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Predicting and explaining transtheoretical model stage transitions in relation to condom-carrying behaviour

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PREDICTING AND EXPLAINING TRANSTHEORETICAL MODEL STAGE
TRANSITIONS IN RELATION TO CONDOM CARRYING BEHAVIOUR

ABSTRACT

Objectives: The stages of change component of the transtheoretical model has been applied to safe sex behaviours in cross-sectional analyses, but have not yet been subject to prospective analysis. It was predicted that: (a) cross-sectional analyses would demonstrate good discrimination between the stages of change, (b) prospective analyses would allow for the identification of predictors of stage transitions, and (c) implementation intentions would explain progression from the preparation stage.

Design: This study employed an experimental longitudinal design. Participants were randomly assigned to the experimental (implementation intention) or control conditions and completed questionnaires at baseline and at 2-months follow up.

Methods: 525 adolescents who were broadly representative of the UK population completed questionnaires at baseline and follow up ($n = 393$) measuring: demographic variables, stage of change, theory of planned behaviour constructs, anticipated regret and moral norm in relation to condom carrying behaviour. The experimental condition completed a self-generated implementation intention to carry condoms at the end of the baseline questionnaire.

Results: Discriminant function analyses indicated that the stages of change could be accurately discriminated from one another cross-sectionally and that, longitudinally, the measured variables were able to predict transitions between most stages. Implementation intentions caused people to progress from the preparation stage.

Conclusions: Transitions between most stages were reliably predicted thereby providing potential targets for intervention. The brief implementation intention intervention was effective and could easily be utilised and expanded to encompass a broader range of sexual health behaviours.

INTRODUCTION

New episodes of sexually transmitted infection seen in UK genito-urinary medicine clinics

increased from 669,291 in 1991 to 1,332,910 in 2001 (UK National statistics website:

www.statistics.gov.uk)[i]. Much of this increase can be attributed to changes in infection rates

among young adults: In 1991, 350 per 100,000 people aged between 16 and 19 suffered a sexually

transmitted infection but by 2001 this figure had risen to 1,025 per 100,000 (UK National statistics

website: www.statistics.gov.uk). Across a similar period of time (1990-2000) several key risk

factors for transmitting sexual infections increased in the UK. In particular, between 1990 and 2000,

the proportion of people reporting having two or more sexual partners in the previous year yet used

condoms inconsistently increased from 7.1% to 10.1% in women and from 13.6% to 15.4% in men

($N = 11,161$; Johnson, Mercer, Erens, Copas, McManus, Wellings, Fenton, Korovessis, MacDowall,

Nanchahal, Purdon, & Field, 2001). Of particular concern is that throughout this period, the UK

government sponsored several high-profile public health campaigns to reduce sexually transmitted

infection rates in young adults.   The implication is that further understanding of the processes

underpinning safe sex is warranted and that interventions based explicitly on theory need to be

designed and tested (cf. Michie & Abraham, 2004). The broad aims of the present study were to

examine predictors of transitions between the transtheoretical model stages of change and to test

the efficacy of a minimal intervention to promote safer sexual behaviour.

The stages of change component of Prochaska and DiClemente's (e.g., 1983, 1984)

transtheoretical model (TTM) has proved highly influential in better understanding behaviour

change in relation to sexually transmitted infection prevention (e.g., Horowitz, 2003; Prochaska,

Redding, Harlow, Rossi, & Velicer, 1994). Prochaska and DiClemente (1983, 1984) identify five

stages – precontemplation, contemplation, preparation, action and maintenance – through which

people may pass in the process of changing a health behaviour. First, precontemplators are regarded

as people who are not thinking about performing the health behaviour in question and who may not

be sufficiently aware that their current behaviour is risky. Second, contemplators are people who have begun to think seriously about their behaviour, but have yet to act. The third stage is labelled preparation and consists of people who are preparing themselves for health behaviour change in the near future (i.e., within the next month). Fourth, the action stage is reached when individuals have successfully and consistently performed the health behaviour in question. The fifth, maintenance, stage is defined as having remained in the action stage for at least six months. Although this description implies that people progress through the stages of change in a linear fashion, in fact, it is possible to progress, regress, or remain static.

The stages of change have received considerable research attention in relation to pregnancy and sexually transmitted infection prevention (e.g., Bowen & Trotter, 1995; Stark, Tesselaar, O'Connell, Person, Galavotti, Cohen, & Walls, 1998). For example, Horowitz (2003) identified 32 applications of the transtheoretical model to pregnancy and sexually transmitted disease prevention, and concluded that the stages of change held much promise for the development of interventions.

The TTM proposes that decisional balance and self-efficacy are predictors of change and these variables have therefore been used to test whether the TTM stages can be discriminated from one another. Cross-sectional analyses have generally found that self-efficacy and decisional balance show linear differences across the stages of change (e.g. DiClemente et al., 1991; Herzog, Abrams, Emmons, Linnan & Shadel, 1999; Prochaska et al., 1994) . However, longitudinal analyses designed to predict stage transitions have produced more mixed findings (e.g. de Vries & Mudde, 1998; DiClementa, Prochaska & Gibertini, 1985; Velicer, Norman, Fava & Prochaska, 1999). For example, in the domain of smoking, Dijkestra, Tromp & Conijn (2003) found stage-specific TTM determinants for stage changes except those from contemplation, while Herzog et al. (1999) could not predict stage progression from 10 TTM variables. No studies to date have examined predictors

of transitions between the stages of change in the domain of pregnancy and sexually transmitted disease prevention (Horowitz, 2003). This is an important omission because explanatory variables can be used to inform the content of interventions and predictor variables can identify at whom interventions should be targeted, and may even be relevant to the content (cf. Sutton, 1998).

In response to the challenge of reliably predicting stage transitions a number of other variables have been investigated. The theory of planned behaviour (TPB; Ajzen, 1991) has been shown to have good predictive validity (e.g. Armitage & Conner, 1991) and has therefore been widely used to predict health behaviour. A number of studies have found that TPB variables provide very good cross-sectional discrimination between the stages of change (e.g. Armitage, Povey & Arden, 2003; Courneya, 1995). TPB variables have also been found to be predictive of most transitions between the stages of change in the domains of exercise (Courneya, Plotnikoff, Hotz & Birkett, 2001) and eating a low fat diet (Armitage, Sheeran, Conner & Arden, 2004). However, although transitions between most stages of change are predictable, there is often a notable difficulty in accounting for the transition between preparation and subsequent stages (e.g. Armitage et al., 2004; Plotnikoff, Hotz, Birkett, and Courneya, 2001).

It has been argued that the apparent gap in understanding how preparation is translated into action might be clarified by Gollwitzer's (1990, 1993) model of action phases and his proposed distinction between a motivational phase and a volitional phase in particular (e.g., Armitage et al., 2004). According to Gollwitzer (1993), the motivational phase culminates in the formation of an intention to act whereas the volitional phase ends with the act itself. Translating Gollwitzer's (1990, 1993) model of action phases into Prochaska and DiClemente's (1983) stages of change, the motivational phase ends with the preparation stage and the volitional phase commences with the action stage. Of particular interest is the fact that Gollwitzer (1993, 1999) has identified volitional strategies that can be used when people are motivated to act, but cannot translate their motivation

into action. Thus, implementation intentions (Gollwitzer, 1993, 1999) represent a means by which

preparation might be translated into action. Briefly, implementation intentions are if-then plans,

which specify both a critical situation ("if") and appropriate behavioural response ("then") that

become linked in memory. This procedure heightens the accessibility of the critical situation and

ensures the appropriate behavioural response is triggered when the situation is encountered.

Consistent with this theorizing, laboratory studies show that implementation intentions can operate

beyond conscious awareness and work by increasing information processing efficiency and

speed of responding, meaning that when the critical situation is encountered in the environment,

the linked behavioural response is initiated automatically (see Gollwitzer & Sheeran, 2006).

These promising findings from the laboratory have been extended into the field and

implementation intention-based interventions have been successful in changing a range of health

behaviours, from reducing dietary fat intake (Armitage, 2004, 2006) and increasing fruit intake

(Armitage, 2007a) to encouraging smoking cessation (Armitage, in press) , although not yet in

the domain of safe sex. In relation to the stages of change specifically, implementation intentions

have been identified as an important determinant for progression to action (de Vet, Brug, de

Nooijer, Dijkstra & de Vries, 2005). Armitage (2006) found that people in the preparation stage

who were exposed to an implementation intention intervention were more likely to progress to

subsequent stages than were either precontemplators or contemplators who were exposed to the

same intervention. Similarly, Armitage (2007b) found that of smokers who were exposed to an

implementation intention intervention, 35% (6/17) subsequently quit if they had been in

preparation at baseline, 9% (4/46) subsequently quit if they had been in contemplation at

baseline, and 8% (4/52) subsequently quit if they had been in precontemplation at baseline. The

implication is that the stages of change may represent a good means of targeting implementation

intention-based interventions to encourage safe sex, and that implementation intentions might explain the apparent gap between preparation and action.

Safe sex behaviour encompasses a very broad range of possible actions. Condoms have been focused on in the literature due to their ability to protect against both unintended pregnancy and sexually transmitted infections. Condom use itself requires a broad range of behaviours from obtaining or purchasing condoms, carrying condoms, negotiating condom use with a sexual partner, and using a condom during sexual intercourse. Ideally an intervention would focus on all of these behaviours, however this poses significant problems for the transtheoretical model because an individual could be in precontemplation for condom use for two reasons: because they are not sexually active or because they are sexually active but not thinking about using condoms. For the purposes of the present study "carrying condoms" was defined as the target behaviour. This decision was based on four rationales. First, whereas actual condom use differs between those who are and those who are not sexually active, carrying a condom is of relevance regardless of whether participants are sexually active or not. Second, condom carrying is a key preparatory act in relation to actual condom use and potentially protects people in unplanned sexual situations thereby making it a legitimate target for intervention (e.g., Sheeran, Abraham, & Orbell, 1999). Third, the act of carrying condoms is equivalent for men and women in contrast with condom use, which is a goal for women but a behaviour for men. Fourth, condom availability has been identified as a key barrier to condom use (Brafford & Beck, 1991; Bryan, Aiken & West, 1996) and condom carrying has been used as a key outcome measure in evaluating community-level interventions (e.g., The CDC AIDS Community Demonstration Projects Research Group, 1999).

Derivation of the Present Study and Research Questions

The literature reviewed above provides the following rationale for the present study. First, theory-based attempts to improve safe sex behaviour must be identified and tested in the field.

Second, there is relatively little research that has attempted to establish predictors of transitions between the stages of change. Third, despite its success in cross-sectional studies, it was not possible to locate any studies that were designed to identify predictors of stage transitions in the domain of sexually transmitted infection prevention specifically. Fourth, a gap has been identified between the preparation stage and subsequent stages that might be explained by volitional strategies such as implementation intentions. Thus the aims of the study were twofold: 1) to identify the predictors of stage transitions and 2) to assess the utility of implementation intentions for promoting transitions between the preparation stage and subsequent stages. More specifically it was predicted that: (a) cross-sectional analyses would demonstrate good discrimination between the stages of change, (b) prospective analyses would allow for the identification of predictors of stage transitions, and (c) implementation intentions would explain progression from the preparation stage.

METHOD

Participants and Procedure

Five hundred and eighty adolescents and young adults based in community colleges and schools and aged 16 years or older were invited to participate in the study by being asked by their teachers/lecturers to complete and return questionnaires on "attitudes to sexual health issues" in classes. No incentive was offered. Of the 580 who were approached, 525 consented to participate and were recruited successfully.

The sample consisted of 393 women and 131 men (1 not reported) aged between 16 and 22 years ($M = 18.25$, $SD = 1.70$). On average, participants reported having had 3 sexual partners ($M = 3.11$), although there was considerable variability across the sample ($SD = 3.25$). 15.4% of the sample reported being sexually inexperienced.

In order to assess the potential generalizability of the findings, the sample was compared with the UK population as a whole on key demographic and social variables (Source: UK National statistics website: www.statistics.gov.uk) and with a probability sample survey on sexual behaviour (Johnson et al., 2001). Consistent with the sampling frame, the present sample was younger and less likely to be in fulltime employment than the UK population. Although women were overrepresented in the present sample (74.9% versus 51.3% in the UK), the sample was well matched in terms of ethnicity (94.1% versus 90.9% White in the UK; 4.0% versus 3.5% Asian in the UK) and socioeconomic status[ii] (9.5% versus 10.8% highest social class in the UK; 13.3% versus 16.5% lowest social class in the UK). In terms of behaviour, although the present sample had fewer lifetime sexual partners compared with the probability sample (*Median* = 2 versus 3 lifetime sexual partners), the narrower age range of the present sample (16-22 year olds versus 16-24 year olds) implies that the present sample were directly comparable with the UK as a whole (cf. Johnson et al., 2001).

A randomized controlled design was used, with all measures assessed at baseline and follow-up two months later. Questionnaires were sorted into random order on the basis of coin tosses and were distributed to participants in class by an individual who was blind to the conditions. Anonymity was ensured through the generation of a personal code and the questionnaires were placed in sealed envelopes and collected by the same individual. Participants were informed they could withdraw from the study at any time without being identified by returning a blank questionnaire in the sealed envelope. The measures used are described in the following section.

In addition to the questionnaire, participants randomly assigned to the experimental condition were asked to form an implementation intention linking critical situations to appropriate behavioural responses (cf. Gollwitzer, 1993). Participants randomized to the

experimental condition received the following written instructions at the end of their questionnaires: "We want you to plan to carry a condom with you every time you go out in the next 2 months. You are free to choose *how* you will do this, but we want you to formulate your plans in as much detail as possible. Please pay particular attention to the situations in which you will implement these plans." Three blank lines were included to allow participants to write down their implementation intentions[iii]. This form of implementation intention has been successfully utilized in a number of studies (e.g. Armitage, 2004; 2006). The questionnaire completed by people randomized to the control group was identical in all respects apart from this item.

Participants' subsequent stage of change, cognition and behaviour were measured at follow-up, two months post-baseline. All participants received the same questionnaire at follow-up, which was identical to the control group baseline questionnaire. These were handed back to the experimenter in sealed envelopes and matched on the basis of the self-generated personal code. Three hundred and ninety three (74.86%) participants completed both the baseline and follow-up measures and provided sufficient information to match their responses on the basis of their self-generated personal code.

Measures

Measures of age, gender, ethnicity, number of sexual partners and socioeconomic status (derived from participants' parents' occupations) were taken at baseline. These and the following measures were included in the questionnaires at both baseline and follow-up. Given that adolescents are most likely to engage in sexual intercourse after 6 p.m. (Fortenberry et al., 2006) questions were phrased in relation to condom carrying when going out in the evening. Unless otherwise stated, all measures were taken on 7-point bipolar (-3 to +3) scales.

Stage of change. The measure of transtheoretical stage was adapted from Courneya (1995). Respondents were asked to indicate which of five statements best described their current behaviour:

"I currently do not carry a condom with me every time I go out for the evening and I am not thinking about starting" (precontemplation); "I currently do not carry a condom with me every time I go out for the evening but I am thinking about starting" (contemplation); "I currently do not carry a condom with me every time I go out for the evening but I am planning to start in the next month" (preparation); "I currently carry a condom with me every time I go out for the evening but I have only begun to do so in the last 6 months" (action); and "I currently carry a condom with me every time I go out for the evening and I have done so for longer than 6 months" (maintenance).

The stages of change statements map closely onto accepted definitions of the stages of change and provide a parsimonious method of classifying individuals into stages. In the present study, the test-retest correlation across two months for the stages of change measure was strong, $r = .85, p < .01$. Construct validity was confirmed by examining differences in self-reported behavior across stages of change. As expected, given the definitions self-selected by participants for each stage of change, condom carrying as a proportion of times going out in the evening increased across the stages of change at both baseline ($M_{precontemplation} = 0.72$; $M_{maintenance} = 94.83$) and follow-up ($M_{precontemplation} = 2.12$; $M_{maintenance} = 82.73$).

TPB. Variables from the TPB (Ajzen, 1991) were used to predict stage transitions because the model accounts for large proportions of the variance in safe sex behaviour (e.g., Albarracin, Johnson, Fishbein, & Muellerleile, 2001) and has been shown to be predictive of transitions between stages (e.g., Armitage et al., 2004; Courneya et al., 2001). Items used to measure TPB variables were standard items with established validity. A measure of attitude was taken using a semantic differential scale. Respondents were presented with the stem: "Overall, my attitude towards carrying a condom with me every time I go out for the evening in the next 2 months is/would be…", which was rated on three pairs of adjectives (e.g., *bad-good*). The mean of the three items was used as the measure of attitude (Cronbach's αs = .96 and .89 for baseline and

follow-up, respectively). *Subjective norm* was measured using three items (e.g., "People who are important to me think I should carry a condom with me every time I go out for the evening in the next 2 months *strongly disagree-strongly agree*"); Cronbach's αs were .86 (baseline) and .71 (follow-up). *Perceived control* was measured using the item "How confident are you that you will be able to carry a condom with you every time you go out for the evening in the next 2 months? *not very confident-very confident*". *Intention* with respect to condom carrying was assessed using three items (e.g., "I intend to carry a condom with me every time I go out for the evening in the next 2 months *definitely do not-definitely do*"). Cronbach's α for the baseline measure was .91, for the follow-up it was .87.

Two variables that have received attention from researchers interested in enhancing the predictive validity of the TPB (e.g., Conner & Armitage, 1998) were added to the set of predictors. Anticipated regret was measured using two items (e.g., I would regret it if I didn't carry a condom with me every time I went out for the evening in the next 2 months *strongly disagree-strongly agree*"), the mean of which created internally reliable scales (Cronbach's αs = .70 and .71 for baseline and follow-up, respectively). Moral norm was measured with three items (e.g., Carrying a condom with me every time I go out for the evening in the next 2 months is a standard I set for myself that I feel I must meet *strongly disagree-strongly agree*"); Cronbach's αs were .83 (baseline) and .76 (follow-up).

RESULTS

Representativeness Check

Five hundred and twenty-five participants were recruited at baseline, of whom 393 (74.86% response rate) were successfully contacted again at follow-up. MANOVA and chi-square tests were used to establish whether responders and nonresponders differed systematically from one another on demographic variables (age, gender, ethnicity, socioeconomic status, number of sexual partners),

stage of change, TPB variables (attitude, subjective norm, perceived control, intention), anticipated regret, moral norm, and the dummy-coded intervention variable (coded: 0 = did not receive; 1 = did receive). MANOVA revealed no differences between responders and nonresponders, $F(10, 498) = 0.57$, $p = .84$, $\eta_p^2 = .01$, as did each of the univariate F tests, $Fs_{univariate}(1, 508) = 0.01$ to 0.80, $ps > .37$, $\eta_p^2 s < .01$. Chi-square tests showed no association between responders/nonresponders and gender, ethnicity (categorised as white/non-white) or allocation to the experimental condition, $\chi^2 s(1) = 0.08$ to 0.60, $ps > .48$. It was therefore concluded that follow-up responders were representative.

Randomization Check

A randomization check was carried out using MANOVA and chi-square and confirmed that randomization of participants to conditions was successful: There were no significant differences between participants randomized to the experimental condition and those to the control condition on any of the variables measured at baseline, $F(10, 371) = 1.12$, $p = .35$, $\eta_p^2 = .03$; $Fs_{univariate}(1, 382) = 0.01$ to 2.88, $ps > .09$, $\eta_p^2 s < .01$. Chi-square tests confirmed there were no significant associations between condition and gender, $\chi^2(1) = 0.14$, $p = .71$, or ethnicity (categorised as white/non-white), $\chi^2(1) = 0.47$, $p = .49$ at baseline.

The Effect of Sexual Experience

The decision to focus on condom-carrying was due in part to its relevance for sexually experienced and sexually inexperienced individuals. Kruskall Wallis, Mann-Whitney and t-tests were therefore used to assess whether sexually inexperienced individuals were comparable to sexually experienced individuals on the range of variables of interest. Kruskall Wallis revealed there to be a significant difference in the number of sexual partners according to stage of change ($\chi^2(4) = 47.83$, $p < 0.001$), however Mann-Whitney tests showed that while the number of sexual partners in the maintenance stage was significantly higher than for all other stages of change

(Mann Whitney Us = 417.0-6846.5, ps < 0.01) there were no differences between the precontemplation, contemplation, preparation or action stages. This probably reflects a heightened perceived need to carry condoms in individuals with a larger number of sexual partners and an effect of time whereby a larger number of sexual partners have been accumulated in the 6 months required for a participant to meet the definition of maintenance for condom carrying. There were no differences in attitudes, subjective norm, behavioural intention, anticipated regret and moral norm between sexually experienced and inexperienced participants (ts (516-523) = 0.33 - 1.74, ps < 0.05) although sexually inexperienced participants did report lower perceived behavioural control than sexually experienced participants (means: 0.39 and 1.00 respectively; t(523) = 2.83, p = 0.005) and were younger (means: 17.59 and 18.36 respectively; t(523) = 3.83, p < 0.001).

Cross-Sectional Analyses: Predicting Stages of Change

Table 1 presents the sample characteristics and the means and standard deviations for the main study variables at baseline. The majority of participants (59.62%) were in precontemplation, 13.90% were in contemplation, 3.62% were in preparation, 7.05% were in the action stage, and 15.81% reported that they were in the maintenance stage (Table 1).

INSERT TABLE 1 ABOUT HERE

The baseline data were analyzed using discriminant function analysis to establish whether membership of a particular stage of change could be predicted on the basis of demographic, TPB and intervention variables. Discriminant function analysis emphasises the prediction of stage "membership" on the basis of a range of predictors (i.e., demographic, extended TPB variables and the implementation intention intervention) but is mathematically identical to MANOVA (Tabachnick & Fidell, 1989). Stage of change was input as the grouping variable and demographic variables (age, gender, ethnicity, socioeconomic status, number of sexual partners),

TPB variables (attitude, subjective norm, perceived control, intention), anticipated regret, and moral norm as the independent variables.

The analysis produces discriminant functions, which are weighted sums of dependent variables, chosen such that the distributions of the groups (stages of change) are separated to the greatest possible extent (Kinnear & Gray, 1999). There were four significant functions, with a combined $\chi^2(44) = 788.65$, $p < .01$ that accounted for 90.50%, 6.20%, 2.10% and 1.20% of the explained variance, respectively. The first function had the largest group centroid compared with the other functions for 3 out of the 5 stages of change. Examining the largest absolute correlation between each variable and any discriminant function, behavioural intention ($r = .83$), subjective norm ($r = .47$), and attitude ($r = .45$), were all significantly correlated with the first function. Anticipated regret ($r = .69$), age ($r = -.58$), moral norm ($r = .46$), and number of sexual partners ($r = -.36$) were most closely related to the second derived function; age ($r = .43$) was most closely related to the third function, and gender ($r = -.63$) and socioeconomic status ($r = .33$) were most strongly related to the fourth derived function. The predictors correctly classified 69.50% of the participants, substantially more than would have been correctly classified by chance alone (40.02%).

Having established that the predictors were successful in classifying people into stage, pairwise Fs were computed to establish whether each stage could be distinguished from one another[iv]. In other words, each stage was taken in turn and contrasted with subsequent stages (e.g., preparation versus action and maintenance). In this way, it was possible to establish that precontemplation was discriminated from contemplation, preparation, action and maintenance, Fs(11, 493) = 6.40 to 113.39, ps < .01; contemplation was distinct from preparation, action and maintenance Fs(11, 493) = 1.82 to 28.81, ps < .05; preparation was distinguished from action and maintenance, Fs(11, 493) = 2.78 and 14.07, ps < .01, respectively; and action was discriminated from maintenance, F(11, 493) = 16.57, $p < .01$.

Assessing the Effect of the Intervention

A change of stage measure was computed by subtracting baseline stage of change from follow-up stage of change. A chi-square test showed there to be no association between change of stage and being in receipt (or not) of the intervention $\chi^2(7) = 4.60$, $p = 0.71$. However, this analysis could mask differential effects of the experimental intervention on transitions between different stages of change. Thus the intervention was included alongside demographic, TPB, anticipated regret and moral norm in analyses to determine the predictors of stage transitions.

Longitudinal Analyses: Predicting Stage Transitions

The change of stage measure was used to identify who progressed, who remained static and who regressed. Table 2 presents the frequency counts for individuals divided into the stages of change at baseline in relation to their stage at the 2 month follow-up and the three change of stage categories. Overall, 70.1% of individuals remained in the same stage at baseline and follow-up, 24.4% progressed and 5.5% regressed to an earlier stage.

INSERT TABLE 2 ABOUT HERE

Given that full decomposition of these effects would require five cells per stage leading to an unacceptable drop in power, the focus of the analyses was on predicting gross movement, rather than a more fine-grained analysis of specific stage transitions. Thus, for the precontemplation stage, remaining static was contrasted with progressing from that stage; for the maintenance stage, remaining static was contrasted with regressing from that stage; for each remaining stage, remaining static was contrasted with regressing and progressing from that stage. Discriminant function analysis was used to assess whether the prediction of group membership (in this case regression, progression or static movements) was possible from demographic, TPB, anticipated regret, moral norm and (dummy coded) intervention variables.

INSERT TABLE 3 ABOUT HERE

For each change of stage, the predictors correctly classified participants better than would be expected by chance (range = 7.29% to 50.00% improvement in classification). Pairwise *F* analyses in Table 3 show that regression and progression from all the relevant stages of change were predicted from the demographic, TPB, anticipated regret, moral norm, and intervention variables (all *p*s < .05).

INSERT TABLE 4 ABOUT HERE

Decomposition of the effects was achieved by examining the variables that were most strongly associated with the discriminant functions. These were identified using *F to remove* analyses (see Tabachnick & Fidell, 1989). These variables were then subject to planned comparisons (ANOVAs and Fisher's Least-Significant Difference post-hoc tests) to determine the best predictors of stage transitions (Table 4). Analysis of the precontemplation stage demonstrated that progression was predicted by perceived control, gender and age. Thus, participants with greater perceived control, men and older participants were more likely to progress to subsequent stages from the precontemplation stage. Perceived control and age also differed significantly between individuals who regressed, remained static and progressed from the contemplation stage, although the post-hoc tests revealed that only progression was reliably (*p* < .05) predicted. Progression from the contemplation stage was associated with greater perceived control and being older. Unfortunately, the lack of participants regressing from the preparation and action stages precluded these analyses, but several variables were predictive of progression from these stages. Progression from the preparation stage was associated with receiving the implementation intention intervention and with more positive attitudes. Progression from the action stage was more likely in men and people with high intentions. Younger individuals were more likely to regress from the maintenance stage.

In summary, the findings show that progression from all the stages of change were predicted from age, gender, attitude, intention, perceived control, and being in receipt of the implementation intention intervention. Regression from the maintenance stage was also reliably predicted.

DISCUSSION

The present findings corroborate a considerable body of research that has examined differences in social cognitive variables across the stages of change (e.g., DiClemente et al., 1991; Herzog et al., 1999). Comparable with other studies (e.g., Armitage et al., 2004; Courneya et al., 2001), the present study demonstrated that progression from the stages of change could be predicted. Relatively small numbers of people regressed which meant that only regression from the maintenance stage could be reliably predicted.

Progression from precontemplation was predicted by age, gender and perceived control: Older people, men and those with higher perceived control were most likely to progress. Similarly, older participants and those with higher perceived control were more likely to progress from the contemplation stage. Consistent with predictions, individuals who received the implementation intention-based intervention were more likely to progress from the preparation stage, as were those with more positive attitudes. At the action stage, men were more likely to progress to the maintenance stage and those with more positive intentions. Finally, age predicted regression from the maintenance stage: Younger people were more likely to regress. Thus, demographic, psychological and intervention variables were all predictive of several stage transitions.

Thus, in addition to showing that a variable (i.e., the dummy-coded intervention variable) was able to *explain* progression from the preparation stage, the present study also identified several variables that were *predictive* of other stage transitions (cf. Sutton, 1998). Although these predictor variables do not necessarily provide information about the content of interventions to promote stage transitions, they do identify the people who might benefit from

interventions. For example, men were more likely to progress from the precontemplation and action stages, so it would be appropriate to design interventions targeted at women in these stages. Similarly, perceived control was predictive of progression from the contemplation stage, meaning that interventions should be targeted at people in this stage who are low in perceived control. However, just as one would not seek to change participants' gender in the former example, in this latter example, it is not necessarily the case that the intervention would need to enhance perceived control and the content of both interventions would need to be determined through an intervention mapping protocol (e.g., Kok, Schaalma, Ruiter, & van Empelen, 2004).

Three variables from the TPB, namely, attitude, perceived control and intention were predictive of stage transitions, providing further support for the model. Perceived behavioural control was predictive of progression from the precontemplation and contemplation stages. Perceived behavioural control has previously been found to be predictive of progression from contemplation and action stages in the domain of eating a low fat diet (Armitage et al., 2004), and contemplation in the domain of exercise (Courneya et al., 2001). Attitude predicted progression from the preparation stage. Attitude was also found to be predictive of progression from the preparation, contemplation and precontemplation stages in the domain of exercise (Courneya et al. 2001). Intention predicted progression from the action stage as has been found in exercise (Courneya et al., 2001). Thus, the pattern of TPB predictors across stage transitions seems to vary according to the domain. Although it is not yet clear whether these TPB variables *explain* stage transitions (cf. Sutton, 1998), there are numerous techniques that have been shown to be successful in changing attitudes and enhancing perceived control (e.g., Ajzen & Fishbein, 1980; Bandura, 1997), which might form the basis of an intervention. From a conceptual viewpoint, these findings underline the importance of motivation for successful behaviour change.

Notwithstanding these positive findings, data showing that demographic variables predict stage transitions is contrary to what one might predict because the TPB is regarded as a complete model of social behaviour, meaning that the effects of age and gender on stage transitions should be mediated through TPB variables (cf. Ajzen, 1991). The implication is that the theory of planned behaviour may not be a sufficient model of safe sex and that further additional variables are needed to explain the relationship between age and gender and change of stage. It would be valuable to gain further insights into the effects of these demographic variables in particular and explore, for example, whether women perceive condom carrying to be the responsibility of men and whether younger people are less likely to perceive risks associated with not carrying condoms (cf. Kok et al., 2004).

Although the sample size was small, receiving the implementation intention-based intervention caused the transition from preparation to action, providing further evidence that volitional strategies can overcome the apparent gap between preparation and action (cf. Armitage, 2006, 2007b). The fact that both the implementation intention intervention and attitude were predictive of the preparation-action transition may at first seem at odds with Gollwitzer's (1993) model that emphasises distinct motivational and volitional phases in human goal attainment. However, it must be emphasised that whereas implementation intentions explain the transition between preparation and action, attitudes simply predict the transition (as a correlational variable). In other words, the causal role of attitudes in promoting progression from the preparation stage is yet to be established whereas the implementation intention intervention caused people to move from preparation to action.

More generally, implementation intentions have again been shown to be a useful way by which people's motivation to engage in health behaviour can be translated into action (cf. Gollwitzer & Sheeran, 2006). Moreover, in contrast with most laboratory research on

implementation intentions, the present manipulations were self-directed, meaning that not only is there considerable scope for deploying them on a large scale, but their effectiveness might be further enhanced through consultation with a counsellor. Thus, rather than individuals being asked to self-generate their implementation intentions, counsellors could help an individual identify critical situations and appropriate behavioural responses. Indeed, some of Prochaska and DiClemente's (1984) processes of behavior change could be used to generate implementation intentions. For example, an implementation intention of the form: "If I am with a new partner then I will remind myself that I am a responsible individual who takes appropriate measures to prevent pregnancy or transmission of disease" maps closely onto Prochaska and DiClemente's (1984) concept of self-reevaluation, a key process of change. Further research is required to test the effectiveness of implementation intention-based interventions that are directed by others as opposed to being self-generated.

Notwithstanding the promising findings reported here, it is important to note a number of potential limitations that should be addressed in future research. First, the study involved only a two-month follow-up and it would have been valuable to follow people over a longer period of time, particularly given that maintenance is defined as commencing six months after action (Prochaska & DiClemente, 1983). However, Sutton (2005) recommends short follow-ups in order to avoid missing stage transitions. Second, the topic of interest was carrying rather than using condoms, and although condom carrying is a key preparatory behaviour (e.g., Sheeran et al., 1999) with several conceptual advantages (e.g., equivalent for women and men, sexually experienced/inexperienced) it would be valuable to extend the present work in a broader range of safe sex behaviours, including acquiring, using and negotiating the use of condoms. Nevertheless, the fact that implementation intention-based interventions are so brief raises the possibility that participants could be asked to form a series of implementation intentions to cover several preparatory behaviours in relation to

safer sexual behaviour. Third, consistent with research showing that adolescents are most likely to have sexual intercourse after 6.00 pm (Fortenberry et al., 2006), the questions were phrased with reference to carrying condoms every time the participants went out in the evening, however instances of sex, and hence a requirement to be carrying a condom may have occurred at other times of day. Fourth, as with most safe sex behaviours it was not possible to gain an objective outcome measure. However, there was no evidence of under-reporting of regression from the stages of change in the experimental condition and anonymity was maintained through generation of a personal code thereby increasing confidence in the veracity of the present findings. Fifth, although the sample was broadly representative, there were more women than in the population at large and all the young adults were enrolled in part-time or fulltime education, and it would be valuable to extend the research in underserved populations.

In sum, the present research presents the first attempt to predict transitions between the stages of change for a safe sex behaviour. The key findings were that: (a) in cross-sectional analyses demographic and psychological variables provided very good discrimination between the stages of change, (b) transitions between most stages of change were reliably predicted thereby providing potential targets for intervention, and (c) a brief intervention based on implementation intentions was effective in explaining the transition from preparation to action.

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Footnotes

[i] Retrieved September 29, 2005 from http://www.statistics.gov.uk/ Crown copyright material is reproduced with the permission of the Controller of HMSO.

[ii] Note that because the sample were all enrolled in full- or part-time education, consistent with UK government practice, parental occupation was used as a proxy measure of socioeconomic status.

[iii] Participants were informed that if they wished to write more, they could do so on the reverse of the questionnaire. No participants chose to do so.

[iv] Note that it is not possible to generate estimations of effect size for pairwise F values in discriminant function analysis because these analyses are based on pooled standard deviations, which can overestimate effect sizes by as much as 100% (e.g., Dunlop, Cortina, Vaslow, & Burke, 1996).

Table 1: Cross-Sectional Analysis of Stage of Change Data: Baseline (n = 525)

Variables	Precontemplation (*n* = 313)			Contemplation (*n* = 73)			Preparation (*n* = 19)			Action (*n* = 37)			Maintenance (*n* = 83)		
	M	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*
Attitude	-0.08	1.49		1.27	0.90		1.54	1.10		1.45	0.98		2.39	0.56	
Subjective Norm	-0.90	1.40		0.60	0.92		0.44	1.62		0.63	1.10		1.71	1.09	
Perceived Control	0.53	1.94		1.11	1.31		1.21	1.93		1.35	1.30		1.89	1.13	
Behavioral Intention	-1.78	1.23		0.20	0.78		0.19	1.48		0.88	1.16		2.26	0.73	
Anticipated Regret	-2.15	1.13		-1.07	1.10		-0.66	1.37		0.36	2.02		-0.20	1.50	
Moral Norm	-1.92	1.31		-0.60	1.10		0.02	1.39		-0.19	1.19		0.12	1.46	
Sexual Partners	2.54	2.36		2.79	3.09		2.63	2.03		2.92	2.00		5.78	5.17	
Age	18.22	1.58		17.63	1.80		17.79	1.44		17.70	1.33		19.24	1.84	
Women			281			43			17			22			30
Men			31			30			2			15			53
Socioeconomic Status	3.00	1.45		3.00	1.44		3.74	1.85		3.30	1.49		3.01	1.46	
White Ethnic Background			269			68			18			31			68
Asian Ethnic Background			10			2			1			1			7
Black Ethnic Background			9			0			0			0			0
'Other' Ethnic Background			1			0			0			0			0
Control Condition			166			38			7			22			41
Experimental Condition			147			35			12			15			42

Table 2: Frequency of stage transitions

	Stage (2 month follow-up)							Gross Movement					
	PreC	Con	Prep	Act	Main	Total		Regress		Static		Progress	
Stage (baseline)	*N*	*N*	*N*	*N*	*N*	*N*		*N*	*%*	*N*	*%*	*N*	*%*
Precontemplation (PreC)	178	37	13	1	--	229		--	--	178	77.7	51	22.3
Contemplation (Con)	10	22	18	5	--	55		10	18.2	22	40.0	23	41.8
Preparation (Prep)	0	1	6	7	--	14		1	7.1	6	42.9	7	50.0
Action (Act)	2	2	0	13	13	30		4	13.3	13	43.3	13	43.3
Maintenance (Main)	1	2	0	3	51	57		6	10.5	51	89.5	--	--
Totals	191	64	37	29	64	385		21	5.5	270	70.1	94	24.4

Progression to Maintenance was only possible from Action due to the requirement in Maintenance that participants have carried condoms for longer than 6 months. 7 participants had self-selected Maintenance at follow-up when they had been in Precontemplation-Preparation at baseline. They were therefore removed and are not included in subsequent analysis

Table 3: Pair-Wise Fs Testing Differences Between Static and Regress/Progress

Stage of Change	F (df) for Regress Versus Static	F (df) for Static Versus Progress
Precontemplation	--	9.88 (3, 217)**
Contemplation	6.16 (2, 29)**	14.55 (2, 42)**
Preparation	115.09 (2, 4)**	54.64 (2, 9)**
Action	9.31 (2, 13)**	6.00 (2, 23)**
Maintenance	16.25 (1, 53)**	--

**$p < .01$.

Table 4: Means and F Ratios for Variables That Predict Stage Transitions

	Regress M	Static M	Progress M	Univariate Fs	η_p^2
Precontemplation Stage					
Perceived Control	--	0.34	1.36	11.17**	.05
Gender	--	0.06	0.20	8.81**	.04
Age	--	18.14	18.90	9.07**	.04
Contemplation Stage					
Perceived Control	0.10$_a$	0.73$_a$	1.83$_b$	9.01**	.26
Age	17.20$_a$	16.59$_a$	18.70$_b$	11.20**	.30
Preparation Stage					
Intervention	§	0.33	0.83	3.46*‡	.26
Attitude	§	0.61	2.61	45.63**	.82
Action Stage					
Gender	§	0.23	0.69	6.54*	.21
Intention	§	0.31	1.33	6.81*	.22
Maintenance Stage					
Age	16.83	19.54	--	15.22**	.22

Note. Variables were derived from analysis of Wilk's Lambda coefficients. §Removed from analyses because cell size < 4. Values with different superscripts on a row indicate significant ($p < .05$) differences between groups, based on Fisher's Least-Significant Difference *post hoc* tests.

p < .05. **p* < .01. ‡*1-tailed.*