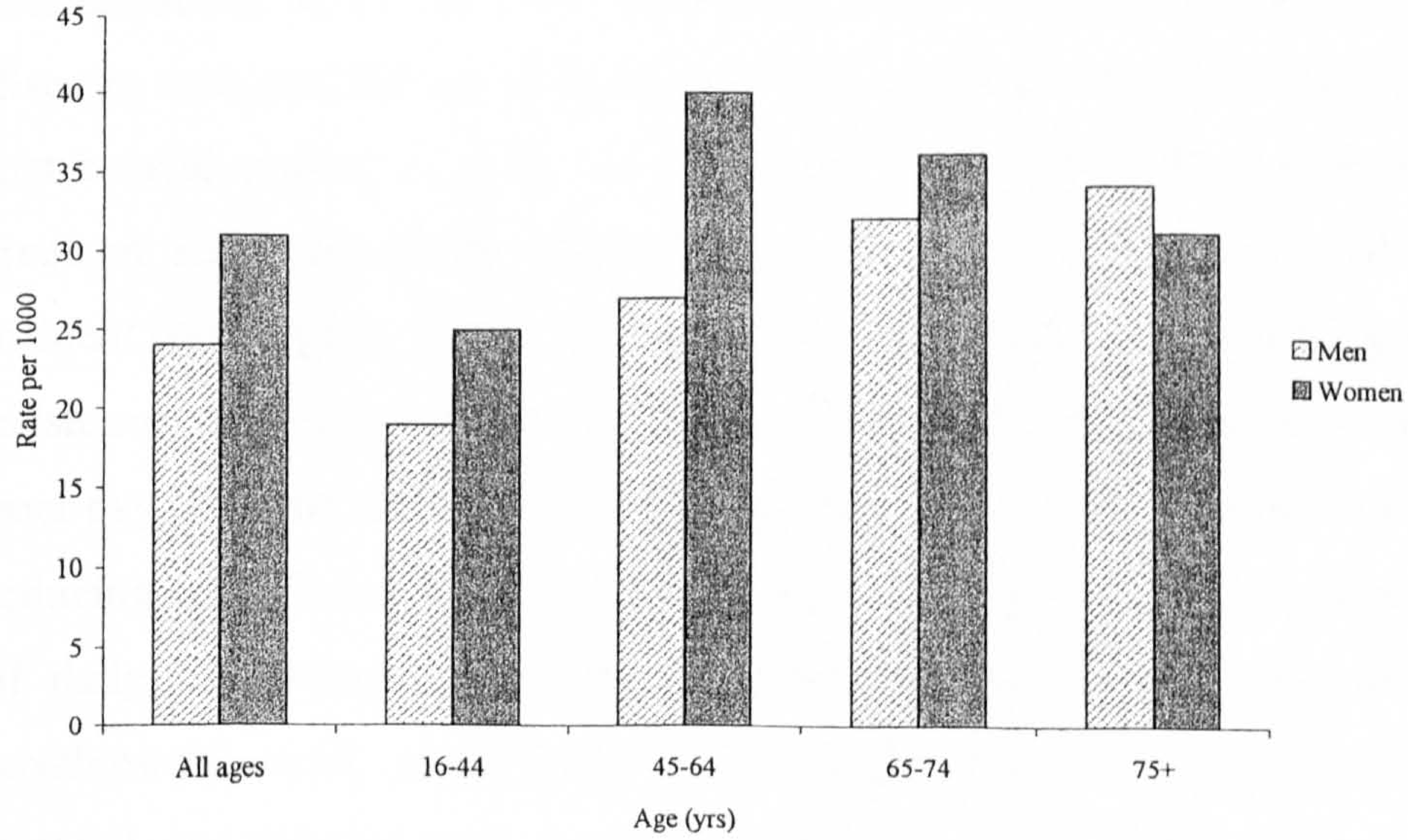
b. Heart and circulatory



c. Respiratory



d. Endocrine and metabolic



e. Nervous system

Appendix 3: Description of the 'stress response' pathway in relation to health inequalities and supporting evidence

The stress or 'fight-or-flight' response is the key biological process implicated in the health-environment connection. In the face of an environmental stressor, such as a physically threatening situation, an array of metabolic and physiological changes take place to allow immediate physical exertion ('fight-or-flight'). The balance of physiological systems that fluctuate to meet these demands has been referred to as *allostasis* (Goldman, 2001). This response operates through two main neuroendocrine pathways. The first occurs within milliseconds via the sympathetic nervous system causing the release of noradrenaline and adrenalin into the bloodstream, which increase the heart rate, increase blood pressure, dilate pupils and airways, constrict blood vessels in the skin and gut (to divert bloods to muscles), and so on. The second, slower pathway operates over the following minutes and hours during which three hormone secreting glands are active. Of particular note is the secretion of several steroid hormones from the adrenal glands, including cortisol. These act as insulin antagonists, mobilising energy reserves, raising blood glucose and promoting fatty acid release from fat tissue.

Clearly such responses have evolved as they confer the advantage of enabling short bursts of physical exertion when required. Ideally all physiological and metabolic changes would return to baseline rapidly after the stressful event (homeostasis) as prolonging the adapted physiological state of elevated blood pressure, blood glucose and fatty acid concentrations would obviously be detrimental to health as they represent risk factors for diseases such as CHD and diabetes (Brunner and Marmot, 2006). However, it is thought that several aspects of daily life for people lower down the social strata cause more frequent activation of the stress response (*allostatic load*) compared with their more affluent counterparts. Even for those with material circumstances adequate for a healthy existence, there may be financial strain, a lack of social support, monotonous work with poor pay (Brunner and Marmot, 2006), lower control at work, with lower rewards, in turn reducing self-efficacy and the expectance of positive outcomes in return for the demands of daily life (Marmot, Siegrist and Tores, 2006). Indeed, adverse changes in the psychosocial work environment, such as reductions in decision latitude, increased demand, and reduced work social supports have been found to promote a long spells of sickness absence (Head, Kivimaki, Martikainen et al., 2006). Repeated frequent activation of the fight-or-flight response from excessive environmental challenges can act to blunt the response through neuroendocrine feedback controls, thus slowing the return to baseline conditions and eventually leading to elevated baseline levels, or *allostasis* (Brunner and Marmot, 2006; Goldman, 2001), increasing the risk of diabetes and cardiovascular disease.

In the past it was thought that stress was associated mainly with high-power occupations, thus more prevalent in higher socio-economic groups. However, occupations such as those in senior management involve stressful challenges but these are more likely to be acute, and potentially offer some excitement and stimulation, with possible emotional and intellectual rewards, and the individual's perception of their control over the situation will be greater (Brunner and Marmot, 2006); some have found that this type of high-effort-high reward can be health promoting (Siegrist, 1996). In contrast, prolonged exposure to psychological demands with low control over the situation and low perceived rewards have been linked to ill-health (Bosma, Marmot, Hemingway et al., 1997). There is epidemiological evidence to suggest that this mechanism is operating.

Evidence for the stress response pathway

Attempts to measure *allostatic load* have involved several biomarkers, most of which act as indicators of the stress response pathway. They include blood pressure, markers of glucose metabolism (such as glycosulated haemoglobin), urinary cortisol, and norepinephrine and epinephrine (Goldman, 2001). Interestingly, socio-economic gradients for allostatic load have been observed that resemble those for mortality (McEwen and Seeman, 1999). The finding that employment grade of British civil servants was a more powerful predictor of CHD than classic risk factors (blood pressure and plasma cholesterol) in the Whitehall study, resulted in the undertaking of the Whitehall II study to elucidate the mechanisms involved (Brunner and Marmot, 2006). This involved the use of various biomarkers in addition to measuring physiological risk factors; analysis in relation to employment grade revealed that in sequentially lower grades, a progressively larger proportion of subjects exhibited adverse alterations in carbohydrate and lipid metabolism, glucose metabolism (Brunner, Marmot and Nanchalal, 1997), and circulating levels of blood clotting agents (Brunner, Davey Smith, Marmot *et al.*, 1996). Of particular note was the apparent disruption to glucose metabolism. Blood glucose concentrations of those in lower positions within the civil service took longer to return to baseline levels following a glucose challenge (75g) indicating an impaired ability to launch a hormonal response to control the glucose challenge (Brunner et al., 1997). This served as an indication a suggestion that insulin antagonists (such as cortisol) were operating at higher levels than usual. Moreover, this was supported when a subsample of male participants of the Whitehall II study in lower employment grades were found to have higher salivary cortisol levels during the day than those in high grades (Steptoe, Kunz, Owen *et al.*, 2003).

Brunner and Marmot (2006) cited evidence from a cross-cultural study conducted in the 1990s that implicates the stress response as a prime candidate explanation behind the increased risk of CHD mortality in Lithuanian men. Samples of middle-aged men from Lithuania and Sweden were compared. In 1978, middle-aged men in both countries exhibited similar CHD mortality rates. However, over subsequent years which saw the collapse of the Soviet system (with adverse socio-economic consequences in Eastern Europe) and a corresponding divergence in life expectancy in the eastern and western Europe, CHD mortality rose in Lithuania but in Sweden it fell, resulting in a four-fold difference by 1994. Conventional risk factors did not provide an adequate explanation. Most striking were psychosocial factors. Lithuanian men reported more social isolation, job strain and depression compared with Swedish men. Consequently, researchers undertook laboratory stress tests to explore the potential role of the stress response pathway. Participants received three types of environmental challenge (anger recall, mental arithmetic, and hand immersed in iced water) and blood cortisol levels were monitored before, during and after. Swedish men in both low and high income groups had an 'adaptive' response to the stressors; i.e. low baseline levels of blood cortisol rose upon the challenge and subsequently fell. High income Lithuanian men exhibited similar low baseline levels but their response was blunted, with a more gradual increase and slower return to baseline levels. Most notable was the response of the low-income Lithuanian men who, in addition to having far higher baseline levels of blood cortisol, failed to respond to the stress challenges. Researchers concluded that stimulation of the stress response in this group had been so frequent that it had become blunted to the point at which a response was no longer possible; a permanent health-damaging disruption to homeostasis had occurred.

The stress response pathway is likely candidate through which the environment impacts on health. This knowledge can be used to inform discussion about the various causal mechanisms that have been proposed and explains how psychosocial explanations have come to prominence.

References:

Bosma, H., Marmot, M. G., Hemingway, H., Nicholson, A., Brunner, E. J. and Stansfeld, S. (1997). Low job control and risk of coronary heart disease in the Whitehall II (prospective cohort) study. British Medical Journal, **314**: 558-565.

Brunner, E. and Marmot, M. (2006). Social organisation, stress and health. In: Social determinants of health: second edition (edited by Marmot, M. and Wilkinson, R. G.). Oxford: Oxford University Press.

Brunner, E. J., Davey Smith, G., Marmot, M. G., Canner, R., Bekinska, M. and O'Brien, J. (1996). Childhood social circumstances and psychosocial and behavioural factors.as determinants of plasma fibrinogen. Lancet, **347**: 1008-1013.

Brunner, E. J., Marmot, M. G. and Nanchalal, K. (1997). Social inequality in coronary risk: central obesity and the metabolic syndrome. Evidence from the Whitehall II study. Diabetologia, **40**: 1341-1349.

Head, J., Kivimaki, M., Martikainen, P., Vahtera, J., Ferrie, J. E. and Marmot, M. G. (2006). Influence of change in psychosocial work characteristics on sickness absence: the Whitehall II study. Journal of Epidemiology and Community Health, **60**: 55-61.

Marmot, M., Siegrist, J. and Tores, T. (2006). Health and the psychosocial environment and work. In: Social determinants of health: second edition (edited by Marmot, M. and Wilkinson, R. G.). Oxford: Oxford University Press.

McEwen, B. S. and Seeman, T. (1999). Protective and damaging effects of mediators of stress. In: Socio-economic status and health in industrial nations (edited by Adler, N. E., Marmot, M., McEwen, B. S. and Stewart, J.). Annals of the New York Academy of Science **896**: 30-47:

Siegrist, J. (1996). Adverse health effects of high-effort/low-reward conditions. Journal of Occupational Health Psychology, **1**: 27-41.

Steptoe, A., Kunz, S., Owen, N., Feldman, P. J., Willemsen, G. and Kirschbaum, C. (2003). Socio-economic status and stress-related biological responses over the working day. Psychosomatic Medicine, **65**: 461-470.

Appendix 4: Quality assessment criteria used to determine quality rating (QR) of epidemiological studies included in the review of socio-economic position-physical activity

QR	Criteria
1	Original data Provide information on participant selection AND response rate Representative sample (based on size, response rate, inclusion criteria, etc) Pre-validated physical activity measure Justify selection of socio-economic measure AND all socio-economic data continuous OR $\geq$ 3 categories Performed multivariate statistical analysis Level of significance clear (p values OR confidence intervals reported)
2	Original data OR data from previous survey Provide information on participant selection AND response rate Representative sample (based on size, response rate, inclusion criteria, etc) Pre-validated physical activity measure Justify selection of socio-economic measure OR all socio-economic data continuous OR $\geq$ 3 categories Performed multivariate statistical analysis Level of significance clear (p values OR confidence intervals reported)
3	Original data OR data from previous survey Provide information on participant selection AND response rate NOT representative sample (based on size, response rate, inclusion criteria, etc) NOT pre-validated physical activity measure Justify selection of socio-economic measure OR all socio-economic data continuous OR $\geq$ 3 categories Performed multivariate statistical analysis Level of significance clear (p values OR confidence intervals reported)
4	Original data OR data from previous survey Provide information on participant selection OR response rate NOT representative sample (based on size, response rate, inclusion criteria, etc) NOT pre-validated physical activity measure NO justification for selection of socio-economic measure AND some socio-economic data dichotomised Level of significance clear (p values OR confidence intervals reported)
5	Original data OR data from previous survey Provide information on participant selection OR response rate NOT representative sample (based on size, response rate, inclusion criteria, etc) NOT pre-validated physical activity measure NO justification for selection of socio-economic measure Some socio-economic data dichotomised Level of significance unclear
6	Original data OR data from previous survey Inadequate information on participant selection AND response rate NOT representative sample (based on size, response rate, inclusion criteria, etc) NOT pre-validated physical activity measure NO justification for selection of socio-economic measure Some socio-economic data dichotomised Level of significance unclear

Appendix 5: Out-patient referral rates per 1000 patient years at risk, by clinical specialty, age, sex and deprivation category: data or England and Wales, 1994-98. Data from the General Household Survey (ONS, 2005d)

		Referral rate per 1000 at risk											
	Age	0-4	5-15	16-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	Crude rate	Age-adj rate
Men	General medicine	1.1	1.2	7.1	10.9	16.1	24.7	37	46.5	44.7	31.4	18.3	17.4
	General surgery	18.2	9.7	12.8	23.1	29.8	32.2	45.4	57.4	60.7	49.5	28.8	27.7
	Orthopaedic	8.3	8.7	14.7	19.7	23	23.9	28	24.3	23.2	14.6	19.2	18.8
	Rheumatology	0.1	0.2	1	2.2	3.5	4.7	5.1	4.5	3.7	2.3	2.7	2.6
	Neurology	0.2	0.5	2.4	3.1	3.7	4.3	5.1	5.3	3.8	1.5	3.1	3
	Gynaecology	0	0	0	0.3	0.2	0.1	0	0	0	0.1	0.1	0.1
	Ophthalmology	11.5	4.5	3.5	4.4	6.3	9.5	16	28.9	45.7	50	11.1	10.5
	Geriatric	0	0	0	0	0	0	0.3	3.8	17.2	29.3	1.4	1.1
	Paediatric	49.5	16.7	0.4	0	0	0	0	0	0	0.1	5.5	6.6
	Ear/nose/throat	19.9	18.4	9.5	10.1	12	15.5	19.3	23.4	26.6	25.9	15.7	15.7
	Psychiatry	1.6	6.1	8.1	8.7	8.1	6.5	4.2	3.8	7.6	12.4	6.6	6.4
	Dermatology	7.4	7	11.2	8.6	8.3	10	13.2	18.4	22.1	23.9	10.7	10.5
	Total	117.9	73	70.7	91.1	111	131.3	173.6	216.1	255.3	240.9	123.1	120.4
Women	General medicine	0.9	1.4	10.6	14	18.9	27.6	36.2	42.2	35	21	19.8	18.3
	General surgery	4	4.4	15.9	28.7	41.5	49.4	45.3	43.1	36.8	26.9	30.5	29.1
	Orthopaedic	9.3	9	12.7	14.7	19.4	26.1	29.4	29.8	27.9	16.3	19.2	18.6
	Rheumatology	0	0.4	1.9	3.5	6	9.1	9.7	8.3	6.2	3.4	5	4.8
	Neurology	0.2	0.6	3.7	4.6	5.3	5.8	5.2	4.2	2.8	1	3.8	3.7
	Gynaecology	0.2	1.1	36.9	59.8	52.9	41.6	25.6	16.4	10.6	7	30.9	30.7
	Ophthalmology	11	4.8	4.1	5	7.7	12.1	19.4	34.1	50.8	49.8	14.7	12.1
	Geriatric	0	0	0.2	0.4	0.4	0.2	0.5	4.3	19.4	27.6	2.6	1.3
	Paediatric	42.1	16.4	0.6	0.1	0	0	0	0.1	0	0	4.7	6
	Ear/nose/throat	14.2	18.2	11.7	10.4	13.3	16.3	18.5	19.9	23.3	23.3	15.8	15.4
	Psychiatry	1	4	10.7	11.8	10	7.8	5.4	5.4	10.4	14.8	8	7.6
	Dermatology	7.1	9.7	15.1	14.7	13.5	14.5	15.9	17.9	20.1	19.6	14.3	13.7
	Total	90.1	69.8	124.2	167.9	188.8	210.7	211	225.9	243.3	210.7	169.3	161.3

Appendix 6: Out-patient referral rates per 1000 patient years at risk, by clinical specialty gender and deprivation category: data or England and Wales, 1994-98. Data from the General Household Survey 2003 (ONS 2005d).

Referral Type	Deprivation Quintile	Age-standardised rate (all ages) Men	Women	Total
General medicine	Q1	20.0	20.3	40.3
	Q2	17.3	17.9	35.2
	Q3	16.6	17.4	34.0
	Q4	17.4	18.3	35.7
	Q5	16.8	18.9	35.7
General surgery	Q1	29.2	32.7	61.9
	Q2	27.0	27.4	54.4
	Q3	27.8	29.5	57.3
	Q4	28.1	28.0	56.1
	Q5	26.9	29.2	56.1
Orthopaedic	Q1	22.7	22.2	44.9
	Q2	18.7	18.7	37.4
	Q3	19.0	19.1	38.1
	Q4	18.2	17.8	36.0
	Q5	17.0	16.5	33.5
Rheumatology	Q1	2.9	5.4	8.3
	Q2	2.9	4.9	7.8
	Q3	2.5	4.7	7.2
	Q4	2.5	4.6	7.1
	Q5	2.6	4.8	7.4
Neurology	Q1	3.3	3.9	7.2
	Q2	3.2	3.9	7.1
	Q3	3.0	3.8	6.8
	Q4	2.6	3.2	5.8
	Q5	3.2	4.1	7.3
Gynaecology	Q1	0.2	28.8	29.0
	Q2	0.1	28.6	28.7
	Q3	0.1	32.1	32.2
	Q4	0.1	30.9	31.0
	Q5	0.1	31.6	31.7
Ophthalmology	Q1	11.9	13.6	25.5
	Q2	10.4	12.2	22.6
	Q3	10.6	12	22.6
	Q4	10.1	11.7	21.8
	Q5	10	11.6	21.6
Geriatric	Q1	1.2	1.3	2.5
	Q2	1.3	1.5	2.8
	Q3	0.8	1.0	1.8
	Q4	1.0	1.4	2.4
	Q5	1.3	1.5	2.8

Paediatric	Q1	9.0	7.4	16.4
	Q2	6.5	6.0	12.5
	Q3	6.4	5.8	12.2
	Q4	6.5	5.8	12.3
	Q5	5.8	5.6	11.4
Ear, nose and throat	Q1	16.2	15.1	31.3
	Q2	15.6	15.0	30.6
	Q3	15.3	15.3	30.6
	Q4	16.1	15.7	31.8
	Q5	15.4	15.7	31.1
Psychiatry	Q1	5.0	6.6	11.6
	Q2	5.8	7.2	13.0
	Q3	6.3	7.5	13.8
	Q4	7.3	8.6	15.9
	Q5	7.0	7.6	14.6
Dermatology	Q1	10.3	13.4	23.7
	Q2	11.6	14.8	26.4
	Q3	10.2	13.4	23.6
	Q4	10.5	13.8	24.3
	Q5	9.9	13.4	23.3
Total included specialties	Q1	131.9	170.6	302.5
	Q2	120.4	158.2	278.6
	Q3	118.6	161.6	280.2
	Q4	120.4	159.8	280.2
	Q5	115.9	160.4	276.3

Q1=least deprived, Q5=most deprived

Appendix 7: Description of different occupational social classification schemas

Social Class (SC) Scale

In Britain, each census has seen amendments to the original British Registrar General's scale. In all the various derivations, ultimately the decisions to assign occupations to particular social classes have been made by staff of the Office for National Statistics and other experts, rather than in accordance with a coherent body of social theory (Rose and O'Reilly, 1997). The most recent incarnation was the Social Class based on occupation (SC) in 1990, The main disadvantages of the SC were the lack of a clear conceptual basis, the outmoded view of social structure (still based on skill and manual/nonmanual distinctions), and continuing evolution of the scale making temporal comparisons problematic. A further criticism was that the SC neglected non-working groups, who could potentially comprise some of the most deprived sections of the population. The SC's strength was its wide use that ensured good data availability and comparability (Rose and O'Reilly, 1997).

Socio-economic Groups (SEG)

The SEG was the official schema developed as an alternative to the SC with greater theoretical robustness, yet attracted less attention. It took account of employment status and the number of people employed by establishments/companies, and therefore, moved closer to becoming a measure of employment relations, like the Goldthorpe schema (Erikson and Goldthorpe, 1992). The SEG was regarded as being closer to a sociological measure of class (Rose and O'Reilly, 1997).

Alternative Schemas

The wealth and diversity of alternative, unofficial schemas that have been developed reflects a dissatisfaction with official government used schemas (Bergman and Joye, 2001; Rose and O'Reilly, 1997). The Goldthorpe schema is the most widely used alternative (Rose and O'Reilly, 1997), evolving from the 1970s to its most recent form in 1997 (Goldthorpe, 1997). The schema itself is only a conceptual construction and has been operationalised in about twenty different national societies with varying degrees of effectiveness. Moreover, it was used in the development of the latest official classification schema (Office for National Statistics, 2002), which is discussed subsequently. Goldthorpe rejected the idea of an ascending-descending hierarchy based on a single dimension such as prestige, status or economic resources. The researcher's focus was on how individuals fit into the labour market relative to each other. Although other there are considerations, the schema broadly breaks down into *employers*, *the self-employed* and *employees*; i.e. those in authority who do/do not purchase labour, and those under authority who sell their labour. Despite having a more satisfactory theoretical basis than the SC (Rose and O'Reilly (1997) the conceptual validity of the underpinning aversion to hierarchy, somehow ignores the fundamental reliance of all social class schemas on the existence of social hierarchy (Bergman and Joye, 2001); surely this is an inescapable assumption in social stratification.

The Wright Class Structure is based on a similar concept of relationships between classes: material welfare of one class has to depend on the exploitation of another, and the material welfare of one class must depend on the efforts of another. It is regarded as theoretically rigorous but has performed poorly in empirical application (Bergman and Joye, 2001; Marshall, Rose, Newby *et al.*, 1988). Finally, occupational prestige has been used to classify occupations in scales such as the Treiman's prestige scales. The limitation of using occupational prestige is the assumption of society-wide consensus on prestige associated to occupational titles (Bergman and Joye, 2001; Pomerleau, Pederson, Ostbye et al., 1997).

Classification of individuals according to a single occupational attribute such as skill or prestige is simplistic and lacks in conceptual robustness. The final classification system reviewed is that currently used the most recent census in Britain. It is far more sophisticated than most, is based on several factors and has a theoretical base founded primarily in the aforementioned ideas of Goldthorpe.

References:

Bergman, M. M. and Joye, D. (2001) SIDOS, Neuchatel and University of Cambridge, Cambridge.

Erikson, R. and Goldthorpe, J. H. (1992). The constant flux: a study of class mobility in industrial societies. Oxford: Clarendon Press.

Goldthorpe, J. H. (1997). The 'Goldthorpe' class schema: some observations on conceptual issues in relation to the ESRC review of government social classifications. In: Constructing classes: towards a new social classification for the UK (edited by Rose, D. and O'Reilly, K.). Swindon: ESRC/ONS.

Marshall, G., Rose, D., Newby, H. and Vogler, C. (1988). Social Class in Modern Britain. London: Hutchinson.

Office for National Statistics. (2002). The National Statistics Socio-economic Classification user manual. Version 1. London: Stationary Office.

Pomerleau, J., Pederson, L. L., Ostbye, T., Speechley, M. and Speechley, K. (1997). Health behaviours and socio-economic status in Ontario, Canada. European Journal of Epidemiology, 13: 613-622.

Rose, D. and O'Reilly, K. (1997). Constructing classes: towards a new social classification for the UK. Swindon: ESRC and ONS.

Appendix 8: Domains and indicators used in the IMD 2004 (ODPM 2004)

Domain	Indicators (and sources)	Weight
Income	o Adults and children in Income Support households (2001, Source: DWP) o Adults and children in Income Based Job Seekers Allowance households (2001, Source: DWP) o Adults and children in Working Families Tax Credit households whose equivalised income (excluding housing benefits) is below 60% of median before housing costs (2001, Source: Inland Revenue and DWP) o Adults and children in Disabled Person's Tax Credit households whose equivalised income (excluding housing benefits) is below 60% of median before housing costs (2001, Source: Inland Revenue and DWP) o National Asylum Support Service (NASS) supported asylum seekers in England in receipt of subsistence only and accommodation support (2002, Source: Home Office and NASS)	22.5%
Employment	o Unemployment claimant count (JUVOS) of women aged 18-59 and men aged 18-64 averaged over 4 quarters (2001, Source: ONS) o Incapacity Benefit claimants women aged 18-59 and men aged 18-64 (2001, Source: DWP) o Severe Disablement Allowance claimants women aged 18-59 and men aged 18-64 (2001, Source: DWP) o Participants in New Deal for the 18-24s who are not included in the claimant count (2001, Source: DWP) o Participants in New Deal for 25+ who are not included in the claimant count o (2001, Source: DWP) o Participants in New Deal for Lone Parents aged 18 and over (2001, Source: DWP)	22.5%
Health Deprivation and Disability	o Years of Potential Life Lost (YPLL) (1997 to 2001, Source: Mortality data from ONS) o Comparative Illness and Disability Ratio (CIDR) (2001, Source: IS, AA, DLA, SDA, IB from DWP) o Measures of emergency admissions to hospital, derived from Hospital Episode Statistics (1999/2000 to 2001/2002, Source: Department of Health) o Measure of adults under 60 suffering from mood or anxiety disorders, based on prescribing (2001, Source: Prescribing Pricing Authority), Hospital Episode Statistics (1998/1999 to 2001/2002, Source: Department of Health), suicides (1997 to 2001, Source: ONS) and health benefits data (1999, Source: IB and SDA from DWP)	13.5%
Education, Skills and Training	o Average points score of pupils at Key Stage 2 (end of primary) (2002, Source: Pupil Level Annual School Census (PLASC) and the National Pupil Database (NPD) from the DfES) o Average points score of pupils at Key Stage 3 (2002, Source: Pupil Level Annual School Census (PLASC) and the National Pupil Database (NPD) from the DfES) o Average points score of pupils at Key Stage 4 (GCSE/GNVQ – best of eight results) (2002, Source: Pupil Level Annual School Census (PLASC) and the o National Pupil Database (NPD) from the DfES) o Proportion of young people not staying on in school or non-advanced further education above 16 (Child Benefit 2001, Source: DWP) o Secondary school absence rate (Average of 2001 and 2002, Source: DfES school level survey of authorised and unauthorised absences, allocated to the local area via the PLASC data, DfES) o Proportion of those aged under 21 not entering Higher Education (1999-2002, Source: UCAS) o Proportions of working age adults (aged 25-54) in the area with no or low qualifications (2001, Source: 2001 Census).	13.5%

Barriers to Housing and Services Domain	**Sub-Domain: Wider Barriers** o Household overcrowding (2001, Source: 2001 Census) o LA level percentage of households for whom a decision on their application for assistance under the homeless provisions of housing legislation has been made, assigned to the constituent SOAs (2002, Source: ODPM) o Difficulty of Access to owner-occupation (2002) **Sub-Domain: Geographical Barriers** o Road distance to GP premises (May 2003, Source: National Health Service Information Authority) o Road distance to a supermarket or convenience store (December 2002, Source: MapInfo Ltd) o Road distance to a primary school (2001-02, Source: DfES) o Road distance to a Post Office (End of March 2003, Source: Post Office Ltd)	9.3%
Living environment deprivation	**Sub-Domain: The 'indoors' living environment** o Social and private housing in poor condition (2001, Source: BRE and ODPM, modelled EHCS) o Houses without central heating (2001, Source: 2001 Census). **Sub-Domain: The 'outdoors' living environment** o Air quality (2001, Source: UK National Air Quality Archive data modelled at SOA level by the Geography Department at Staffordshire University) o Road traffic accidents involving injury to pedestrians and cyclists (2000-2002, o Source: DfT, STATS19 (Road Accident Data) smoothed to SOA level)	9.3%
Crime and disorder	o Burglary (4 recorded crime offence types, Police Force data for April 2002 March 2003, constrained to Crime and Disorder Reduction Partnership (CDRP) level) o Theft (5 recorded crime offence types, Police Force data for April 2002-March 2003, constrained to CDRP level) o Criminal damage (10 recorded crime offence types, Police Force data for April 2002-March 2003, constrained to CDRP level) o Violence (14 recorded crime offence types, Police Force data for April 2002-March 2003, constrained to CDRP level) o	9.3%

Appendix 9: ProActive referral criteria for health professionals

ProACTIVE PHYSICAL ACTIVITY REFERRAL SCHEME

physical activity group Somerset

GUIDELINES FOR REFERRERS

The ProActive Physical Activity Referral Scheme is a countywide scheme designed to provide a safe introduction to physical activity for people who have specific health problems and have previously led an inactive lifestyle. We welcome referrals for clients who would benefit from a structured approach to increasing their activity levels. Our aim is to provide safe and effective exercise within the knowledge base and experience of our instructors (all of whom have been assessed by Somerset Physical Activity Group and achieved the required standard to be working on the scheme).

The scheme is designed for patients who will be able to exercise independently once they have completed the scheme. Clients who require continuous 1-1 supervision or help with undressing can be accepted if a carer is in attendance.

The conditions listed below are known to be associated with an increased risk when exercise is undertaken. Patients with the following conditions are therefore **not** eligible for referral to the SPAG ProActive scheme. These are adapted from the American College of Sports Medicine Guidelines for Exercise Testing and Prescription, Sixth Edition, 2000.

Cardiac

- Recent significant change in a resting ECG suggesting significant ischaemia, recent myocardial infarction or other acute cardiac event
- Unstable angina
- Uncontrolled cardiac arrythmias causing symptoms or haemodynamic compromise
- Severe symptomatic aortic stenosis
- Uncontrolled symptomatic heart failure
- Acute pulmonary embolus
- Acute myocarditis or pericarditis
- Suspected or known dissecting aneurysm
- Tachycardia of >100 bpm
- *Uncontrolled* Hypertension i.e. Systolic > 180mmHg or Diastolic >110mmHg

Metabolic

- *Uncontrolled* metabolic disease (e.g. diabetes, thyrotoxicosis, or myxoedema)

Muscular

- Neuromuscular, musculoskeletal, or rheumatoid disorders that are exacerbated by exercise

Other

- Acute infections/illness/fever
- *Uncontrolled* mental health condition

TO REFER A PATIENT TO PROACTIVE:

- Complete a referral form for each patient
- The patient should be asked to sign the form
- White copy of the form initiates the scheme, and should be sent to the address opposite
- Blue copy of the form is for practice records
- Patient is given a ProActive leaflet

Appendix 10: ProActive referral form

ProACTIVE

Physical Activity Referral Form

Client Details	*Reasons for Referral:*
Title: Mr / Mrs / Miss / Ms / Dr	....
Name:	*Relevant Medical History:* ....
Date of Birth:	*Medication:* ....
Address:	
Town:	
Postcode:	
Best telephone number to call:	
(.........)...	*Recent Blood Pressure Reading:* ..../.........
(.........)...	*Additional Information (eg. activity to be avoided):* ....
Best time to call:	

This section must be completed by the health professional

I recommend that the client named above should undertake a programme to increase his/her physical activity levels.

Referrer Details

Name: .... *Signature:* ....

Appendix 11: Letter of ethical approval

WEST SOMERSET LOCAL RESEARCH ETHICS COMMITTEE

Chair: Dr R Mann

TAUNTON & SOMERSET HOSPITAL
MUSGROVE PARK
TAUNTON
SOMERSET
TA1 5DA
TEL: (01823) 342799
Fax: (01823) 342780
Email: Alison.Courtney@tst.nhs.uk

PLEASE QUOTE LREC REFERENCE IN ALL CORRESPONDENCE

RM/ac

28th August 2002

Dr L Johnston
School of Sport & Leisure
University of Gloucestershire
Francis Close Hall
Swindon Road
Cheltenham, Glos.
GL50 4AZ

Dear Dr Johnston

RE: PROACTIVE PHYSICAL ACTIVITY REFERRAL SCHEME

Thank you for your letter dated 16th August 2002 regarding the above.

It seems from your letter that that this is simply an audit to support service planning and delivery and as such will not require formal submission to the Ethics Committee.

Yours sincerely

Alison Courtney

pp Dr R MANN
Chair
West Somerset Ethics Committee

Appendix 12: ProActive Personal client record form (front and back)

ProACTIVE

physical activity group Somerset

PERSONAL CLIENT RECORD

Referral Information

Name<title<first name>><Name> *Address* *Contact Number* *Referrer* <referrers name> *Position* *Surgery* *Date of referral*	*Reasons for Referral* *Medication* *Additional relevant medical information*

Personal Information

Gender M/F *Date of Birth* *Occupation*	

Initial Assessment Information

Date .... *Attended* Yes / No *Physical Activity Objectives* 1. .... 2. .... 3. .... *Physical Activity Barriers* 1. .... 2. .... 3. .... *Height* .... *metres* Weight ....kilograms Blood Pressure High? Yes / No Blood Pressure .... mmHg *High Cholesterol?* *Yes / No*	**Lifestyle Assessment** *Physical Activity / times per week* *(number of sessions lasting 15 mins or more)* *Strenuous* .... *Moderate* .... *Mild* .... *Physical Activity Stage of Change* 1. Not wishing to be active ☐ 2. Thinking about being active ☐ 3. Preparing to be active ☐ 4. Becoming more active ☐ 5. Maintaining activity ☐ 6. Relapsing ☐ *Smoker Yes / No (how many? ...../day)*

Final Assessment Information

Date .... *Attended* Yes / No *Total no of sessions attended.........* *out of a possible.......... sessions* *Physical Activity Objectives* 1. .... 2. .... 3. .... *Physical Activity Barriers* 1. .... 2. .... 3. .... *Height* .... *metres* Weight .... kilograms Blood Pressure High? Yes / No Blood Pressure .... mmHg	**Lifestyle Assessment** *Physical Activity / times per week* *(number of sessions lasting 15 mins or more)* *Strenuous* .... *Moderate* .... *Mild* .... *Physical Activity Stage of Change* 1. Not wishing to be active ☐ 2. Thinking about being active ☐ 3. Preparing to be active ☐ 4. Becoming more active ☐ 5. Maintaining activity ☐ 6. Relapsing ☐ *Smoker Yes / No (how many? ...../day* *High Cholesterol?* Yes / No

Appendix 13: Characteristics of Somerset residents compared with the average for England. Data from the 2001 census (Casweb, 2004).

		Mean %		Difference	
		Somerset	England	Eng-Somerset	%
Age (%residents)					
	20-29	9.54	12.25	-2.71	-22.09
	30-39	14.01	15.29	-1.28	-8.38
	40-49	13.34	13.45	-0.11	-0.83
	50-59	14.03	12.79	1.23	9.63
	60-69	10.43	9.40	1.03	10.97
	70-79	9.03	7.48	1.55	20.75
	80-89	4.51	3.63	0.88	24.24
	90+	0.86	0.66	0.20	30.34
Gender (%residents)					
	Men	48.58	48.84	-0.26	-0.53
	Women	51.42	51.16	0.26	0.51
Townsend variables					
	% households overcrowded	3.86	5.84	-1.98	-33.92
	% residents unemployed	2.46	3.21	-0.76	-23.55
	% households not owned	25.72	29.31	-3.59	-12.25
	% households with no car	17.57	24.79	-7.22	-29.13
NS-SEC Social Class (%residents)					
1	Higher managerial and professional	7.00	8.15	-1.15	-14.06
2	Lower managerial and professional	17.89	18.27	-0.38	-2.08
3	Intermediate	8.05	9.34	-1.29	-13.83
4	Small employers, own account workers	9.81	7.06	2.75	38.90
5	Lower supervisory, craft and related occupations	8.24	7.61	0.63	8.23
6	Semi-routine	13.13	12.17	0.96	7.89
7	Routine	9.91	9.53	0.37	3.92
8	Never worked, long-term unemployed	2.09	3.27	-1.18	-35.98
	unclassifiable	23.89	24.60	-0.71	-2.90
Car ownership (% households)					
	0 car	17.57	24.79	-7.22	-29.13
	1 car	46.22	44.20	2.03	4.58
	2 car	28.19	24.77	3.42	13.81
	3 car	5.97	4.78	1.19	24.97
	4+ car	2.05	1.46	0.58	39.84
	2+ cars	36.21	31.01	5.20	16.76
Housing tenure (% households)					
	owned	74.28	70.69	3.59	5.08
	social rented	13.82	17.42	-3.60	-20.69
	private rented	9.36	9.88	-0.52	-5.27
	rent free	2.54	2.01	0.53	26.52
Occupancy rating (% households)					
	2+	58.02	51.50	6.52	12.65
	1	23.89	25.53	-1.64	-6.43
	0	14.23	17.13	-2.89	-16.90
	-1	3.01	4.31	-1.29	-30.06
	-2	0.85	1.53	-0.69	-44.75

	Mean %		Difference	
	Somerset	England	Eng-Somerset	%
Economic activity (%residents)				
economically active (total)	67.92	67.15	0.77	1.14
employees (total)	52.29	53.19	-0.90	-1.70
P-T employees	13.80	12.40	1.41	11.35
F-T employees	38.49	40.80	-2.31	-5.66
self-employed	11.08	8.19	2.89	35.32
unemployed	2.46	3.21	-0.76	-23.55
economically inactive (total)	32.08	32.85	-0.77	-2.33
retired	16.33	13.93	2.40	17.24
Disabled/LLI	4.34	5.26	-0.92	-17.53
Industry (%residents)				
Agriculture hunting and forestry	3.71	1.60	2.11	132.32
Fishing	0.02	0.04	-0.01	-32.91
Mining and quarrying	0.40	0.27	0.13	47.48
Manufacturing	16.58	15.81	0.77	4.85
Electric, gas, water supply	0.82	0.78	0.04	5.20
Construction	7.68	6.94	0.74	10.61
Wholesale/retail trade, repair	18.53	17.20	1.33	7.71
Hotels/restaurant	5.09	5.02	0.07	1.31
%transport, storage, communic'n	5.25	7.13	-1.88	-26.34
Financial intermediation	2.28	4.14	-1.86	-44.87
Real estate, renting and business	9.81	12.14	-2.32	-19.14
Pub admin, defence, Soc Security	6.21	5.80	0.42	7.18
Education	7.88	7.62	0.26	3.35
Health and social work	11.17	10.68	0.49	4.58
Other community, soc/pers service	4.44	4.71	-0.27	-5.75
Private HH with employed person	0.11	0.08	0.02	25.42
Extraterritorial organisations/bodies	0.02	0.04	-0.02	-50.03
Ethnicity (%residents)				
White	98.80	94.12	4.68	4.97
Mixed	0.47	1.01	-0.54	-53.18
Asian	0.28	3.21	-2.93	-91.35
Black	0.15	1.03	-0.88	-85.58
Chinese/other	0.30	0.63	-0.33	-52.79

LLI, long-term limiting illness

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Appendix 14: Census Area Statistics (CAS) tables for variables extracted for analysis (Taken from: Casweb: web interface to Census aggregate outputs and digital boundary data http://www.census.ac.uk/casweb)

TABLE UV03 SEX

Table population : All people
Geographical level : Output Area to UK

ALL PEOPLE	0001
Males	0002
Females	0003

TABLE UV04 AGE

Table population : All people
Geographical level : Output Area to UK

ALL PEOPLE	0001
Under 1	0002
1	0003
2	0004
3	0005
4	0006
5	0007
6	0008
7	0009
8	0010
9	0011
10	0012
11	0013
12	0014
13	0015
14	0016
15	0017
16	0018
17	0019
18	0020
19	0021
20	0022
21	0023
22	0024
23	0025
24	0026
25	0027
26	0028
27	0029
28	0030
29	0031
30	0032
31	0033
32	0034
33	0035
34	0036
35	0037
36	0038
37	0039
38	0040
39	0041
40	0042
41	0043
42	0044
43	0045
44	0046
45	0047
46	0048
47	0049
48	0050
49	0051
50	0052
51	0053
52	0054
53	0055
54	0056
55	0057
56	0058
57	0059
58	0060
59	0061
60	0062
61	0063
62	0064
63	0065
64	0066
65	0067
66	0068
67	0069
68	0070
69	0071
70	0072
71	0073
72	0074
73	0075
74	0076
75 to 79	0077
80 to 84	0078
85 to 89	0079
90 to 94	0080
95 to 99	0081
100 years and over	0082

TABLE UV28 ECONOMIC ACTIVITY

Table population : All people aged 16 to 74
Geographical level : Output Area to UK

ALL PEOPLE	C001
Economically active	C002
Employee	C003
Part-time	C004
Full-time	C005
Self employed with employees	C006
Part-time	C007
Full-time	C008
Self employed without employees	C009
Part-time	C010
Full-time	C011
Unemployed	C012
Full-time students	C013
Economically inactive	C014
Retired	C015
Student	C016
Looking after home/family	C017
Permanently sick/disabled	C018
Other	C019

Footnote:
1. For the Census, part-time is defined as working 30 hours or less a week. Full-time is defined as working 31 or more hours a week.

TABLE UV31 NATIONAL STATISTICS SOCIO-ECONOMIC CLASSIFICATION (NS-SeC)

Table population : All people aged 16 to 74
Geographical level : Output Area to UK

ALL PEOPLE	D001
1. Higher managerial and professional occupations	D002
1.1 Large employers and higher managerial occupations	D003
L1 Employers in large organisations	D004
L2 Higher managerial	D005
1.2 Higher professional occupations	D006
L3.1 Higher professionals (traditional) - employees	D007
L3.2 Higher professionals (new) - employees	D008
L3.3 Higher professionals (traditional) - self-employed	D009
L3.4 Higher professionals (new) - self-employed	D010
2. Lower managerial and professional occupations	D011
L4.1 Lower professionals and higher technical (traditional) - employees	D012
L4.2 Lower professionals and higher technical (new) - employees	D013
L4.3 Lower professionals and higher technical (traditional) - self-employed	D014
L4.4 Lower professionals and higher technical (new) - self-employed	D015
L5 Lower managerial	D016
L6 Higher supervisory	D017
3. Intermediate occupations	D019
L7.1 Intermediate clerical and administrative	D019
L7.2 Intermediate sales and service	D020
L7.3 Intermediate technical and auxiliary	D021
L7.4 Intermediate engineering	D022
4. Small employers and own account workers	D023
L8.1 Employers in small organisations (non-professional)	D024
L8.2 Employers in small organisations (agriculture)	D025
L9.1 Own account workers (non-professional)	D026
L9.2 Own account workers (agriculture)	D027

TABLE UV31 NATIONAL STATISTICS SOCIO-ECONOMIC CLASSIFICATION (NS-SeC)

Table population : All people aged 16 to 74
Geographical level : Output Area to UK

5. Lower supervisory and technical occupations	0028
L10 Lower supervisory	0029
L11.1 Lower technical craft	0030
L11.2 Lower technical process operative	0031
6. Semi-routine occupations	0032
L12.1 Semi-routine sales	0033
L12.2 Semi-routine service	0034
L12.3 Semi-routine technical	0035
L12.4 Semi-routine operative	0036
L12.5 Semi-routine agriculture	0037
L12.6 Semi-routine clerical	0038
L12.7 Semi-routine childcare	0039
7. Routine occupations	0040
L13.1 Routine sales and service	0041
L13.2 Routine production	0042
L13.3 Routine technical	0043
L13.4 Routine operative	0044
L13.5 Routine agricultural	0045
8. Never worked and long-term unemployed	0046
L14.1 Never worked	0047
L14.2 Long-term unemployed	0048
Not Classified	0049
L15 Full-time students	0050
L17 Not classifiable for other reasons	0051

Footnotes:
1. Year last worked is 1992 or earlier.
2. Not classifiable for other reasons includes people whose occupation has not been coded and those who cannot be allocated to an NS-SeC category.
3. In the NS-SeC classification, all full-time students are recorded in the 'full-time students' category regardless of if they are economically active or not.

TABLE UV58 OCCUPANCY RATING

Table population : All households
Geographical level : Output Area to UK

ALL HOUSEHOLDS	0001
Occupancy rating +2 or more	0002
Occupancy rating +1	0003
Occupancy rating 0	0004
Occupancy rating -1	0005
Occupancy rating -2 or less	0006

Footnote:
1. The occupancy rating provides a measure of under-occupancy and overcrowding. For example a value of -1 implies that there is one room too few and that there is overcrowding in the household.

TABLE UV62 CARS OR VANS

Table population : All households
Geographical level : Output Area to UK

ALL HOUSEHOLDS	0001
No car or van	0002
1 car or van	0003
2 cars or vans	0004
3 cars or vans	0005
4 or more cars or vans	0006
TOTAL CARS OR VANS	0007

Footnote:
1. Includes any company car or van if available for private use.

TABLE UV63 TENURE (HOUSEHOLDS) (England, Wales and Northern Ireland)

Table population : All households
Geographical level : Output Area to England and Wales and Northern Ireland

ALL HOUSEHOLDS	0001
Owned	0002
Owns outright	0003
Owns with a mortgage or loan	0004
Shared ownership	0005
Social rented	0006
Rented from Council (Local Authority)	0007
Other social rented	0008
Private rented	0009
Private landlord or letting agency	0010
Employer of a household member	0011
Relative or friend of a household member	0012
Other	0013
Living rent free	0014

Footnotes :

1. The terms used to describe tenure are defined as: Owned: either owned outright, owned with a mortgage or loan, or paying part rent and part mortgage (shared ownership). Other social rented includes rented from Registered Social Landlord, Housing association, Housing Co-operative and Charitable Trust. In Northern Ireland, 'Rented from council' refers to rented from the Northern Ireland Housing Executive. Private rented: renting from a private landlord or letting agency, employer of a household member, a relative or friend of a household member or other person.

2. 'Living rent free' could include households that are living in accommodation other than private rented.

Appendix 15: SPSS output for Kolmogorov-Smirnov tests for normality – all socio-economic variables for study population of ProActive referrals and for population of Somerset

A. Townsend score

ProActive Referrals

One-Sample Kolmogorov-Smirnov Test[c]

		Townsend Score
N		3569
Normal Parameters[a,b]	Mean	.326159
	Std. Deviation	3.1769987
Most Extreme Differences	Absolute	.082
	Positive	.082
	Negative	-.044
Kolmogorov-Smirnov Z		4.898
Asymp. Sig. (2-tailed)		.000

a. Test distribution is Normal.

b. Calculated from data.

c. SampleVSsomerset = ProActive Referrals

Somerset

One-Sample Kolmogorov-Smirnov Test[c]

		Townsend Score
N		1748
Normal Parameters[a,b]	Mean	.000000
	Std. Deviation	3.1347769
Most Extreme Differences	Absolute	.082
	Positive	.082
	Negative	-.045
Kolmogorov-Smirnov Z		3.433
Asymp. Sig. (2-tailed)		.000

a. Test distribution is Normal.

b. Calculated from data.

c. SampleVSsomerset = Somerset

B. Car ownership

ProActive Referrals

One-Sample Kolmogorov-Smirnov Test

		% HH with 0 car	% HH with 1 car	% HH with 2 car	% HH with 3 car	% HH with 4 car	Average cars/HH
N		3569	3569	3569	3569	3569	3569
Normal Parameters [a,b]	Mean	18.353359	46.746175	27.253856	5.669682	1.976928	1.271273
	Std. Deviation	12.61198	8.0133956	10.94510	3.7033960	2.2048327	.3221012
Most Extreme Differences	Absolute	.102	.031	.033	.095	.255	.027
	Positive	.102	.023	.033	.095	.255	.020
	Negative	-.083	-.031	-.031	-.088	-.185	-.027
Kolmogorov-Smirnov Z		6.097	1.871	1.954	5.663	15.247	1.590
Asymp. Sig. (2-tailed)		.000	.002	.001	.000	.000	.013

a. Test distribution is Normal.

b. Calculated from data.

c. SampleVSsomerset = ProActive Referrals

Somerset

One-Sample Kolmogorov-Smirnov Test

		% HH with 0 car	% HH with 1 car	% HH with 2 car	% HH with 3 car	% HH with 4 car	Average cars/HH
N		1748	1748	1748	1748	1748	1748
Normal Parameters [a,b]	Mean	17.212580	45.987536	28.536508	6.132630	2.130746	1.310667
	Std. Deviation	12.72634	8.4504373	11.41791	4.0945667	2.4320278	.3421038
Most Extreme Differences	Absolute	.114	.028	.035	.090	.250	.029
	Positive	.114	.017	.035	.090	.250	.021
	Negative	-.095	-.028	-.033	-.088	-.190	-.029
Kolmogorov-Smirnov Z		4.757	1.159	1.456	3.782	10.453	1.223
Asymp. Sig. (2-tailed)		.000	.136	.029	.000	.000	.101

a. Test distribution is Normal.

b. Calculated from data.

c. SampleVSsomerset = Somerset

C. Housing tenure

ProActive Referrals

One-Sample Kolmogorov-Smirnov Test

		% owner occupied household	% social rented household	% private rented households	% households rent-free
N		3569	3569	3569	3569
Normal Parameters [a,b]	Mean	73.254973	14.667031	9.572208	2.505789
	Std. Deviation	19.9434368	18.6318737	9.1987632	2.7971300
Most Extreme Differences	Absolute	.121	.216	.168	.185
	Positive	.097	.207	.168	.170
	Negative	-.121	-.216	-.149	-.185
Kolmogorov-Smirnov Z		7.238	12.879	10.038	11.062
Asymp. Sig. (2-tailed)		.000	.000	.000	.000

a. Test distribution is Normal.

b. Calculated from data.

c. SampleVSsomerset = ProActive Referrals

Somerset

One-Sample Kolmogorov-Smirnov Test

		% owner occupied household	% social rented household	% private rented households	% households rent-free
N		1748	1748	1748	1748
Normal Parameters[a,b]	Mean	74.269735	13.649735	9.477933	2.602597
	Std. Deviation	19.4374542	17.9166878	9.0320066	2.8451287
Most Extreme Differences	Absolute	.110	.223	.153	.180
	Positive	.100	.210	.153	.177
	Negative	-.110	-.223	-.147	-.180
Kolmogorov-Smirnov Z		4.597	9.327	6.381	7.532
Asymp. Sig. (2-tailed)		.000	.000	.000	.000

a. Test distribution is Normal.

b. Calculated from data.

c. SampleVSsomerset = Somerset

D. Occupancy Rating

ProActive Referrals

One-Sample Kolmogorov-Smirnov Test

		% HH Occupancy Rating 2 or more	% HH Occupancy Rating 1	% HH Occupancy Rating 0+	% HH Occupancy Rating -1	% HH Occupancy Rating -2 or less
N		3569	3569	3569	3569	3569
Normal Parameters[a,b]	Mean	56.905179	23.967964	15.014043	3.187142	.925671
	Std. Deviation	18.8927119	9.4079806	10.9284652	3.3272678	1.7403947
Most Extreme Differences	Absolute	.061	.046	.119	.169	.403
	Positive	.034	.046	.119	.133	.403
	Negative	-.061	-.023	-.098	-.169	-.297
Kolmogorov-Smirnov Z		3.646	2.756	7.111	10.100	24.097
Asymp. Sig. (2-tailed)		.000	.000	.000	.000	.000

a. Test distribution is Normal.

b. Calculated from data.

c. SampleVSsomerset = ProActive Referrals

Somerset

One-Sample Kolmogorov-Smirnov Test

		% HH Occupancy Rating 2 or more	% HH Occupancy Rating 1	% HH Occupancy Rating 0+	% HH Occupancy Rating -1	% HH Occupancy Rating -2 or less
N		1748	1748	1748	1748	1748
Normal Parameters[a,b]	Mean	58.497984	23.657569	14.031727	2.957394	.855327
	Std. Deviation	19.0363255	9.8088665	10.4802382	3.2261771	1.6852827
Most Extreme Differences	Absolute	.068	.040	.113	.180	.419
	Positive	.039	.040	.113	.137	.419
	Negative	-.068	-.030	-.098	-.180	-.306
Kolmogorov-Smirnov Z		2.834	1.687	4.732	7.511	17.515
Asymp. Sig. (2-tailed)		.000	.007	.000	.000	.000

a. Test distribution is Normal.

b. Calculated from data.

c. SampleVSsomerset = Somerset

E. Employment Status

ProActive Referrals

One-Sample Kolmogorov-Smirnov Test

		% Economically Active	% Employed	% P-T employed	% F-T employed	% Self-employed	% Unemployed	% Economically Inactive	% Retired	% Carers	% Disabled/LLI
N		3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
Normal Parameters[a,b]	Mean	67.034817	51.500308	13.877211	37.623096	10.796158	2.715444	32.965183	16.726097	6.020034	4.797024
	Std. Deviation	8.7702820	9.9167369	3.1131381	9.0628209	5.8909014	1.9457839	8.7702820	7.6981712	2.7625435	3.0233468
Most Extreme Differences	Absolute	.043	.027	.018	.055	.109	.103	.043	.065	.075	.098
	Positive	.017	.027	.018	.055	.109	.103	.043	.065	.075	.098
	Negative	-.043	-.017	-.017	-.026	-.062	-.100	-.017	-.034	-.057	-.084
Kolmogorov-Smirnov Z		2.561	1.637	1.086	3.295	6.517	6.149	2.561	3.908	4.509	5.829
Asymp. Sig. (2-tailed)		.000	.009	.189	.000	.000	.000	.000	.000	.000	.000

a. Test distribution is Normal.

b. Calculated from data.

c. SampleVSsomerset = ProActive Referrals

Somerset

One-Sample Kolmogorov-Smirnov Test

		% Economically Active	% Employed	% P-T employed	% F-T employed	% Self-employed	% Unemployed	% Economically Inactive	% Retired	% Carers	% Disabled/LLI
N		1748	1748	1748	1748	1748	1748	1748	1748	1748	1748
Normal Parameters[a,b]	Mean	67.443818	51.705612	13.719332	37.986280	11.190241	2.517568	32.556182	16.811811	6.140161	4.450920
	Std. Deviation	8.7609262	10.3067646	3.1765189	9.2042075	6.3698048	1.8151726	8.7609262	7.7333562	2.6968046	2.9579357
Most Extreme Differences	Absolute	.042	.025	.011	.053	.106	.094	.042	.061	.066	.112
	Positive	.021	.025	.011	.053	.106	.094	.042	.061	.066	.112
	Negative	-.042	-.015	-.011	-.021	-.066	-.090	-.021	-.035	-.050	-.094
Kolmogorov-Smirnov Z		1.777	1.038	.463	2.216	4.415	3.935	1.777	2.561	2.773	4.682
Asymp. Sig. (2-tailed)		.004	.232	.983	.000	.000	.000	.004	.000	.000	.000

a. Test distribution is Normal.

b. Calculated from data.

c. SampleVSsomerset = Somerset

F. NS-SEC Social Class

ProActive Referrals

One-Sample Kolmogorov-Smirnov Test

		% Class 1	% Class 2	% Class 3	% Class 4	% Class 5	% Class 6	% Class 7	% Class 8	% Unclassified
N		3569	3569	3569	3569	3569	3569	3569	3569	3569
Normal Parameters[a,b]	Mean	6.550990	17.525000	7.781684	9.590468	8.093662	13.387945	10.376961	2.361229	24.332062
	Std. Deviation	3.8995317	5.8006033	3.2282145	4.9263512	3.1468025	4.7578425	5.3942324	2.2303657	7.6505502
Most Extreme Differences	Absolute	.046	.022	.054	.109	.033	.038	.060	.145	.043
	Positive	.043	.020	.054	.109	.033	.038	.060	.134	.043
	Negative	-.046	-.022	-.046	-.067	-.018	-.022	-.043	-.145	-.024
Kolmogorov-Smirnov Z		2.777	1.290	3.241	6.533	1.949	2.288	3.560	8.655	2.558
Asymp. Sig. (2-tailed)		.000	.072	.000	.000	.001	.000	.000	.000	.000

a. Test distribution is Normal.

b. Calculated from data.

c. SampleVSsomerset = ProActive Referrals

Somerset

One-Sample Kolmogorov-Smirnov Test

		% Class 1	% Class 2	% Class 3	% Class 4	% Class 5	% Class 6	% Class 7	% Class 8	% Unclassified
N		1748	1748	1748	1748	1748	1748	1748	1748	1748
Normal Parameters[a,b]	Mean	-630.8162	-2273.946	-777.5021	-1329.589	-813.1599	-1498.946	-831.6866	-127.7273	-2791.799244
	Std. Deviation	13485.77	52037.98	18740.26	30323.77	28674.35	56732.72	36006.89	6358.071	70393.11220
Most Extreme Differences	Absolute	.372	.403	.388	.397	.407	.420	.410	.415	.402
	Positive	.365	.382	.369	.386	.393	.400	.396	.393	.386
	Negative	-.372	-.403	-.388	-.397	-.407	-.420	-.410	-.415	-.402
Kolmogorov-Smirnov Z		15.566	16.831	16.215	16.608	17.019	17.558	17.159	17.334	16.818
Asymp. Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000	.000	.000

a. Test distribution is Normal.

b. Calculated from data.

c. SampleVSsomerset = Somerset

Appendix 16: Statistical alternatives explored to enable difference tests between socio-economic characteristics of ProActive participants areas of residence versus the Somerset average using data weighted for Output Area (OA) population size

Several consultations with a statistician resulted in several alternatives being explored:

i. One-sample t-test
ii. Pooled standard deviation calculation (i.e. pool SD of socio-economic values for each OA)
iii. Standard Error of Proportions

In each case the nature of the data meant that tests were either inappropriate or impossible. Firstly, all t-tests were ruled out as data were non-parametric. Secondly, the standard deviations of socio-economic variables for each OA were unknown and therefore could not be pooled. Finally, the Standard Error of Proportions calculation involved the total number of households (n=210587) or people (n=353419) for Somerset. This produced significant results for all variables due to very large number of subjects. Conversely, if these totals were substituted for the mean number of households (n=120) or people (n=299) per OA in Somerset, no significant outcomes were found due to the small sample size. Therefore, either approach produced outcomes that were merely statistical artefacts of the sample size.

Given the absence of a satisfactory alternative and the small effect that weighting had on mean values for socio-economic variables (for Somerset OAs), the most satisfactory approach was to run non-parametric (Mann-Whitney and Kruskal-Wallis) tests on unweighted data to give a best impression of the direction, magnitude and significance of differences.

Appendix 17: SPSS output from Spearman's rank tests for correlations between the Townsend's score of material deprivation and other socio-economic variables (data from sample in RQ1; n= 3569)

A. Car ownership

Correlations[a]

			Townsend Score	% HH with 0 car	% HH with 1 car	% HH with 2 car	% HH with 3 car	% HH with 4 car	Average cars/HH
Spearman's rho	Townsend Score	Correlation Coefficient	1.000	.818**	.054**	-.737**	-.563**	-.335**	-.773**
		Sig. (2-tailed)	.	.000	.001	.000	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569
	% HH with 0 car	Correlation Coefficient	.818**	1.000	.119**	-.876**	-.687**	-.423**	-.929**
		Sig. (2-tailed)	.000	.	.000	.000	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569
	% HH with 1 car	Correlation Coefficient	.054**	.119**	1.000	-.434**	-.409**	-.370**	-.363**
		Sig. (2-tailed)	.001	.000	.	.000	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569
	% HH with 2 car	Correlation Coefficient	-.737**	-.876**	-.434**	1.000	.676**	.414**	.925**
		Sig. (2-tailed)	.000	.000	.000	.	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569
	% HH with 3 car	Correlation Coefficient	-.563**	-.687**	-.409**	.676**	1.000	.400**	.799**
		Sig. (2-tailed)	.000	.000	.000	.000	.	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569
	% HH with 4 car	Correlation Coefficient	-.335**	-.423**	-.370**	.414**	.400**	1.000	.609**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.	.000
		N	3569	3569	3569	3569	3569	3569	3569
	Average cars/HH	Correlation Coefficient	-.773**	-.929**	-.363**	.925**	.799**	.609**	1.000
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.
		N	3569	3569	3569	3569	3569	3569	3569

**. Correlation is significant at the 0.01 level (2-tailed).

a. SampleVSsomerset = ProActive Referrals

B. Housing tenure

Correlations[a]

			Townsend Score	% Owner Occupied HH	% Social Rented HH	% Private Rented HH	% Rent-free HH
Spearman's rho	Townsend Score	Correlation Coefficient	1.000	-.851**	.713**	.200**	.315**
		Sig. (2-tailed)	.	.000	.000	.000	.000
		N	3569	3569	3569	3569	3569
	% Over Occupied HH	Correlation Coefficient	-.851**	1.000	-.833**	-.248**	-.482**
		Sig. (2-tailed)	.000	.	.000	.000	.000
		N	3569	3569	3569	3569	3569
	% Social Rented HH	Correlation Coefficient	.713**	-.833**	1.000	-.162**	.388**
		Sig. (2-tailed)	.000	.000	.	.000	.000
		N	3569	3569	3569	3569	3569
	% Private Rented HH	Correlation Coefficient	.200**	-.248**	-.162**	1.000	-.016
		Sig. (2-tailed)	.000	.000	.000	.	.350
		N	3569	3569	3569	3569	3569
	% Rent-free HH	Correlation Coefficient	.315**	-.482**	.388**	-.016	1.000
		Sig. (2-tailed)	.000	.000	.000	.350	.
		N	3569	3569	3569	3569	3569

**. Correlation is significant at the 0.01 level (2-tailed).

a. SampleVSsomerset = ProActive Referrals

C. Occupancy Rating

Correlations[a]

			Townsend Score	% HH Occupancy Rating 2 or more	% HH Occupancy Rating 1	% HH Occupancy Rating 0+	% HH Occupancy Rating -1	% HH Occupancy Rating -2 or less
Spearman's rho	Townsend Score	Correlation Coefficient	1.000	-.774**	.382**	.789**	.733**	.489**
		Sig. (2-tailed)	.	.000	.000	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569
	% HH Occupancy Rating 2 or more	Correlation Coefficient	-.774**	1.000	-.764**	-.892**	-.614**	-.373**
		Sig. (2-tailed)	.000	.	.000	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569
	% HH Occupancy Rating 1	Correlation Coefficient	.382**	-.764**	1.000	.483**	.242**	.107**
		Sig. (2-tailed)	.000	.000	.	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569
	% HH Occupancy Rating 0+	Correlation Coefficient	.789**	-.892**	.483**	1.000	.594**	.323**
		Sig. (2-tailed)	.000	.000	.000	.	.000	.000
		N	3569	3569	3569	3569	3569	3569
	% HH Occupancy Rating -1	Correlation Coefficient	.733**	-.614**	.242**	.594**	1.000	.347**
		Sig. (2-tailed)	.000	.000	.000	.000	.	.000
		N	3569	3569	3569	3569	3569	3569
	% HH Occupancy Rating -2 or less	Correlation Coefficient	.489**	-.373**	.107**	.323**	.347**	1.000
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.
		N	3569	3569	3569	3569	3569	3569

**. Correlation is significant at the 0.01 level (2-tailed).

a. SampleVSsomerset = ProActive Referrals

D.EconomicActivity

Correlations [a]

			Townsend Score	% Economically Active	% Employed	% P-T employed	% F-T employed	% Self-employed	% Unemployed	% Economically Inactive	% Retired	% Carers	% Disabled/ LLI
Spearman's rho	Townsend Score	Correlation Coefficient	1.000	-.163**	-.088**	-.128**	-.058**	-.321**	.712**	.163**	-.227**	.180**	.546**
		Sig. (2-tailed)	.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Economically Active	Correlation Coefficient	-.163**	1.000	.773**	.246**	.767**	.120**	-.047**	-1.000**	-.717**	-.188**	-.433**
		Sig. (2-tailed)	.000	.	.000	.000	.000	.000	.005	.000	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Employed	Correlation Coefficient	-.088**	.773**	1.000	.458**	.948**	-.417**	-.092**	-.773**	-.543**	-.211**	-.258**
		Sig. (2-tailed)	.000	.000	.	.000	.000	.000	.000	.000	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% P-T employed	Correlation Coefficient	-.128**	.246**	.458**	1.000	.191**	-.295**	-.116**	-.246**	-.111**	-.059**	-.081**
		Sig. (2-tailed)	.000	.000	.000	.	.000	.000	.000	.000	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% F-T employed	Correlation Coefficient	-.058**	.767**	.948**	.191**	1.000	-.353**	-.064**	-.767**	-.552**	-.209**	-.256**
		Sig. (2-tailed)	.000	.000	.000	.000	.	.000	.000	.000	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Self-employed	Correlation Coefficient	-.321**	.120**	-.417**	-.295**	-.353**	1.000	-.166**	-.120**	.060**	.005	-.278**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.	.000	.000	.000	.744	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Unemployed	Correlation Coefficient	.712**	-.047**	-.092**	-.116**	-.064**	-.166**	1.000	.047**	-.228**	.159**	.339**
		Sig. (2-tailed)	.000	.005	.000	.000	.000	.000	.	.005	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Economically Inactive	Correlation Coefficient	.163**	-1.000**	-.773**	-.246**	-.767**	-.120**	.047**	1.000	.717**	.188**	.433**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.005	.	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Retired	Correlation Coefficient	-.227**	-.717**	-.543**	-.111**	-.552**	.060**	-.228**	.717**	1.000	-.143**	.023
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.	.000	.173
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Carers	Correlation Coefficient	.180**	-.188**	-.211**	-.059**	-.209**	.005	.159**	.188**	-.143**	1.000	.109**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.744	.000	.000	.000	.	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Disabled/LLI	Correlation Coefficient	.546**	-.433**	-.258**	-.081**	-.256**	-.278**	.339**	.433**	.023	.109**	1.000
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.173	.000	.
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569

**. Correlation is significant at the 0.01 level (2-tailed).

a. SampleVSsomerset = ProActive Referrals

E. NS-SEC social class

Correlations[a]

			Townsend Score	% Class 1	% Class 2	% Class 3	% Class 4	% Class 5	% Class 6	% Class 7	% Class 8	% Unclassified
Spearman's rho	Townsend Score	Correlation Coefficient	1.000	-.545**	-.522**	-.368**	-.251**	.288**	.428**	.580**	.559**	.004
		Sig. (2-tailed)	.	.000	.000	.000	.000	.000	.000	.000	.000	.834
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Class 1	Correlation Coefficient	-.545**	1.000	.638**	.261**	.279**	-.462**	-.606**	-.636**	-.345**	-.131**
		Sig. (2-tailed)	.000	.	.000	.000	.000	.000	.000	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Class 2	Correlation Coefficient	-.522**	.638**	1.000	.339**	.241**	-.358**	-.534**	-.625**	-.379**	-.297**
		Sig. (2-tailed)	.000	.000	.	.000	.000	.000	.000	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Class 3	Correlation Coefficient	-.368**	.261**	.339**	1.000	-.182**	.044**	-.047**	-.234**	-.303**	-.335**
		Sig. (2-tailed)	.000	.000	.000	.	.000	.008	.005	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Class 4	Correlation Coefficient	-.251**	.279**	.241**	-.182**	1.000	-.325**	-.443**	-.379**	-.107**	-.099**
		Sig. (2-tailed)	.000	.000	.000	.000	.	.000	.000	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Class 5	Correlation Coefficient	.288**	-.462**	-.358**	.044**	-.325**	1.000	.520**	.549**	.047**	-.382**
		Sig. (2-tailed)	.000	.000	.000	.008	.000	.	.000	.000	.005	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Class 6	Correlation Coefficient	.428**	-.606**	-.534**	-.047**	-.443**	.520**	1.000	.613**	.215**	-.234**
		Sig. (2-tailed)	.000	.000	.000	.005	.000	.000	.	.000	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Class 7	Correlation Coefficient	.580**	-.636**	-.625**	-.234**	-.379**	.549**	.613**	1.000	.303**	-.212**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.	.000	.000
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Class 8	Correlation Coefficient	.559**	-.345**	-.379**	-.303**	-.107**	.047**	.215**	.303**	1.000	.019
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.005	.000	.000	.	.269
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569
	% Unclassified	Correlation Coefficient	.004	-.131**	-.297**	-.335**	-.099**	-.382**	-.234**	-.212**	.019	1.000
		Sig. (2-tailed)	.834	.000	.000	.000	.000	.000	.000	.000	.269	.
		N	3569	3569	3569	3569	3569	3569	3569	3569	3569	3569

**. Correlation is significant at the 0.01 level (2-tailed).

a. SampleVSsomerset = ProActive Referrals

Appendix 18: Descriptive age-gender statistics for ProActive participants for comparison with Somerset average (Excel and SPSS output)

Gender distribution: ProActive participants only (SPSS)

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Men	1386	38.8	38.8	38.8
	Women	2182	61.1	61.2	100.0
	Total	3568	100.0	100.0	
Missing	System	1	.0		
Total		3569	100.0		

Note: Missing gender for 1 participant

Gender distribution: Somerset only (Excel)

	Frequency	Percent
Men	241960	48.577
Women	256133	51.423

Age distribution: ProActive participants only (SPSS)

10-yr age bands

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-10	2	.1	.1	.1
	10-19	58	1.6	1.9	2.0
	20-29	175	4.9	5.8	7.9
	30-39	476	13.3	15.9	23.8
	40-49	571	16.0	19.1	42.8
	50-59	810	22.7	27.1	69.9
	60-69	636	17.8	21.2	91.1
	70-79	240	6.7	8.0	99.2
	80-89	24	.7	.8	100.0
	90+	1	.0	.0	100.0
	Total	2993	83.9	100.0	
Missing	System	576	16.1		
Total		3569	100.0		

Age distribution: ProActive versus Somerset (Excel)

	% per age group	
	ProActive	Somerset
0-9	0.06	11.46
10-19	1.63	12.79
20-29	4.90	9.54
30-39	13.34	14.01
40-49	16.00	13.34
50-59	22.70	14.03
60-69	17.82	10.43
70-79	6.72	9.03
80-89	0.67	4.51
90+	0.03	0.86

Age-gender distribution: ProActive participants only (SPSS Crosstabs)

10-yr age bands * Gender Crosstabulation

			Gender		
			Men	Women	Total
10-yr age bands	0-10	Count	0	2	2
		% within Gender	.0%	.1%	.1%
	10-19	Count	21	37	58
		% within Gender	1.8%	2.0%	1.9%
	20-29	Count	53	122	175
		% within Gender	4.6%	6.6%	5.8%
	30-39	Count	159	317	476
		% within Gender	13.8%	17.2%	15.9%
	40-49	Count	230	341	571
		% within Gender	20.0%	18.5%	19.1%
	50-59	Count	285	525	810
		% within Gender	24.8%	28.5%	27.1%
	60-69	Count	280	356	636
		% within Gender	24.4%	19.3%	21.2%
	70-79	Count	114	126	240
		% within Gender	9.9%	6.8%	8.0%
	80-89	Count	7	17	24
		% within Gender	.6%	.9%	.8%
	90+	Count	0	1	1
		% within Gender	.0%	.1%	.0%
Total		Count	1149	1844	2993
		% within Gender	100.0%	100.0%	100.0%

Note: n=2993 because of missing age data

Appendix 19: SPSS output for comparison between ProActive sample and Somerset socio-economic variables

A. Townsend Score: Mann-Whitney Test

Ranks

	SampleVSsomerset	N	Mean Rank	Sum of Ranks
Townsend Deprivation Score	ProActive Referrals	3569	2712.17	9679729.00
	Somerset	1748	2550.44	4458174.00
	Total	5317		

Test Statistics[a]

	Townsend Deprivation Score
Mann-Whitney U	2929548.000
Wilcoxon W	4458174.000
Z	-3.609
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: SampleVSsomerset

IMD 2004: Mann-Whitney Test

Ranks

	sampleORsomerset	N	Mean Rank	Sum of Ranks
IMD 2004	sample	3569	1958.16	6988680.50
	somerset	327	1843.04	602675.50
	Total	3896		
IncomeScore	sample	3569	1957.48	6986233.50
	somerset	327	1850.53	605122.50
	Total	3896		
EmploymentScore	sample	3569	1963.40	7007371.50
	somerset	327	1785.89	583984.50
	Total	3896		
HealthDeprivation Disability	sample	3569	1957.71	6987069.50
	somerset	327	1847.97	604286.50
	Total	3896		
Education+Skills	sample	3569	1951.23	6963948.50
	somerset	327	1918.68	627407.50
	Total	3896		
BarriersToHousing+ Services	sample	3569	1947.67	6951239.50
	somerset	327	1957.54	640116.50
	Total	3896		
Crime+Disorder	sample	3569	1949.27	6956928.50
	somerset	327	1940.15	634427.50
	Total	3896		
Living Environ't	sample	3569	1946.77	6948009.00
	somerset	327	1967.42	643347.00
	Total	3896		
Av for 7 Domains	sample	3569	1940.29	6924892.50
	somerset	327	2038.11	666463.50
	Total	3896		

Note: Somerset n=327 is number of SOAs (versus 1748 OAs)

Test Statistics[a]

	IMD 2004	Income	Employment	Health Deprivation Disability	Education AndSkills	Barriers To Housing+ Services	Crime+ Disorder	Living Environ't	Av for 7 Domains
Mann-Whitney U	549048	551495	530356.500	550658.500	573779.500	580574.500	580799.50	577344.0	554227.50
Wilcoxon W	602676	605123	583984.500	604286.500	627407.500	6951239.50	634427.50	6948009	6924892.5
Z	-1.771	-1.646	-2.731	-1.689	-.501	-.152	-.140	-.318	-1.505
Asymp. Sig. (2-tailed)	.077	.100	.006	.091	.616	.879	.888	.751	.132

a. Grouping Variable: sampleORsomerset

B. Car ownership: Kruskal-Wallis Test

Ranks

	SampleVSsomerset	N	Mean Rank
% households with 0 cars	ProActive Referrals	3569	2718.02
	Somerset	1748	2538.49
	Total	5317	
% households with 1 car	ProActive Referrals	3569	2701.48
	Somerset	1748	2572.26
	Total	5317	
% households with 2 cars	ProActive Referrals	3569	2601.64
	Somerset	1748	2776.11
	Total	5317	
% households with 3 cars	ProActive Referrals	3569	2610.81
	Somerset	1748	2757.38
	Total	5317	
% households with 4+ cars	ProActive Referrals	3569	2637.70
	Somerset	1748	2702.49
	Total	5317	
Mean no. cars per household	ProActive Referrals	3569	2599.73
	Somerset	1748	2780.02
	Total	5317	
% households with 2or more cars	ProActive Referrals	3569	2599.88
	Somerset	1748	2779.71
	Total	5317	

Test Statistics[a,b]

	% households with 0 cars	% households with 1 car	% households with 2 cars	% households with 3 cars	% households with 4+ cars	Mean no. cars per household	% households with 2or more cars
Chi-Square	16.049	8.316	15.157	10.702	2.285	16.187	16.104
df	1	1	1	1	1	1	1
Asymp. Sig.	.000	.004	.000	.001	.131	.000	.000

a. Kruskal Wallis Test

b. Grouping Variable: SampleVSsomerset

C. Housing tenure: Kruskal-Wallis Test

Ranks

	SampleVSsomerset	N	Mean Rank
% households owned	ProActive Referrals	3569	2635.27
	Somerset	1748	2707.45
	Total	5317	
% households social rented	ProActive Referrals	3569	2685.12
	Somerset	1748	2605.67
	Total	5317	
% households private rented	ProActive Referrals	3569	2657.32
	Somerset	1748	2662.43
	Total	5317	
% households rent free	ProActive Referrals	3569	2644.81
	Somerset	1748	2687.98
	Total	5317	

Test Statistics[a,b]

	% households owned	% households social rented	% households private rented	% households rent free
Chi-Square	2.594	3.199	.013	.972
df	1	1	1	1
Asymp. Sig.	.107	.074	.909	.324

a. Kruskal Wallis Test

b. Grouping Variable: SampleVSsomerset

D. Occupancy rating: Kruskal-Wallis Test

Ranks

	SampleVSsomerset	N	Mean Rank
% households occupancy rating 2+	ProActive Referrals	3569	2614.28
	Somerset	1748	2750.31
	Total	5317	
% households occupancy rating 1	ProActive Referrals	3569	2680.95
	Somerset	1748	2614.17
	Total	5317	
% households occupancy rating 0	ProActive Referrals	3569	2705.32
	Somerset	1748	2564.43
	Total	5317	
% households occupancy rating -1	ProActive Referrals	3569	2698.74
	Somerset	1748	2577.85
	Total	5317	
% households occupancy rating -2	ProActive Referrals	3569	2678.49
	Somerset	1748	2619.21
	Total	5317	

Test Statistics[a,b]

	% households occupancy rating 2+	% households occupancy rating 1	% households occupancy rating 0	% households occupancy rating -1	% households occupancy rating -2
Chi-Square	9.215	2.221	9.883	7.471	2.717
df	1	1	1	1	1
Asymp. Sig.	.002	.136	.002	.006	.099

a. Kruskal Wallis Test

b. Grouping Variable: SampleVSsomerset

E. Economic activity: Kruskal-Wallis Test

Ranks

	SampleVSsomerset	N	Mean Rank
% people economically active (total)	ProActive Referrals	3569	2632.10
	Somerset	1748	2713.93
	Total	5317	
% employees (total)	ProActive Referrals	3569	2648.37
	Somerset	1748	2680.71
	Total	5317	
% P-T employees	ProActive Referrals	3569	2688.34
	Somerset	1748	2599.09
	Total	5317	
% F-T employees	ProActive Referrals	3569	2635.53
	Somerset	1748	2706.92
	Total	5317	
% self-employed (total)	ProActive Referrals	3569	2639.36
	Somerset	1748	2699.11
	Total	5317	
% unemployed	ProActive Referrals	3569	2701.88
	Somerset	1748	2571.44
	Total	5317	
% economically inactive (total)	ProActive Referrals	3569	2685.90
	Somerset	1748	2604.07
	Total	5317	
% retired	ProActive Referrals	3569	2652.70
	Somerset	1748	2671.86
	Total	5317	
% carers	ProActive Referrals	3569	2628.83
	Somerset	1748	2720.60
	Total	5317	
% permanently disabled/longterm illness	ProActive Referrals	3569	2725.92
	Somerset	1748	2522.37
	Total	5317	

Test Statistics[a,b]

	% people economically active (total)	% employees (total)	% P-T employees	% F-T employees	% self-employ-ed (total)	% unemploy-ed	% econom inactive (total)	% retired	% carers	% perm disabled/ LLI
Chi-Square	3.335	.521	3.967	2.538	1.778	8.483	3.335	.183	4.194	20.632
df	1	1	1	1	1	1	1	1	1	1
Asymp. Sig.	.068	.470	.046	.111	.182	.004	.068	.669	.041	.000

a. Kruskal Wallis Test

b. Grouping Variable: SampleVSsomerset

F. NS-SEC social class: Kruskal-Wallis Test

Ranks

	SampleVSsomerset	N	Mean Rank
% social class 1	ProActive Referrals	3569	2613.13
	Somerset	1748	2752.65
	Total	5317	
% social class 2	ProActive Referrals	3569	2632.72
	Somerset	1748	2712.65
	Total	5317	
% social class 3	ProActive Referrals	3569	2643.06
	Somerset	1748	2691.56
	Total	5317	
% social class 4	ProActive Referrals	3569	2639.09
	Somerset	1748	2699.66
	Total	5317	
% social class 5	ProActive Referrals	3569	2656.03
	Somerset	1748	2665.06
	Total	5317	
% social class 6	ProActive Referrals	3569	2693.50
	Somerset	1748	2588.57
	Total	5317	
% social class 7	ProActive Referrals	3569	2704.34
	Somerset	1748	2566.42
	Total	5317	
% social class 8	ProActive Referrals	3569	2716.20
	Somerset	1748	2542.22
	Total	5317	
% unclassifiable	ProActive Referrals	3569	2666.52
	Somerset	1748	2643.64
	Total	5317	

Test Statistics[a,b]

	% social class 1	% social class 2	% social class 3	% social class 4	% social class 5	% social class 6	% social class 7	% social class 8	% unclassifiable
Chi-Square	9.693	3.181	1.171	1.827	.041	5.482	9.473	15.299	.261
df	1	1	1	1	1	1	1	1	1
Asymp. Sig.	.002	.075	.279	.177	.840	.019	.002	.000	.610

a. Kruskal Wallis Test

b. Grouping Variable: SampleVSsomerset

Appendix 20: SPSS output for *post hoc* analysis to explore distribution of ProActive participants across range of Somerset deprivation percentiles (Townsend score)

A. Range of Townsend score: determined using SPSS 'Explore' function

Descriptives

			Statistic	Std. Error
Townsend Deprivation Score	Mean		-.068173	.0043529
	95% Confidence Interval for Mean	Lower Bound	-.076705	
		Upper Bound	-.059642	
	5% Trimmed Mean		-.211872	
	Median		-.683525	
	Variance		9.438	
	Std. Deviation		3.0720891	
	Minimum		-5.9917	
	Maximum		12.9717	
	Range		18.9634	
	Interquartile Range		4.2346	
	Skewness		.734	.003
	Kurtosis		.194	.007

Note: mean Townsend score =-0.068 because calculated using data weighted for population size

B. Percentiles of Townsend score: across Somerset population calculated

Statistics

Townsend Deprivation Score

N	Valid	498093
	Missing	0
Percentiles	20	-2.739770
	40	-1.297196
	60	.140096
	80	2.423771

C. Range and percentiles applied to ProActive participants: used to explore distribution within percentiles of deprivation calculated for Somerset above

Percentiles of Townsend score

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-20th percentile	595	16.7	16.7	16.7
	20-40th percentile	646	18.1	18.1	34.8
	40-60th percentile	700	19.6	19.6	54.4
	60-80th percentile	783	21.9	21.9	76.3
	80-100 percentile	845	23.7	23.7	100.0
	Total	3569	100.0	100.0	

Appendix 21: SPSS output for proportions of ProActive participants and Somerset residents living in areas defined by urban-rural and settlement type variables

A. Urban-rural and settlement type: ProActive participants: Frequency Table

rural versus urban (pop size)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	rural	1796	50.3	50.3	50.3
	urban	1773	49.7	49.7	100.0
	Total	3569	100.0	100.0	

Rurality (settlement type)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	hamlet + isolated dwelling	294	8.2	8.2	8.2
	village	691	19.4	19.4	27.6
	small town + fringe	811	22.7	22.7	50.3
	urban	1773	49.7	49.7	100.0
	Total	3569	100.0	100.0	

B. Urban-rural and settlement type: Somerset: Frequency Table

rural versus urban (pop size)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	rural	257144	51.6	51.6	51.6
	urban	240949	48.4	48.4	100.0
	Total	498093	100.0	100.0	

Rurality (settlement type)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	hamlet + isolated dwelling	48120	9.7	9.7	9.7
	village	111675	22.4	22.4	32.1
	small town + fringe	97349	19.5	19.5	51.6
	urban	240949	48.4	48.4	100.0
	Total	498093	100.0	100.0	

Appendix 22: SPSS output from Spearman's rank tests for correlations between Townsend score of material deprivation and socio-economic variables (data from sample included in RQ2 logistic regression analysis n=2864)

A. Car ownership

Correlations

			Townsend Score	% HH with 0 car	% HH with 1 car	% HH with 2 cars	% HH with 3 cars	% HH with 4+ cars	Average cars/HH
Spearman's rho	Townsend Score	Correlation Coefficient	1.000	.817**	.087**	-.746**	-.558**	-.356**	-.775**
		Sig. (2-tailed)	.	.000	.000	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864
	% HH with 0 car	Correlation Coefficient	.817**	1.000	..152**	-.880**	-.684**	-.435**	-.928**
		Sig. (2-tailed)	.000	.	.000	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864
	% HH with 1 car	Correlation Coefficient	.087**	.152**	1.000	-.456**	-.427**	-.390**	-.394**
		Sig. (2-tailed)	.000	.000	.	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864
	% HH with 2 cars	Correlation Coefficient	-.746**	-.880**	-.456**	1.000	.670**	.424**	.923**
		Sig. (2-tailed)	.000	.000	.000	.	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864
	% HH with 3 cars	Correlation Coefficient	-.558**	-.684**	-.427**	.670**	1.000	.432**	.805**
		Sig. (2-tailed)	.000	.000	.000	.000	.	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864
	% HH with 4+ cars	Correlation Coefficient	-.356**	-.435**	-.390**	.424**	.432**	1.000	.622**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.	.000
		N	2864	2864	2864	2864	2864	2864	2864
	Average cars/HH	Correlation Coefficient	-.775**	-.928**	-.394**	.923**	.805**	.622**	1.000
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.
		N	2864	2864	2864	2864	2864	2864	2864

**. Correlation is significant at the 0.01 level (2-tailed).

B. Housing tenure

Correlations

			Townsend Score	% Owner Occupied HH	% Social Rented HH	% Private Rented HH	% Rent-free HH
Spearman's rho	Townsend Score	Correlation Coefficient	1.000	-.858**	.726**	.198**	.337**
		Sig. (2-tailed)	.	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864
	% Owner Occupied HH	Correlation Coefficient	-.858**	1.000	-.842**	-.244**	-.491**
		Sig. (2-tailed)	.000	.	.000	.000	.000
		N	2864	2864	2864	2864	2864
	% Social Rented HH	Correlation Coefficient	.726**	-.842**	1.000	-.153**	.397**
		Sig. (2-tailed)	.000	.000	.	.000	.000
		N	2864	2864	2864	2864	2864
	% Private Rented HH	Correlation Coefficient	.198**	-.244**	-.153**	1.000	-.021
		Sig. (2-tailed)	.000	.000	.000	.	.253
		N	2864	2864	2864	2864	2864
	% Rent-free HH	Correlation Coefficient	.337**	-.491**	.397**	-.021	1.000
		Sig. (2-tailed)	.000	.000	.000	.253	.
		N	2864	2864	2864	2864	2864

**. Correlation is significant at the 0.01 level (2-tailed).

C. Occupancy Rating

Correlations

			Townsend Score	% HH Occupancy Rating 2 or more	% HH Occupancy Rating 1	% HH Occupancy Rating 0	% HH Occupancy Rating -1	% HH Occupancy Rating -2 or less
Spearman's rho	Townsend Score	Correlation Coefficient	1.000	-.777**	.384**	.798**	.742**	.493**
		Sig. (2-tailed)	.	.000	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864
	% HH Occupancy Rating 2 or more	Correlation Coefficient	-.777**	1.000	-.766**	-.893**	-.619**	-.377**
		Sig. (2-tailed)	.000	.	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864
	% HH Occupancy Rating 1	Correlation Coefficient	.384**	-.766**	1.000	.490**	.246**	.113**
		Sig. (2-tailed)	.000	.000	.	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864
	% HH Occupancy Rating 0	Correlation Coefficient	.798**	-.893**	.490**	1.000	.604**	.314**
		Sig. (2-tailed)	.000	.000	.000	.	.000	.000
		N	2864	2864	2864	2864	2864	2864
	% HH Occupancy Rating -1	Correlation Coefficient	.742**	-.619**	.246**	.604**	1.000	.350**
		Sig. (2-tailed)	.000	.000	.000	.000	.	.000
		N	2864	2864	2864	2864	2864	2864
	% HH Occupancy Rating -2 or less	Correlation Coefficient	.493**	-.377**	.113**	.314**	.350**	1.000
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.
		N	2864	2864	2864	2864	2864	2864

**. Correlation is significant at the 0.01 level (2-tailed).

D. Economic Activity

Correlations

			Townsend Score	% Economically active (total)	% Employees (total)	% P-T employees	% F-T employees	% Self-employ -ed (total)	% Unemployed	% Economically inactive (total)	% Retired	% Carers	% Disabled /LLI
Spearman's rho	Townsend Score	Correlation Coefficient	1.000	-.174**	-.097**	-.137**	-.061**	-.333**	.702**	.174**	-.248**	.182**	.569**
		Sig. (2-tailed)	.	.000	.000	.000	.001	.000	.000	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Economically active (total)	Correlation Coefficient	-.174**	1.000	.755**	.221**	.750**	.152**	-.024	-1.000**	-.680**	-.236**	-.397**
		Sig. (2-tailed)	.000	.	.000	.000	.000	.000	.205	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Employees (total)	Correlation Coefficient	-.097**	.755**	1.000	.448**	.941**	-.404**	-.077**	-.755**	-.487**	-.269**	-.211**
		Sig. (2-tailed)	.000	.000	.	.000	.000	.000	.000	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% P-T employees	Correlation Coefficient	-.137**	.221**	.448**	1.000	.164**	-.302**	-.116**	-.221**	-.066**	-.086**	-.069**
		Sig. (2-tailed)	.000	.000	.000	.	.000	.000	.000	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% F-T employees	Correlation Coefficient	-.061**	.750**	.941**	.164**	1.000	-.332**	-.041*	-.750**	-.499**	-.261**	-.206**
		Sig. (2-tailed)	.001	.000	.000	.000	.	.000	.028	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Self-employed (total)	Correlation Coefficient	-.333**	.152**	-.404**	-.302**	-.332**	1.000	-.176**	-.152**	.034	.034	-.305**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.	.000	.000	.068	.069	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Unemployed	Correlation Coefficient	.702**	-.024	-.077**	-.116**	-.041*	-.176**	1.000	.024	-.271**	.187**	.335**
		Sig. (2-tailed)	.000	.205	.000	.000	.028	.000	.	.205	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Economically inactive (total)	Correlation Coefficient	.174**	-1.000**	-.755**	-.221**	-.750**	-.152**	.024	1.000	.680**	.236**	.397**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.205	.	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Retired	Correlation Coefficient	-.248**	-.680**	-.487**	-.066**	-.499**	.034	-.271**	.680**	1.000	-.112**	-.053**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.068	.000	.000	.	.000	.005
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Carers	Correlation Coefficient	.182**	-.236**	-.269**	-.086**	-.261**	.034	.187**	.236**	-.112**	1.000	.129**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.069	.000	.000	.000	.	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Disabled/LLI	Correlation Coefficient	.569**	-.397**	-.211**	-.069**	-.206**	-.305**	.335**	.397**	-.053**	.129**	1.000
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.005	.000	.
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

E. NS-SEC social class

Correlations

			Townsend Score	% Class 1	% Class 2	% Class 3	% Class 4	% Class 5	% Class 6	% Class 7	% Class 8	% Unclassified
Spearman's rho	Townsend Score	Correlation Coefficient	1.000	-.558**	-.514**	-.357**	-.260**	.283**	.413**	.592**	.569**	.004
		Sig. (2-tailed)	.	.000	.000	.000	.000	.000	.000	.000	.000	.842
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Class 1	Correlation Coefficient	-.558**	1.000	.630**	.219**	.320**	-.489**	-.619**	-.689**	-.348**	-.096**
		Sig. (2-tailed)	.000	.	.000	.000	.000	.000	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Class 2	Correlation Coefficient	-.514**	.630**	1.000	.309**	.261**	-.382**	-.541**	-.666**	-.383**	-.280**
		Sig. (2-tailed)	.000	.000	.	.000	.000	.000	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Class 3	Correlation Coefficient	-.357**	.219**	.309**	1.000	-.170**	.061**	-.017	-.262**	-.322**	-.322**
		Sig. (2-tailed)	.000	.000	.000	.	.000	.001	.351	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Class 4	Correlation Coefficient	-.260**	.320**	.261**	-.170**	1.000	-.310**	-.436**	-.342**	-.129**	-.149**
		Sig. (2-tailed)	.000	.000	.000	.000	.	.000	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Class 5	Correlation Coefficient	.283**	-.489**	-.382**	.061**	-.310**	1.000	.521**	.546**	.051**	-.364**
		Sig. (2-tailed)	.000	.000	.000	.001	.000	.	.000	.000	.006	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Class 6	Correlation Coefficient	.413**	-.619**	-.541**	-.017	-.436**	.521**	1.000	.615**	.213**	-.241**
		Sig. (2-tailed)	.000	.000	.000	.351	.000	.000	.	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Class 7	Correlation Coefficient	.592**	-.689**	-.666**	-.262**	-.342**	.546**	.615**	1.000	.331**	-.181**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Class 8	Correlation Coefficient	.569**	-.348**	-.383**	-.322**	-.129**	.051**	.213**	.331**	1.000	.021
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.006	.000	.000	.	.259
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864
	% Unclassified	Correlation Coefficient	.004	-.096**	-.280**	-.322**	-.149**	-.364**	-.241**	-.181**	.021	1.000
		Sig. (2-tailed)	.842	.000	.000	.000	.000	.000	.000	.000	.259	.
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864	2864

**. Correlation is significant at the 0.01 level (2-tailed).

F. IMD 2004

Correlations

			Townsend Deprivation Score	IMD2004	income	employment	healthdepdis	eductraining	barriersh singserv	crimdisorder	livingenv
Spearman's rho	Townsend Deprivation Score	Correlation Coefficient	1.000	.623**	.640**	.605**	.607**	.471**	-.329**	.396**	.336**
		Sig. (2-tailed)	.	.000	.000	.000	.000	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864
	IMD2004	Correlation Coefficient	.623**	1.000	.879**	.838**	.815**	.582**	-.205**	.633**	.560**
		Sig. (2-tailed)	.000	.	.000	.000	.000	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864
	income	Correlation Coefficient	.640**	.879**	1.000	.857**	.880**	.685**	-.403**	.505**	.347**
		Sig. (2-tailed)	.000	.000	.	.000	.000	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864
	employment	Correlation Coefficient	.605**	.838**	.857**	1.000	.912**	.565**	-.456**	.519**	.310**
		Sig. (2-tailed)	.000	.000	.000	.	.000	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864
	healthdepdis	Correlation Coefficient	.607**	.815**	.880**	.912**	1.000	.634**	-.489**	.548**	.252**
		Sig. (2-tailed)	.000	.000	.000	.000	.	.000	.000	.000	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864
	eductraining	Correlation Coefficient	.471**	.582**	.685**	.565**	.634**	1.000	-.478**	.352**	.042*
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.	.000	.000	.024
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864
	barriershsingserv	Correlation Coefficient	-.329**	-.205**	-.403**	-.456**	-.489**	-.478**	1.000	-.366**	-.003
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.	.000	.877
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864
	crimdisorder	Correlation Coefficient	.396**	.633**	.505**	.519**	.548**	.352**	-.366**	1.000	.391**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.	.000
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864
	livingenv	Correlation Coefficient	.336**	.560**	.347**	.310**	.252**	.042*	-.003	.391**	1.000
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.024	.877	.000	.
		N	2864	2864	2864	2864	2864	2864	2864	2864	2864

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix 23: SPSS output for logistic regression Models 1-4

Model 1: Self-removal versus referred to leisure provider

Data included in analysis and encoding information

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	2864	100.0
	Missing Cases	0	.0
	Total	2864	100.0
Unselected Cases		0	.0
Total		2864	100.0

a. If weight is in effect, see classification table for the total number of cases.

Dependent Variable Encoding

Original Value	Internal Value
Removed (no contact+psychosocial)	0
Referred to LP	1

Categorical Variables Codings

		Frequency	Paramete (1)
rural versus urban	rural	1377	.000
	urban	1487	1.000
gender	male	1093	.000
	female	1771	1.000

Significant determinants identified in final step of regression (step 2):

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	TownsendScore	-.044	.017	7.086	1	.008	.957	.926	.988
	Constant	1.884	.056	1141.040	1	.000	6.579		
Step 2[b]	TownsendScore	-.054	.017	9.948	1	.002	.948	.916	.980
	RuralVsUrban(1)	.304	.113	7.295	1	.007	1.356	1.087	1.691
	Constant	1.737	.076	522.148	1	.000	5.678		

a. Variable(s) entered on step 1: TownsendScore.

b. Variable(s) entered on step 2: RuralVsUrban.

Variables excluded from regression equation as non-significant in final step of regression (step 2):

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	2.210	1	.137
		RuralVsUrban(1)	7.330	1	.007
	Overall Statistics		9.689	2	.008
Step 2	Variables	gendercode(1)	2.366	1	.124
	Overall Statistics		2.366	1	.124

Model 2: Self-removal versus attendance (uptake of referral)

Data included in analysis and encoding information

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	2543	88.8
	Missing Cases	321	11.2
	Total	2864	100.0
Unselected Cases		0	.0
Total		2864	100.0

a. If weight is in effect, see classification table for the total number of cases.

Dependent Variable Encoding

Original Value	Internal Value
Removed selves before Attending	0
Attended 1 or more sessions	1

Categorical Variables Codings

		Frequency	Paramete (1)
gender	male	966	.000
	female	1577	1.000
rural versus urban	rural	1230	.000
	urban	1313	1.000

Significant determinants identified in final step of regression (step 3):

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	age	.017	.003	29.955	1	.000	1.017	1.011	1.023
	Constant	.031	.154	.040	1	.841	1.031		
Step 2[b]	TownsendScore	-.060	.014	19.394	1	.000	.942	.917	.967
	age	.014	.003	21.344	1	.000	1.014	1.008	1.020
	Constant	.166	.158	1.113	1	.291	1.181		
Step 3[c]	RuralVsUrban(1)	.275	.090	9.396	1	.002	1.317	1.104	1.570
	TownsendScore	-.069	.014	24.216	1	.000	.933	.908	.959
	age	.014	.003	21.081	1	.000	1.014	1.008	1.020
	Constant	.033	.164	.041	1	.840	1.034		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: TownsendScore.

c. Variable(s) entered on step 3: RuralVsUrban.

Variables excluded from regression equation as non-significant in final step of regression (step 3):

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	RuralVsUrban(1)	4.532	1	.033
		TownsendScore	19.561	1	.000
		gendercode(1)	.458	1	.499
	Overall Statistics		29.168	3	.000
Step 2	Variables	RuralVsUrban(1)	9.419	1	.002
		gendercode(1)	.464	1	.496
	Overall Statistics		9.790	2	.007
Step 3	Variables	gendercode(1)	.373	1	.542
	Overall Statistics		.373	1	.542

Model 3: Fail-to-attend versus attend (out of those referred to leisure providers n=2377)

Data included in analysis and encoding information

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	2377	83.0
	Missing Cases	487	17.0
	Total	2864	100.0
Unselected Cases		0	.0
Total		2864	100.0

a. If weight is in effect, see classification table for the total number of cases.

Dependent Variable Encoding

Original Value	Internal Value
Fail-to-Attend	0
Attended 1 or more session	1

Categorical Variables Codings

		Frequency	Paramete (1)
gender	male	898	.000
	female	1479	1.000

Significant determinants identified in final step of regression (step 2):

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	TownsendScore	-.084	.015	32.995	1	.000	.920	.894	.946
	Constant	1.129	.048	543.572	1	.000	3.093		
Step 2[b]	age	.016	.003	22.686	1	.000	1.016	1.010	1.023
	TownsendScore	-.071	.015	22.741	1	.000	.932	.905	.959
	Constant	.327	.173	3.587	1	.058	1.387		

a. Variable(s) entered on step 1: TownsendScore.

b. Variable(s) entered on step 2: age.

Variables excluded from regression equation as non-significant in final step of regression (step 2):

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	1.904	1	.168
		age	22.900	1	.000
		RuralVsUrban	3.580	1	.058
	Overall Statistics		27.280	3	.000
Step 2	Variables	gendercode(1)	1.169	1	.280
		RuralVsUrban	3.364	1	.067
	Overall Statistics		4.420	2	.110

Model 4: Fail-to-complete versus complete (out of those who took up referral n=1782)

Data included in analysis and encoding information

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	1782	62.2
	Missing Cases	1082	37.8
	Total	2864	100.0
Unselected Cases		0	.0
Total		2864	100.0

a. If weight is in effect, see classification table for the total number of cases.

Dependent Variable Encoding

Original Value	Internal Value
Fail-to-Complete	0
Completers	1

Categorical Variables Codings

		Frequency	Paramete (1)
rural versus urban	rural	839	.000
	urban	943	1.000
gender	male	688	.000
	female	1094	1.000

Significant determinants identified in final step of regression (step 2):

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	age	.018	.003	27.618	1	.000	1.018	1.012	1.025
	Constant	-1.026	.185	30.674	1	.000	.358		
Step 2[b]	gendercode(1)	-.201	.098	4.171	1	.041	.818	.675	.992
	age	.018	.003	26.356	1	.000	1.018	1.011	1.025
	Constant	-.883	.198	19.940	1	.000	.413		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: gendercode.

Variables excluded from regression equation as non-significant in final step of regression (step 2):

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	4.175	1	.041
		TownsendScore	2.423	1	.120
		RuralVsUrban(1)	.087	1	.769
	Overall Statistics		6.600	3	.086
Step 2	Variables	TownsendScore	2.429	1	.119
		RuralVsUrban(1)	.113	1	.737
	Overall Statistics		2.430	2	.297

Appendix 24: SPSS output from Discriminant Analysis

Model 1: Self-removal versus referred to leisure provider

Outcomes from analysis when group sizes assumed equal:

Variables in the Analysis

Step		Tolerance	F to Remove	Wilks' Lambda
1	Townsend Deprivation Score	1.000	7.126	
2	Townsend Deprivation Score	.962	9.871	.998
	rural versus urban	.962	7.270	.998

Variables Not in the Analysis

Step		Tolerance	Min. Tolerance	F to Enter	Wilks' Lambda
0	gender	1.000	1.000	2.306	.999
	Townsend Deprivation Score	1.000	1.000	7.126	.998
	rural versus urban	1.000	1.000	4.526	.998
1	gender	1.000	1.000	2.214	.997
	rural versus urban	.962	.962	7.270	.995
2	gender	.999	.962	2.374	.994

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	1	.998	1	1	2862	7.126	1	2862.000	.008
2	2	.995	2	1	2862	7.206	2	2861.000	.001

Outcomes from analysis with differences in the group sizes accounted for:

Variables in the Analysis

Step		Tolerance	F to Remove	Wilks' Lambda
1	Townsend Deprivation Score	1.000	7.126	
2	Townsend Deprivation Score	.962	9.871	.998
	rural versus urban	.962	7.270	.998

Variables Not in the Analysis

Step		Tolerance	Min. Tolerance	F to Enter	Wilks' Lambda
0	gender	1.000	1.000	2.306	.999
	Townsend Deprivation Score	1.000	1.000	7.126	.998
	rural versus urban	1.000	1.000	4.526	.998
1	gender	1.000	1.000	2.214	.997
	rural versus urban	.962	.962	7.270	.995
2	gender	.999	.962	2.374	.994

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F Statistic	Exact F df1	Exact F df2	Exact F Sig.
1	1	.998	1	1	2862	7.126	1	2862.000	.008
2	2	.995	2	1	2862	7.206	2	2861.000	.001

Model 2: Self-removal versus attendance (uptake of referral)

Outcomes from analysis when group sizes assumed equal:

Variables In the Analysis

Step		Tolerance	F to Remove	Wilks' Lambda
1	age	1.000	30.627	
2	age	.971	21.776	.989
	Townsend Deprivation Score	.971	19.982	.988
3	age	.971	21.558	.985
	Townsend Deprivation Score	.934	24.802	.986
	rural versus urban	.961	9.361	.980

Variables Not In the Analysis

Step		Tolerance	Min. Tolerance	F to Enter	Wilks' Lambda
0	gender	1.000	1.000	.977	1.000
	Townsend Deprivation Score	1.000	1.000	28.826	.989
	rural versus urban	1.000	1.000	3.947	.998
	age	1.000	1.000	30.627	.988
1	gender	.997	.997	.451	.988
	Townsend Deprivation Score	.971	.971	19.982	.980
	rural versus urban	.999	.999	4.563	.986
2	gender	.997	.968	.456	.980
	rural versus urban	.961	.934	9.361	.977
3	gender	.996	.934	.360	.977

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F Statistic	Exact F df1	Exact F df2	Exact F Sig.
1	1	.988	1	1	2541	30.627	1	2541.000	.000
2	2	.980	2	1	2541	25.419	2	2540.000	.000
3	3	.977	3	1	2541	20.122	3	2539.000	.000

Outcomes from analysis with differences in the group sizes accounted for:

Variables in the Analysis

Step		Tolerance	F to Remove	Wilks' Lambda
1	age	1.000	30.627	
2	age	.971	21.776	.989
	Townsend Deprivation Score	.971	19.982	.988
3	age	.971	21.558	.985
	Townsend Deprivation Score	.934	24.802	.986
	rural versus urban	.961	9.361	.980

Variables Not in the Analysis

Step		Tolerance	Min. Tolerance	F to Enter	Wilks' Lambda
0	gender	1.000	1.000	.977	1.000
	Townsend Deprivation Score	1.000	1.000	28.826	.989
	rural versus urban	1.000	1.000	3.947	.998
	age	1.000	1.000	30.627	.988
1	gender	.997	.997	.451	.988
	Townsend Deprivation Score	.971	.971	19.982	.980
	rural versus urban	.999	.999	4.563	.986
2	gender	.997	.968	.456	.980
	rural versus urban	.961	.934	9.361	.977
3	gender	.996	.934	.360	.977

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	1	.988	1	1	2541	30.627	1	2541.000	.000
2	2	.980	2	1	2541	25.419	2	2540.000	.000
3	3	.977	3	1	2541	20.122	3	2539.000	.000

Model 3: Fail-to-attend versus attend (out of those referred to leisure providers n=2377)

Outcomes from analysis when group sizes assumed equal:

Variables in the Analysis

Step		Tolerance	F to Remove	Wilks' Lambda
1	Townsend Deprivation Score	1.000	34.015	
2	Townsend Deprivation Score	.970	23.710	.986
	age	.970	23.279	.986

Variables Not In the Analysis

Step		Tolerance	Min. Tolerance	F to Enter	Wilks' Lambda
0	gender	1.000	1.000	2.084	.999
	Townsend Deprivation Score	1.000	1.000	34.015	.986
	rural versus urban	1.000	1.000	.491	1.000
	age	1.000	1.000	33.581	.986
1	gender	1.000	1.000	1.912	.985
	rural versus urban	.962	.962	3.468	.984
	age	.970	.970	23.279	.976
2	gender	.996	.966	1.137	.976
	rural versus urban	.962	.934	3.298	.975

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F Statistic	Exact F df1	Exact F df2	Exact F Sig.
1	1	.986	1	1	2375	34.015	1	2375.000	.000
2	2	.976	2	1	2375	28.806	2	2374.000	.000

Outcomes from analysis with differences in the group sizes accounted for:

Variables In the Analysis

Step		Tolerance	F to Remove	Wilks' Lambda
1	Townsend Deprivation Score	1.000	34.015	
2	Townsend Deprivation Score	.970	23.710	.986
	age	.970	23.279	.986

Variables Not In the Analysis

Step		Tolerance	Min. Tolerance	F to Enter	Wilks' Lambda
0	gender	1.000	1.000	2.084	.999
	Townsend Deprivation Score	1.000	1.000	34.015	.986
	rural versus urban	1.000	1.000	.491	1.000
	age	1.000	1.000	33.581	.986
1	gender	1.000	1.000	1.912	.985
	rural versus urban	.962	.962	3.468	.984
	age	.970	.970	23.279	.976
2	gender	.996	.966	1.137	.976
	rural versus urban	.962	.934	3.298	.975

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F Statistic	Exact F df1	Exact F df2	Exact F Sig.
1	1	.986	1	1	2375	34.015	1	2375.000	.000
2	2	.976	2	1	2375	28.806	2	2374.000	.000

Model 4: Fail-to-complete versus complete (out of those who took up referral n=1782)

Outcomes from analysis when group sizes assumed equal:

Variables In the Analysis

Step		Tolerance	F to Remove	Wilks' Lambda
1	age	1.000	28.413	
2	age	.997	27.064	.997
	gender	.997	4.183	.984

Variables Not In the Analysis

Step		Tolerance	Min. Tolerance	F to Enter	Wilks' Lambda
0	gender	1.000	1.000	5.502	.997
	Townsend Deprivation Score	1.000	1.000	5.640	.997
	rural versus urban	1.000	1.000	.310	1.000
	age	1.000	1.000	28.413	.984
1	gender	.997	.997	4.183	.982
	Townsend Deprivation Score	.976	.976	2.421	.983
	rural versus urban	.998	.998	.087	.984
2	Townsend Deprivation Score	.976	.973	2.421	.981
	rural versus urban	.997	.995	.112	.982

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	1	.984	1	1	1780	28.413	1	1780.000	.000
2	2	.982	2	1	1780	16.323	2	1779.000	.000

Outcomes from analysis with differences in the group sizes accounted for:

Variables In the Analysis

Step		Tolerance	F to Remove	Wilks' Lambda
1	age	1.000	28.413	
2	age	.997	27.064	.997
	gender	.997	4.183	.984

Variables Not In the Analysis

Step		Tolerance	Min. Tolerance	F to Enter	Wilks' Lambda
0	gender	1.000	1.000	5.502	.997
	Townsend Deprivation Score	1.000	1.000	5.640	.997
	rural versus urban	1.000	1.000	.310	1.000
	age	1.000	1.000	28.413	.984
1	gender	.997	.997	4.183	.982
	Townsend Deprivation Score	.976	.976	2.421	.983
	rural versus urban	.998	.998	.087	.984
2	Townsend Deprivation Score	.976	.973	2.421	.981
	rural versus urban	.997	.995	.112	.982

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	1	.984	1	1	1780	28.413	1	1780.000	.000
2	2	.982	2	1	1780	16.323	2	1779.000	.000

Appendix 25: SPSS output for logistic regression Models 1-4 using Townsend component Zscores

Model 1: Self-removal versus referred to leisure provider (significant determinants identified in final step of regression presented only)

Zscore 1 - overcrowding

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	RuralVsUrban(1)	.233	.110	4.509	1	.034	1.263	1.018	1.566
	Constant	1.749	.076	531.708	1	.000	5.750		
Step 2[b]	RuralVsUrban(1)	.273	.111	6.032	1	.014	1.314	1.057	1.635
	Zscore1	-.138	.057	5.972	1	.015	.871	.779	.973
	Constant	1.746	.076	528.668	1	.000	5.733		

a. Variable(s) entered on step 1: RuralVsUrban.

b. Variable(s) entered on step 2: Zscore1.

Zscore 2 - unemployment

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	Zscore2	-.121	.057	4.566	1	.033	.886	.793	.990
	Constant	1.880	.056	1141.735	1	.000	6.551		
Step 2[b]	RuralVsUrban(1)	.246	.110	4.987	1	.026	1.279	1.031	1.587
	Zscore2	-.128	.057	5.037	1	.025	.880	.787	.984
	Constant	1.758	.076	532.368	1	.000	5.800		

a. Variable(s) entered on step 1: Zscore2.

b. Variable(s) entered on step 2: RuralVsUrban.

Zscore 3 – non-homeownership

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	Zscore3	-.111	.051	4.694	1	.030	.895	.809	.989
	Constant	1.874	.055	1151.043	1	.000	6.513		
Step 2[b]	RuralVsUrban(1)	.261	.111	5.560	1	.018	1.299	1.045	1.613
	Zscore3	-.126	.052	5.780	1	.016	.882	.796	.977
	Constant	1.745	.076	528.257	1	.000	5.726		

a. Variable(s) entered on step 1: Zscore3.

b. Variable(s) entered on step 2: RuralVsUrban.

Zscore 4 – non-car ownership

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	RuralVsUrban(1)	.233	.110	4.509	1	.034	1.263	1.018	1.566
	Constant	1.749	.076	531.708	1	.000	5.750		
Step 2[b]	RuralVsUrban(1)	.353	.118	9.002	1	.003	1.423	1.130	1.793
	Zscore4	-.170	.057	9.060	1	.003	.843	.755	.942
	Constant	1.708	.077	493.778	1	.000	5.515		

a. Variable(s) entered on step 1: RuralVsUrban.

b. Variable(s) entered on step 2: Zscore4.

Model 2: Self-removal versus attendance (uptake of referral: significant determinants identified in final step of regression presented only)

Zscore 1 – overcrowding

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.017	.003	29.955	1	.000	1.017	1.011	1.023
	Constant	.031	.154	.040	1	.841	1.031		
Step 2[b]	Zscore1	-.129	.044	8.538	1	.003	.879	.807	.959
	age	.015	.003	25.059	1	.000	1.015	1.009	1.022
	Constant	.105	.156	.451	1	.502	1.111		
Step 3[c]	RuralVsUrban(1)	.225	.088	6.494	1	.011	1.253	1.053	1.489
	Zscore1	-.145	.045	10.470	1	.001	.865	.793	.945
	age	.015	.003	25.227	1	.000	1.015	1.009	1.022
	Constant	-.011	.163	.005	1	.946	.989		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: Zscore1.

c. Variable(s) entered on step 3: RuralVsUrban.

Zscore 2 – unemployment

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.017	.003	29.955	1	.000	1.017	1.011	1.023
	Constant	.031	.154	.040	1	.841	1.031		
Step 2[b]	age	.015	.003	24.693	1	.000	1.015	1.009	1.021
	Zscore2	-.132	.045	8.449	1	.004	.877	.802	.958
	Constant	.110	.157	.495	1	.482	1.117		
Step 3[c]	RuralVsUrban(1)	.198	.088	5.097	1	.024	1.218	1.026	1.446
	age	.015	.003	25.076	1	.000	1.015	1.009	1.022
	Zscore2	-.137	.046	9.004	1	.003	.872	.798	.954
	Constant	.004	.164	.000	1	.982	1.004		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: Zscore2.

c. Variable(s) entered on step 3: RuralVsUrban.

Zscore 3 – non-homeownership

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.017	.003	29.955	1	.000	1.017	1.011	1.023
	Constant	.031	.154	.040	1	.841	1.031		
Step 2[b]	age	.015	.003	22.341	1	.000	1.015	1.009	1.021
	Zscore3	-.179	.042	17.984	1	.000	.836	.770	.908
	Constant	.143	.157	.828	1	.363	1.153		
Step 3[c]	RuralVsUrban(1)	.231	.088	6.847	1	.009	1.260	1.060	1.498
	age	.015	.003	22.577	1	.000	1.015	1.009	1.021
	Zscore3	-.193	.043	20.317	1	.000	.825	.758	.897
	Constant	.022	.164	.018	1	.893	1.022		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: Zscore3.

c. Variable(s) entered on step 3: RuralVsUrban.

Zscore 4 – non-car ownership

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.017	.003	29.955	1	.000	1.017	1.011	1.023
	Constant	.031	.154	.040	1	.841	1.031		
Step 2[b]	age	.015	.003	25.301	1	.000	1.015	1.009	1.022
	Zscore4	-.172	.043	15.720	1	.000	.842	.773	.917
	Constant	.107	.156	.468	1	.494	1.112		
Step 3[c]	RuralVsUrban(1)	.348	.094	13.729	1	.000	1.416	1.178	1.703
	age	.015	.003	24.934	1	.000	1.015	1.009	1.021
	Zscore4	-.233	.047	25.044	1	.000	.792	.723	.868
	Constant	-.061	.162	.141	1	.707	.941		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: Zscore4.

c. Variable(s) entered on step 3: RuralVsUrban.

Model 3: Fail-to-attend versus attend (out of those referred to leisure providers n=2377: significant determinants identified in final step of regression presented only)

Zscore 1 – overcrowding

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.019	.003	32.696	1	.000	1.019	1.013	1.026
	Constant	.157	.168	.873	1	.350	1.170		
Step 2[b]	age	.018	.003	27.041	1	.000	1.018	1.011	1.024
	Zscore1	-.150	.049	9.527	1	.002	.861	.783	.947
	Constant	.248	.171	2.110	1	.146	1.282		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: Zscore1.

Zscore 2 – unemployment

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.019	.003	32.696	1	.000	1.019	1.013	1.026
	Constant	.157	.168	.873	1	.350	1.170		
Step 2[b]	age	.017	.003	26.686	1	.000	1.018	1.011	1.024
	Zscore2	-.153	.050	9.196	1	.002	.858	.777	.947
	Constant	.254	.171	2.189	1	.139	1.289		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: Zscore2.

Zscore 3 – non-homeownership

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.019	.003	32.696	1	.000	1.019	1.013	1.026
	Constant	.157	.168	.873	1	.350	1.170		
Step 2[b]	age	.017	.003	23.902	1	.000	1.017	1.010	1.023
	Zscore3	-.209	.045	21.116	1	.000	.811	.742	.887
	Constant	.297	.172	2.984	1	.084	1.345		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: Zscore3.

Zscore 4 – non-car ownership

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.019	.003	32.696	1	.000	1.019	1.013	1.026
	Constant	.157	.168	.873	1	.350	1.170		
Step 2[b]	age	.017	.003	27.079	1	.000	1.018	1.011	1.024
	Zscore4	-.210	.047	19.970	1	.000	.811	.739	.889
	Constant	.257	.170	2.273	1	.132	1.293		
Step 3[c]	RuralVsUrban(1)	.260	.103	6.376	1	.012	1.297	1.060	1.586
	age	.017	.003	26.767	1	.000	1.018	1.011	1.024
	Zscore4	-.254	.050	25.688	1	.000	.775	.703	.855
	Constant	.131	.177	.543	1	.461	1.140		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: Zscore4.

c. Variable(s) entered on step 3: RuralVsUrban.

Model 4: Fail-to-complete versus complete (out of those who took up referral n=1782: significant determinants identified in final step of regression presented only)

Zscore 1 – overcrowding

Variables in the Equation

		B	S.E.	Wald	df	Sig	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.018	.003	27.618	1	.000	1.018	1.012	1.025
	Constant	-1.026	.185	30.674	1	.000	.358		
Step 2[b]	gendercode(1)	-.201	.098	4.171	1	.041	.818	.675	.992
	age	.018	.003	26.356	1	.000	1.018	1.011	1.025
	Constant	-.883	.198	19.940	1	.000	.413		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: gendercode.

Zscore 2 – unemployment

Variables in the Equation

		B	S.E.	Wald	df	Sig	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.018	.003	27.618	1	.000	1.018	1.012	1.025
	Constant	-1.026	.185	30.674	1	.000	.358		
Step 2[b]	gendercode(1)	-.201	.098	4.171	1	.041	.818	.675	.992
	age	.018	.003	26.356	1	.000	1.018	1.011	1.025
	Constant	-.883	.198	19.940	1	.000	.413		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: gendercode.

Zscore 3 – non-homeownership

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.018	.003	27.618	1	.000	1.018	1.012	1.025
	Constant	-1.026	.185	30.674	1	.000	.358		
Step 2[b]	age	.017	.004	24.261	1	.000	1.017	1.010	1.024
	Zscore3	-.108	.049	4.752	1	.029	.898	.815	.989
	Constant	-.981	.186	27.675	1	.000	.375		
Step 3[c]	gendercode(1)	-.198	.098	4.040	1	.044	.820	.676	.995
	age	.017	.004	23.159	1	.000	1.017	1.010	1.024
	Zscore3	-.106	.049	4.622	1	.032	.899	.816	.991
	Constant	-.841	.199	17.886	1	.000	.431		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: Zscore3.

c. Variable(s) entered on step 3: gendercode.

Zscore 4 – non-car ownership

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.018	.003	27.618	1	.000	1.018	1.012	1.025
	Constant	-1.026	.185	30.674	1	.000	.358		
Step 2[b]	gendercode(1)	-.201	.098	4.171	1	.041	.818	.675	.992
	age	.018	.003	26.356	1	.000	1.018	1.011	1.025
	Constant	-.883	.198	19.940	1	.000	.413		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: gendercode.

Appendix 26: SPSS output for logistic regression Models 1-4 with settlement type

Coding of settlement type variable in all Models ('urban'= reference category):

Categorical Variables Codings

		Frequency	Parameter coding (1)	(2)	(3)
Type of settlement	hamlet + isolated dwelling	228	1.000	.000	.000
	village	538	.000	1.000	.000
	small town+fringe	611	.000	.000	1.000
	urban	1487	.000	.000	.000
gender	male	1093	.000		
	female	1771	1.000		

Model 1: Self-removal versus referred to leisure provider (significant determinants identified in final step of regression presented only)

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	TownsendScore	-.044	.017	7.086	1	.008	.957	.926	.988
	Constant	1.884	.056	1141.040	1	.000	6.579		
Step 2[b]	TownsendScore	-.058	.018	10.729	1	.001	.943	.911	.977
	SettleType			8.687	3	.034			
	SettleType(1)	-.478	.202	5.616	1	.018	.620	.417	.921
	SettleType(2)	-.332	.154	4.668	1	.031	.718	.531	.970
	SettleType(3)	-.230	.139	2.729	1	.099	.794	.604	1.044
	Constant	2.047	.083	604.022	1	.000	7.743		

a. Variable(s) entered on step 1: TownsendScore.

b. Variable(s) entered on step 2: SettleType.

Model 2: Self-removal versus attendance (uptake of referral: significant determinants identified in final step of regression presented only)

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.017	.003	29.955	1	.000	1.017	1.011	1.023
	Constant	.031	.154	.040	1	.841	1.031		
Step 2[b]	TownsendScore	-.060	.014	19.394	1	.000	.942	.917	.967
	age	.014	.003	21.344	1	.000	1.014	1.008	1.020
	Constant	.166	.158	1.113	1	.291	1.181		
Step 3[c]	TownsendScore	-.072	.014	24.991	1	.000	.930	.904	.957
	SettleType			11.851	3	.008			
	SettleType(1)	-.177	.174	1.037	1	.308	.838	.596	1.178
	SettleType(2)	-.399	.121	10.887	1	.001	.671	.529	.850
	SettleType(3)	-.212	.112	3.607	1	.058	.809	.650	1.007
	age	.014	.003	21.178	1	.000	1.014	1.008	1.020
	Constant	.311	.165	3.550	1	.060	1.364		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: TownsendScore.

c. Variable(s) entered on step 3: SettleType.

Model 3: Fail-to-attend versus attend (out of those referred to leisure providers n=2377: (significant determinants identified in final step of regression presented only)

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	TownsendScore	-.084	.015	32.995	1	.000	.920	.894	.946
	Constant	1.129	.048	543.572	1	.000	3.093		
Step 2[b]	TownsendScore	-.071	.015	22.741	1	.000	.932	.905	.959
	age	.016	.003	22.686	1	.000	1.016	1.010	1.023
	Constant	.327	.173	3.587	1	.058	1.387		

a. Variable(s) entered on step 1: TownsendScore.

b. Variable(s) entered on step 2: age.

Model 4: Fail-to-complete versus complete (out of those who took up referral n=1782: significant determinants identified in final step of regression presented only)

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.018	.003	27.618	1	.000	1.018	1.012	1.025
	Constant	-1.026	.185	30.674	1	.000	.358		
Step 2[b]	gendercode(1)	-.201	.098	4.171	1	.041	.818	.675	.992
	age	.018	.003	26.356	1	.000	1.018	1.011	1.025
	Constant	-.883	.198	19.940	1	.000	.413		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: gendercode.

Appendix 26: SPSS output for logistic regression Models 1-4 with IMD 2004 and the seven constituent Domains

Model 1: Self-removal versus referred to leisure provider (significant determinants identified in final step of regression presented only)

IMD 2004 score

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	IMD2004	-.020	.006	9.913	1	.002	.980	.968	.992
	Constant	2.194	.121	329.924	1	.000	8.973		
Step 2[b]	RuralVsUrban(1)	.298	.112	7.089	1	.008	1.347	1.082	1.678
	IMD2004	-.023	.007	12.651	1	.000	.977	.964	.990
	Constant	2.096	.126	278.538	1	.000	8.130		

a. Variable(s) entered on step 1: IMD2004.

b. Variable(s) entered on step 2: RuralVsUrban.

Income

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	income	-1.762	.822	4.599	1	.032	.172	.034	.859
	Constant	2.043	.101	407.456	1	.000	7.714		
Step 2[b]	RuralVsUrban(1)	.303	.113	7.134	1	.008	1.353	1.084	1.690
	income	-2.288	.841	7.397	1	.007	.101	.020	.528
	Constant	1.945	.106	335.712	1	.000	6.997		

a. Variable(s) entered on step 1: income.

b. Variable(s) entered on step 2: RuralVsUrban.

Employment

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	employment	-2.978	1.238	5.784	1	.016	.051	.004	.576
	Constant	2.115	.119	313.948	1	.000	8.286		
Step 2[b]	RuralVsUrban(1)	.299	.112	7.109	1	.008	1.349	1.083	1.681
	employment	-3.638	1.238	8.634	1	.003	.026	.002	.298
	Constant	2.020	.122	275.251	1	.000	7.541		

a. Variable(s) entered on step 1: employment.

b. Variable(s) entered on step 2: RuralVsUrban.

Health deprivation and disability (no significant effect)

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	RuralVsUrban(1)	.541	.164	10.849	1	.001	1.718	1.245	2.370
	Constant	2.414	.104	540.223	1	.000	11.178		

a. Variable(s) entered on step 1: RuralVsUrban.

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	age	.614	1	.433
		gendercode(1)	.806	1	.369
		healthdepdis	.095	1	.758
	Overall Statistics		1.544	3	.672

Education skills and training (no significant effect)

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	RuralVsUrban(1)	.233	.110	4.509	1	.034	1.263	1.018	1.566
	Constant	1.749	.076	531.708	1	.000	5.750		

a. Variable(s) entered on step 1: RuralVsUrban.

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	2.450	1	.118
		eductraining	.587	1	.444
	Overall Statistics		3.089	2	.213

Barriers to housing and services (no significant effect)

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	RuralVsUrban(1)	.233	.110	4.509	1	.034	1.263	1.018	1.566
	Constant	1.749	.076	531.708	1	.000	5.750		

a. Variable(s) entered on step 1: RuralVsUrban.

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	2.450	1	.118
		barriershsingserv	.487	1	.485
	Overall Statistics		2.884	2	.236

Crime and disorder

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	crimdisorder	-.311	.073	18.020	1	.000	.733	.635	.846
	Constant	1.818	.055	1075.128	1	.000	6.158		
Step 2[b]	RuralVsUrban(1)	.271	.111	5.989	1	.014	1.311	1.055	1.628
	crimdisorder	-.324	.073	19.567	1	.000	.724	.627	.835
	Constant	1.681	.077	477.062	1	.000	5.370		

a. Variable(s) entered on step 1: crimdisorder.

b. Variable(s) entered on step 2: RuralVsUrban.

Living environment

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	livingenv	-.016	.005	11.105	1	.001	.984	.975	.994
	Constant	2.152	.105	420.988	1	.000	8.599		
Step 2[b]	RuralVsUrban(1)	.236	.110	4.605	1	.032	1.267	1.021	1.572
	livingenv	-.016	.005	11.204	1	.001	.984	.975	.993
	Constant	2.040	.117	303.923	1	.000	7.691		

a. Variable(s) entered on step 1: livingenv.

b. Variable(s) entered on step 2: RuralVsUrban.

Model 2: Self-removal versus attendance (uptake of referral: significant determinants identified in final step of regression presented only)

IMD 2004 score

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	age	.017	.003	29.955	1	.000	1.017	1.011	1.023
	Constant	.031	.154	.040	1	.841	1.031		
Step 2[b]	IMD2004	-.023	.005	18.618	1	.000	.977	.967	.987
	age	.015	.003	22.774	1	.000	1.015	1.009	1.021
	Constant	.493	.189	6.840	1	.009	1.638		
Step 3[c]	RuralVsUrban(1)	.259	.089	8.407	1	.004	1.295	1.088	1.543
	IMD2004	-.026	.005	22.459	1	.000	.974	.964	.985
	age	.015	.003	22.806	1	.000	1.015	1.009	1.021
	Constant	.406	.191	4.516	1	.034	1.501		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: IMD2004.

c. Variable(s) entered on step 3: RuralVsUrban.

Income

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.017	.003	29.955	1	.000	1.017	1.011	1.023
	Constant	.031	.154	.040	1	.841	1.031		
Step 2[b]	age	.015	.003	23.122	1	.000	1.015	1.009	1.021
	income	-2.738	.672	16.603	1	.000	.065	.017	.241
	Constant	.394	.179	4.856	1	.028	1.483		
Step 3[c]	RuralVsUrban(1)	.289	.091	10.184	1	.001	1.336	1.118	1.595
	age	.015	.003	22.775	1	.000	1.015	1.009	1.021
	income	-3.289	.697	22.293	1	.000	.037	.010	.146
	Constant	.306	.181	2.859	1	.091	1.358		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: income.

c. Variable(s) entered on step 3: RuralVsUrban.

Employment

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.017	.003	29.955	1	.000	1.017	1.011	1.023
	Constant	.031	.154	.040	1	.841	1.031		
Step 2[b]	age	.015	.003	24.444	1	.000	1.015	1.009	1.021
	employment	-3.326	1.032	10.390	1	.001	.036	.005	.272
	Constant	.375	.188	3.978	1	.046	1.455		
Step 3[c]	RuralVsUrban(1)	.262	.090	8.455	1	.004	1.299	1.089	1.549
	age	.015	.003	24.203	1	.000	1.015	1.009	1.021
	employment	-4.020	1.063	14.302	1	.000	.018	.002	.144
	Constant	.302	.190	2.524	1	.112	1.352		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: employment.

c. Variable(s) entered on step 3: RuralVsUrban.

Health deprivation and disability

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.017	.003	29.955	1	.000	1.017	1.011	1.023
	Constant	.031	.154	.040	1	.841	1.031		
Step 2[b]	age	.015	.003	24.738	1	.000	1.015	1.009	1.021
	healthdepdis	-.244	.088	7.711	1	.005	.784	.660	.931
	Constant	.021	.154	.019	1	.891	1.021		
Step 3[c]	RuralVsUrban(1)	.319	.094	11.402	1	.001	1.376	1.143	1.656
	age	.015	.003	23.556	1	.000	1.015	1.009	1.021
	healthdepdis	-.363	.095	14.594	1	.000	.696	.578	.838
	Constant	-.161	.164	.965	1	.326	.851		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: healthdepdis.

c. Variable(s) entered on step 3: RuralVsUrban.

Education skills and training

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	age	.017	.003	29.955	1	.000	1.017	1.011	1.023
	Constant	.031	.154	.040	1	.841	1.031		
Step 2[b]	age	.017	.003	30.524	1	.000	1.017	1.011	1.023
	RuralVsUrban(1)	.186	.087	4.527	1	.033	1.204	1.015	1.429
	Constant	-.072	.162	.198	1	.656	.931		
Step 3[c]	age	.016	.003	27.071	1	.000	1.016	1.010	1.022
	RuralVsUrban(1)	.256	.092	7.842	1	.005	1.292	1.080	1.546
	eductraining	-.010	.004	7.151	1	.007	.990	.983	.997
	Constant	.106	.175	.369	1	.544	1.112		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: RuralVsUrban.

c. Variable(s) entered on step 3: eductraining.

Barriers to housing and services (no significant effect)

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	age	.017	.003	29.955	1	.000	1.017	1.011	1.023
	Constant	.031	.154	.040	1	.841	1.031		
Step 2[b]	RuralVsUrban(1)	.186	.087	4.527	1	.033	1.204	1.015	1.429
	age	.017	.003	30.524	1	.000	1.017	1.011	1.023
	Constant	-.072	.162	.198	1	.656	.931		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: RuralVsUrban.

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	.458	1	.499
		RuralVsUrban(1)	4.532	1	.033
		barriershsingserv	.440	1	.507
	Overall Statistics		7.915	3	.048
Step 2	Variables	gendercode(1)	.393	1	.531
		barriershsingserv	2.890	1	.089
	Overall Statistics		3.335	2	.189

Crime and disorder

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	age	.017	.003	29.955	1	.000	1.017	1.011	1.023
	Constant	.031	.154	.040	1	.841	1.031		
Step 2[b]	age	.015	.003	25.420	1	.000	1.016	1.009	1.022
	crimdisorder	-.203	.060	11.301	1	.001	.816	.725	.919
	Constant	.047	.155	.094	1	.760	1.048		
Step 3[c]	age	.016	.003	25.814	1	.000	1.016	1.010	1.022
	crimdisorder	-.214	.061	12.470	1	.000	.807	.717	.909
	RuralVsUrban(1)	.210	.088	5.708	1	.017	1.233	1.038	1.465
	Constant	-.068	.162	.177	1	.674	.934		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: crimdisorder.

c. Variable(s) entered on step 3: RuralVsUrban.

Living environment

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	age	.017	.003	29.955	1	.000	1.017	1.011	1.023
	Constant	.031	.154	.040	1	.841	1.031		
Step 2[b]	age	.016	.003	27.277	1	.000	1.016	1.010	1.022
	livingenv	-.014	.004	13.716	1	.000	.986	.978	.993
	Constant	.320	.173	3.403	1	.065	1.377		
Step 3[c]	RuralVsUrban(1)	.183	.088	4.359	1	.037	1.200	1.011	1.425
	age	.016	.003	27.907	1	.000	1.016	1.010	1.022
	livingenv	-.014	.004	13.565	1	.000	.986	.978	.993
	Constant	.217	.180	1.453	1	.228	1.243		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: livingenv.

c. Variable(s) entered on step 3: RuralVsUrban.

Model 3: Fail-to-attend versus attend (out of those referred to leisure providers n=2377: significant determinants identified in final step of regression presented only)

IMD 2004 score

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.019	.003	32.696	1	.000	1.019	1.013	1.026
	Constant	.157	.168	.873	1	.350	1.170		
Step 2[b]	IMD2004	-.024	.006	17.588	1	.000	.976	.965	.987
	age	.017	.003	25.115	1	.000	1.017	1.010	1.024
	Constant	.649	.206	9.880	1	.002	1.913		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: IMD2004.

Income

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.019	.003	32.696	1	.000	1.019	1.013	1.026
	Constant	.157	.168	.873	1	.350	1.170		
Step 2[b]	age	.017	.003	24.748	1	.000	1.017	1.010	1.024
	income	-3.181	.723	19.349	1	.000	.042	.010	.171
	Constant	.588	.196	8.998	1	.003	1.800		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: income.

Employment

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.019	.003	32.696	1	.000	1.019	1.013	1.026
	Constant	.157	.168	.873	1	.350	1.170		
Step 2[b]	age	.017	.003	26.350	1	.000	1.018	1.011	1.024
	employment	-3.936	1.135	12.037	1	.001	.020	.002	.180
	Constant	.568	.207	7.553	1	.006	1.765		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: employment.

Health deprivation and disability

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	age	.019	.003	32.696	1	.000	1.019	1.013	1.026
	Constant	.157	.168	.873	1	.350	1.170		
Step 2[b]	age	.017	.003	25.819	1	.000	1.017	1.011	1.024
	healthdepdis	-.337	.097	12.149	1	.000	.714	.591	.863
	Constant	.150	.169	.795	1	.373	1.162		
Step 3[c]	RuralVsUrban(1)	.237	.104	5.248	1	.022	1.268	1.035	1.553
	age	.017	.003	24.864	1	.000	1.017	1.010	1.024
	healthdepdis	-.426	.104	16.648	1	.000	.653	.532	.801
	Constant	.015	.179	.007	1	.933	1.015		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: healthdepdis.

c. Variable(s) entered on step 3: RuralVsUrban.

Education skills and training

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I for EXP(B)	
								Lower	Upper
Step 1[a]	age	.019	.003	32.696	1	.000	1.019	1.013	1.026
	Constant	.157	.168	.873	1	.350	1.170		
Step 2[b]	age	.018	.003	28.611	1	.000	1.018	1.011	1.025
	eductraining	-.011	.004	8.640	1	.003	.989	.981	.996
	Constant	.406	.189	4.620	1	.032	1.500		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: eductraining.

Barriers to housing and services (no significant effect)

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I for EXP(B)	
								Lower	Upper
Step 1[a]	age	.019	.003	32.696	1	.000	1.019	1.013	1.026
	Constant	.157	.168	.873	1	.350	1.170		

a. Variable(s) entered on step 1: age.

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	1.148	1	.284
		RuralVsUrban(1)	.705	1	.401
		barriershsingserv	3.149	1	.076
	Overall Statistics		7.339	3	.062

Crime and disorder

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	age	.019	.003	32.696	1	.000	1.019	1.013	1.026
	Constant	.157	.168	.873	1	.350	1.170		
Step 2[b]	age	.018	.003	29.172	1	.000	1.018	1.012	1.025
	crimdisorder	-.156	.066	5.604	1	.018	.855	.752	.973
	Constant	.169	.169	.999	1	.318	1.184		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: crimdisorder.

Living environment

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	age	.019	.003	32.696	1	.000	1.019	1.013	1.026
	Constant	.157	.168	.873	1	.350	1.170		
Step 2[b]	age	.018	.003	30.527	1	.000	1.019	1.012	1.025
	livingenv	-.011	.004	7.229	1	.007	.989	.980	.997
	Constant	.385	.189	4.158	1	.041	1.470		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: livingenv.

Model 4: Fail-to-complete versus complete (out of those who took up referral n=1782: significant determinants identified in final step of regression for IMD 2004 score and all Domains)

IMD 2004 score (no significant effect)

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
Step 1[a]	age	.018	.003	27.618	1	.000	1.018	1.012	1.025
	Constant	-1.026	.185	30.674	1	.000	.358		
Step 2[b]	gendercode(1)	-.201	.098	4.171	1	.041	.818	.675	.992
	age	.018	.003	26.356	1	.000	1.018	1.011	1.025
	Constant	-.883	.198	19.940	1	.000	.413		

a. Variable(s) entered on step 1: age.

b. Variable(s) entered on step 2: gendercode.

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	4.175	1	.041
		RuralVsUrban(1)	.087	1	.769
		IMD2004	.727	1	.394
	Overall Statistics		4.881	3	.181
Step 2	Variables	RuralVsUrban(1)	.113	1	.737
		IMD2004	.660	1	.417
	Overall Statistics		.707	2	.702

Income (no significant effect)

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	4.175	1	.041
		RuralVsUrban(1)	.087	1	.769
		income	.394	1	.530
	Overall Statistics		4.561	3	.207
Step 2	Variables	RuralVsUrban(1)	.113	1	.737
		income	.346	1	.557
	Overall Statistics		.387	2	.824

Employment (no significant effect)

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	4.175	1	.041
		RuralVsUrban(1)	.087	1	.769
		employment	.027	1	.869
	Overall Statistics		4.291	3	.232
Step 2	Variables	RuralVsUrban(1)	.113	1	.737
		employment	.020	1	.888
	Overall Statistics		.116	2	.944

Health deprivation and disability (no significant effect)

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	4.175	1	.041
		RuralVsUrban(1)	.087	1	.769
		healthdepdis	.720	1	.396
	Overall Statistics		4.864	3	.182
Step 2	Variables	RuralVsUrban(1)	.113	1	.737
		healthdepdis	.689	1	.406
	Overall Statistics		.691	2	.708

Education skills and training (no significant effect)

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	4.175	1	.041
		RuralVsUrban(1)	.087	1	.769
		eductraining	1.194	1	.274
	Overall Statistics		5.258	3	.154
Step 2	Variables	RuralVsUrban(1)	.113	1	.737
		eductraining	1.081	1	.298
	Overall Statistics		1.085	2	.581

Barriers to housing and services (no significant effect)

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	4.175	1	.041
		RuralVsUrban(1)	.087	1	.769
		barriershsingserv	.033	1	.856
	Overall Statistics		4.376	3	.224
Step 2	Variables	RuralVsUrban(1)	.113	1	.737
		barriershsingserv	.016	1	.899
	Overall Statistics		.201	2	.904

Crime and disorder (no significant effect)

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	4.175	1	.041
		RuralVsUrban(1)	.087	1	.769
		crimdisorder	.862	1	.353
	Overall Statistics		5.073	3	.167
Step 2	Variables	RuralVsUrban(1)	.113	1	.737
		crimdisorder	.818	1	.366
	Overall Statistics		.901	2	.637

Living environment (no significant effect)

Variables not in the Equation

			Score	df	Sig.
Step 1	Variables	gendercode(1)	4.175	1	.041
		RuralVsUrban(1)	.087	1	.769
		livingenv	.429	1	.513
	Overall Statistics		4.815	3	.186
Step 2	Variables	RuralVsUrban(1)	.113	1	.737
		livingenv	.507	1	.476
	Overall Statistics		.642	2	.726

Appendix 28: Proportions of the Somerset population reporting health status as 'Not good' and presence/absence of a long-term limiting illness. Data from the 2001 census (Casweb, 2004).

Age (yrs)	All			Good/fairly good health			Not good health		
	total	LLI	No LLI	total	LLI	No LLI	total	LLI	No LLI
SOMERSET NUMBERS									
ALL	485481	84411	401070	446286	51715	394571	39195	32696	6499
0-15	94628	3662	90966	93645	3089	90556	983	573	410
16-34	100455	7046	93409	96935	4825	92110	3520	2221	1299
35-49	102011	11346	90665	95383	6512	88871	6628	4834	1794
50-59	69499	13165	56334	62312	7278	55034	7187	5887	1300
60-64	26891	7467	19424	23375	4352	19023	3516	3115	401
65-84	82047	34908	47139	67570	21608	45962	14477	13300	1177
85+	9950	6817	3133	7066	4051	3015	2884	2766	118
MEN	235493	39387	196106	217714	24532	193182	17779	14855	2924
0-15	48010	2109	45901	47482	1782	45700	528	327	201
16-34	50143	3618	46525	48623	2598	46025	1520	1020	500
35-49	49984	5632	44352	46881	3342	43539	3103	2290	813
50-59	34203	6406	27797	30726	3567	27159	3477	2839	638
60-64	13335	3966	9369	11347	2208	9139	1988	1758	230
65-84	36605	15577	21028	30319	9791	20528	6286	5786	500
85+	3213	2079	1134	2336	1244	1092	877	835	42
WOMEN	249988	45024	204964	228572	27183	201389	21416	17841	3575
0-15	46618	1553	45065	46163	1307	44856	455	246	209
16-34	50312	3428	46884	48312	2227	46085	2000	1201	799
35-49	52027	5714	46313	48502	3170	45332	3525	2544	981
50-59	35296	6759	28537	31586	3711	27875	3710	3048	662
60-64	13556	3501	10055	12028	2144	9884	1528	1357	171
65-84	45442	19331	26111	37251	11817	25434	8191	7514	677
85+	6737	4738	1999	4730	2807	1923	2007	1931	76
SOMERSET PROPOTIONS									
ALL		17.4	82.6	91.9	10.7	81.3	8.1	6.7	1.3
0-15		3.9	96.1	99.0	3.3	95.7	1.0	0.6	0.4
16-34		7.0	93.0	96.5	4.8	91.7	3.5	2.2	1.3
35-49		11.1	88.9	93.5	6.4	87.1	6.5	4.7	1.8
50-59		18.9	81.1	89.7	10.5	79.2	10.3	8.5	1.9
60-64		27.8	72.2	86.9	16.2	70.7	13.1	11.6	1.5
65-84		42.5	57.5	82.4	26.3	56.0	17.6	16.2	1.4
85+		68.5	31.5	71.0	40.7	30.3	29.0	27.8	1.2
MEN		16.7	83.3	92.5	10.4	82.0	7.5	6.3	1.2
0-15		4.4	95.6	98.9	3.7	95.2	1.1	0.7	0.4
16-34		7.2	92.8	97.0	5.2	91.8	3.0	2.0	1.0
35-49		11.3	88.7	93.8	6.7	87.1	6.2	4.6	1.6
50-59		18.7	81.3	89.8	10.4	79.4	10.2	8.3	1.9
60-64		29.7	70.3	85.1	16.6	68.5	14.9	13.2	1.7
65-84		42.6	57.4	82.8	26.7	56.1	17.2	15.8	1.4
85+		64.7	35.3	72.7	38.7	34.0	27.3	26.0	1.3
WOMEN		18.0	82.0	91.4	10.9	80.6	8.6	7.1	1.4
0-15		3.3	96.7	99.0	2.8	96.2	1.0	0.5	0.4
16-34		6.8	93.2	96.0	4.4	91.6	4.0	2.4	1.6
35-49		11.0	89.0	93.2	6.1	87.1	6.8	4.9	1.9
50-59		19.1	80.9	89.5	10.5	79.0	10.5	8.6	1.9
60-64		25.8	74.2	88.7	15.8	72.9	11.3	10.0	1.3
65-84		42.5	57.5	82.0	26.0	56.0	18.0	16.5	1.5
85+		70.3	29.7	70.2	41.7	28.5	29.8	28.7	1.1

Appendix 29: Within-age group relative proportions in different progression categories

Age (yrs)		0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80+
Model 1										
Self-removal before LP referral	n	1	7	7	31	36	35	27	20	2
Referred to LP (Modell)	n	1	48	147	389	461	659	480	176	16
Self-removal before LP referral	%	50.00	12.73	4.55	7.38	7.24	5.04	5.33	10.20	11.11
Referred to LP (Modell)	%	50.00	87.27	95.45	92.62	92.76	94.96	94.67	89.80	88.89
Model 2										
Self-removal before uptake	n	2	21	69	148	163	180	112	60	6
Referral uptake	n	0	34	85	272	334	514	395	136	12
Self-removal before uptake	%	100.00	38.18	44.81	35.24	32.80	25.94	22.09	30.61	33.33
Referral uptake	%	0.00	61.82	55.19	64.76	67.20	74.06	77.91	69.39	66.67
Model 3										
Fail-to-attend	n	1	14	62	117	127	145	85	40	4
Attend LP	n	0	34	85	272	334	514	395	136	12
Fail-to-attend	%	100.00	29.17	42.18	30.08	27.55	22.00	17.71	22.73	25.00
Attend LP	%	0.00	70.83	57.82	69.92	72.45	78.00	82.29	77.27	75.00
Model 4										
Fail-to-complete	n	0	26	56	140	198	271	181	51	7
Complete	n	0	8	29	132	136	243	214	85	5
Fail-to-complete	%	0.00	76.47	65.88	51.47	59.28	52.72	45.82	37.50	58.33
Complete	%	0.00	23.53	34.12	48.53	40.72	47.28	54.18	62.50	41.67

Appendix 30: SPSS output for 'reason for removal' by gender (crosstabs)

Reason for removal:

Reason for removal * Gender Crosstabulation

			Gender		
			Men	Women	Total
Reason for removal	Other (not interested/other)	Count	11	13	24
		% within Gender	4.5%	4.3%	4.4%
	Family and time-related	Count	26	26	52
		% within Gender	10.5%	8.6%	9.5%
	Practical (transport/cost/venue	Count	28	40	68
		% within Gender	11.3%	13.3%	12.4%
	Medical	Count	87	77	164
		% within Gender	35.2%	25.6%	29.9%
	No Contact	Count	81	114	195
		% within Gender	32.8%	37.9%	35.6%
	Already active	Count	14	31	45
		% within Gender	5.7%	10.3%	8.2%
Total		Count	247	301	548
		% within Gender	100.0%	100.0%	100.0%

Psychosocial removal versus medical removal versus No Contact:

RPsych, RMed, and NC * Gender Crosstabulation

			Gender		
			Men	Women	Total
RPsych, RMed, and NC	Psychosocial removal	Count	79	110	189
		% within Gender	32.0%	36.5%	34.5%
	No Contact	Count	81	114	195
		% within Gender	32.8%	37.9%	35.6%
	Medical removal	Count	87	77	164
		% within Gender	35.2%	25.6%	29.9%
Total		Count	247	301	548
		% within Gender	100.0%	100.0%	100.0%

Appendix 31: SPSS output for reason for removal by age (crosstabs)

Reason for removal:

Reason for removal * Young vs old (50+ yrs) Crosstabulation

			Young vs old (50+ yrs)		
			0-49 yrs	50+ yrs	Total
Reason for removal	Other (not interested/other)	Count	9	5	14
		% within Young vs old (50+ yrs)	8.2%	3.2%	5.3%
	Family and time-related	Count	20	18	38
		% within Young vs old (50+ yrs)	18.2%	11.5%	14.3%
	Practical (transport/cost/venue location)	Count	29	35	64
		% within Young vs old (50+ yrs)	26.4%	22.4%	24.1%
	Medical	Count	28	72	100
		% within Young vs old (50+ yrs)	25.5%	46.2%	37.6%
	No Contact	Count	9	3	12
		% within Young vs old (50+ yrs)	8.2%	1.9%	4.5%
	Already active	Count	15	23	38
		% within Young vs old (50+ yrs)	13.6%	14.7%	14.3%
Total		Count	110	156	266
		% within Young vs old (50+ yrs)	100.0%	100.0%	100.0%

Psychosocial removal versus medical removal versus No Contact:

RPsych, RMed, and NC * Young vs old (50+ yrs) Crosstabulation

			Young vs old (50+ yrs)		
			0-49 yrs	50+ yrs	Total
RPsych, RMed, and NC	Psychosocial removal	Count	73	81	154
		% within Young vs old (50+ yrs)	66.4%	51.9%	57.9%
	No Contact	Count	9	3	12
		% within Young vs old (50+ yrs)	8.2%	1.9%	4.5%
	Medical removal	Count	28	72	100
		% within Young vs old (50+ yrs)	25.5%	46.2%	37.6%
Total		Count	110	156	266
		% within Young vs old (50+ yrs)	100.0%	100.0%	100.0%

Appendix 32: SPSS output for reason for removal by Townsend score (descriptive)

Reason for removal:

Descriptives

	Reason for removal			Statistic	Std. Error
Townsend score	Other (not interested/other)	Mean		2.0534000558	********
		95% Confidence Interval for Mean	Lower Bound	.4913140340	
			Upper Bound	3.6154860775	
		5% Trimmed Mean		2.0173316123	
		Median		1.4496497279	
		Variance		13.685	
		Std. Deviation		3.69932043699	
		Minimum		-5.3036421	
		Maximum		9 67396019	
		Range		14 97760230	
		Interquartile Range		5.48716908	
		Skewness		.290	.472
		Kurtosis		-.182	.918
	Family and time-related	Mean		-.6504016857	********
		95% Confidence Interval for Mean	Lower Bound	-1.3741834957	
			Upper Bound	.0733801243	
		5% Trimmed Mean		-.8109915793	
		Median		-1.0655156316	
		Variance		6.759	
		Std. Deviation		2.59977438226	
		Minimum		-5.2530748	
		Maximum		7.00909420	
		Range		12.26216903	
		Interquartile Range		3.12762604	
		Skewness		.916	.330
		Kurtosis		1.045	650
	Practical (transport/cost/venue location)	Mean		.7845891053	********
		95% Confidence Interval for Mean	Lower Bound	.0487199565	
			Upper Bound	1.5204582541	
		5% Trimmed Mean		.7217783538	
		Median		.3766290294	
		Variance		9.242	
		Std. Deviation		3.04013379613	
		Minimum		-5.5502608	
		Maximum		8 68406880	
		Range		14 23434961	
		Interquartile Range		3.77666676	
		Skewness		.455	.291
		Kurtosis		.043	.574
	Medical	Mean		.4956036948	********
		95% Confidence Interval for Mean	Lower Bound	.0005655550	
			Upper Bound	.9906418346	
		5% Trimmed Mean		.3602101787	
		Median		-.1682661746	
		Variance		10.307	
		Std. Deviation		3.21052485365	
		Minimum		-5.2530748	
		Maximum		9 49561323	
		Range		14.74868806	
		Interquartile Range		4.73900241	
		Skewness		.611	.190
		Kurtosis		-.257	.377
	No Contact	Mean		1.2417265977	********
		95% Confidence Interval for Mean	Lower Bound	.7829661867	
			Upper Bound	1.7004870096	
		5% Trimmed Mean		1.1302605767	
		Median		.6934320429	
		Variance		10 551	
		Std. Deviation		3.24816000392	
		Minimum		-4 8642165	
		Maximum		9.03165396	
		Range		13.89607041	
		Interquartile Range		4.99998038	
		Skewness		.472	.174
		Kurtosis		-.564	.346
	Already active	Mean		-1.3098701743	********
		95% Confidence Interval for Mean	Lower Bound	-2.2844750675	
			Upper Bound	-.3352652810	
		5% Trimmed Mean		-1.5703408237	
		Median		-1.7090577171	
		Variance		10.524	
		Std. Deviation		3.24399799832	
		Minimum		-5.5082533	
		Maximum		8 68406880	
		Range		14.19232213	
		Interquartile Range		4.07148940	
		Skewness		1.196	.354
		Kurtosis		1.364	.695

Psychosocial removal versus medical removal versus No Contact:

Descriptives

	RPsych, RMed, and NC			Statistic	Std. Error
Townsend score	Psychosocial removal	Mean		.0522148942	********
		95% Confidence Interval for Mean	Lower Bound	-.4138608954	
			Upper Bound	.5182906837	
		5% Trimmed Mean		-.0954758704	
		Median		-.3761593367	
		Variance		10.550	
		Std. Deviation		3.24813906624	
		Minimum		-5.5502808	
		Maximum		9.67396019	
		Range		15.22424101	
		Interquartile Range		3.94405638	
		Skewness		.685	.177
		Kurtosis		.174	.352
	No Contact	Mean		1.2417265977	********
		95% Confidence Interval for Mean	Lower Bound	.7829661857	
			Upper Bound	1.7004870098	
		5% Trimmed Mean		1.1302805767	
		Median		.6934320429	
		Variance		10.551	
		Std. Deviation		3.24816000392	
		Minimum		-4.8642165	
		Maximum		9.03185395	
		Range		13.89607041	
		Interquartile Range		4.99998038	
		Skewness		.472	.174
		Kurtosis		-.564	.346
	Medical removal	Mean		.4956036948	********
		95% Confidence Interval for Mean	Lower Bound	.0005655550	
			Upper Bound	.9906418346	
		5% Trimmed Mean		.3602101787	
		Median		-.1682661746	
		Variance		10.307	
		Std. Deviation		3.21052485365	
		Minimum		-5.2530748	
		Maximum		9.49561323	
		Range		14.74868805	
		Interquartile Range		4.73900241	
		Skewness		.611	.190
		Kurtosis		-.257	.377

Appendix 33: SPSS output for reason for removal by urban-rural residence (crosstabs)

Reason for removal:

Reason for removal * Urban-rural Crosstabulation

			Urban-rural		
			Urban	Rural	Total
Reason for removal	Other (not interested/other)	Count	14	10	24
		% within Urban-rural	5.5%	3.4%	4.4%
	Family and time-related	Count	18	34	52
		% within Urban-rural	7.1%	11.5%	9.5%
	Practical (transport/cost/venue	Count	31	37	68
		% within Urban-rural	12.3%	12.5%	12.4%
	Medical	Count	73	91	164
		% within Urban-rural	28.9%	30.8%	29.9%
	No Contact	Count	105	90	195
		% within Urban-rural	41.5%	30.5%	35.6%
	Already active	Count	12	33	45
		% within Urban-rural	4.7%	11.2%	8.2%
Total		Count	253	295	548
		% within Urban-rural	100.0%	100.0%	100.0%

Psychosocial removal versus medical removal versus No Contact:

RPsych, RMed, and NC * Urban-rural Crosstabulation

			Urban-rural		
			Urban	Rural	Total
RPsych, RMed, and NC	Psychosocial removal	Count	75	114	189
		% within Urban-rural	29.6%	38.6%	34.5%
	No Contact	Count	105	90	195
		% within Urban-rural	41.5%	30.5%	35.6%
	Medical removal	Count	73	91	164
		% within Urban-rural	28.9%	30.8%	29.9%
Total		Count	253	295	548
		% within Urban-rural	100.0%	100.0%	100.0%

Appendix 34: SPSS output mean and median Townsend deprivation scores for 'Progression categories' compared in each logistic regression model (Models 1-4)

Model 1:

Townsend Score * Att1: Self-removal before referral to LP vs Referred

Townsend Score

Att1: Self-removal before	Mean	N	Std. Deviation	Median
Removed (no contact+psychosocial)	.656264	384	3.2981057	.239712
Referred to LP	.188518	2480	3.1789570	-.440487
Total	.251232	2864	3.1985758	-.362160

Model 2:

Townsend Score * Att2: Self-removal before attending LP vs Attended 1 or more session

Townsend Score

Att2: Self-removal before	Mean	N	Std. Deviation	Median
Removed selves before Attending	.770962	1003	3.3405839	.229026
Attended 1 or more sessions	-.028880	1861	3.0841479	-.685820
Total	.251232	2864	3.1985758	-.362160

Model 3:

Townsend Score * Att3: Fail-to-Attend vs Fail-to-Complete+Completers (out of all ref'd to LP)

Townsend Score

Att3: Fail-to-Attend vs	Mean	N	Std. Deviation	Median
Fail-to-Attend	.842116	619	3.3673550	.229026
Attended 1 or more session	-.028880	1861	3.0841479	-.685820
Total	.188518	2480	3.1789570	-.440487

Model 4:

Townsend Score * Att4: Fail-to-Complete vs Completers (out of all att'd 1 or more sess'n)

Townsend Score

Att4: Fail-to-Complete vs	Mean	N	Std. Deviation	Median
Fail-to-Complete	.145470	969	3.1967949	-.394245
Completers	-.218281	892	2.9470320	-.848314
Total	-.028880	1861	3.0841479	-.685820