A rapid review and expert identification of the Allied Health Professions' interventions as a contribution to public health outcomes

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Review Article

A rapid review and expert identification of the Allied Health Professions' interventions as a contribution to public health outcomes

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ABSTRACT

Background and aim: In preparation for the Public Health England Impact Assessment of the 2014 AHP Public Health Strategy a follow up rapid literature review was commissioned. The aim was to identify primary studies in which Allied Health Professionals (AHP) contribute to public health outcomes, based on UK research evidence. This review was used to inform further UK policy and implementation for AHPs in the UK via Public Health England.

Methods: A rapid mixed methods review was conducted, limiting the selection of studies to those published after December 2014 and recognising the same 12 Allied Health Professions that were used in the previous review. The rapid review included all age groups and patient populations but limited the searches to studies that reflected UK AHP practices and research outcomes. The literature search included title, abstract and full-text screening with data extraction of selected papers. A nominal group method invited expert AHPs to review and select the interventions for potential impact at population level.

Results: 11 selected articles were grouped into two areas of interventions; health intervention/public health and secondary prevention/health improvement, based on the Public Health England Strategic Framework. AHP interventions were effective for Chronic Fatigue Syndrome and Osteoarthritis and specifically used to manage musculoskeletal conditions (e.g. frozen shoulder). AHPs leading vocational rehabilitation and falls management were also effective. These areas were additional to those previously identified and represented some additional specialist activity undertaken to affect health outcomes.

Conclusions: This study also contributed to the UK AHP Public Health Strategic Framework 2019–2024 by appraising the UK evidence and impact of some AHP practices. Further improvement is required; for AHPs to measure the impact of their interventions which would demonstrate evidence of outcomes at population level.

1. Introduction

The rising burden of chronic disease poses a challenge for all public health systems and requires innovative approaches to effectively improve population health [1]. The global debate suggests the need for a more inclusive integrated vision of health that can be shared by all stakeholders [2]. The public health challenge remains focused on disease-specific issues and recent policy initiatives have provided a greater focus on connecting different professions that impact upon population health [3]. This paper presents the results of a rapid mixed methods review that follows on from a previous mapping of the contribution of UK Allied Health Professionals (AHPs) to public health, commissioned by Public Health England [4].

Public Health interventions have been categorised into four groups by the AHP Strategy for Public Health England [5] to be: (a) wider/social determinants of health and wellbeing; (b) health improvement; (c) health

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protection, and (d) healthcare public health. The four UK nations Allied Health Professions have jointly focussed on their ambition to be recognised as integral to the public health workforce with the PHE's Evidence into Action Strategy [6] emphasising the need for clinical interventions to contribute to public health outcomes and stressing the need for enabling approaches for individuals and communities to gain more control over their health. The strategy sought to encourage all services to recognise the wider determinants of health, and demonstrate how families and communities can be enabled to improved health. This focus on prevention and health inequalities has since been reinforced with the publication of the Marmot review 10 years on [7] which highlights how health, as measured by life expectancy, has stopped improving, and health inequalities are growing wider.

There are currently fifteen recognised AHP professions in the UK: art therapy, clinical psychology, dietetics, drama therapy, music therapy, occupational therapy, operating department practice, orthoptics, osteopathy, paramedic practice, physiotherapy, podiatry, prosthetics and orthotics, radiography (diagnostic and therapeutic) and speech and language therapy [8] but for the purpose of replicating the previous review [4] Clinical psychology, operating department practice and osteopathy which were not part of the original project and were excluded. These professional groups have only recently been identified in UK policy as Allied Health Professions. The recent strategic framework [8] identifies how AHPs contribute to public health, recognising them as 'trailblazers' with interventions that affect the physical, mental and social wellbeing of individuals, communities and populations; as well as reducing health inequalities. The degree to which each profession's involvement is evidence-based and producing population-based outcomes is the subject of this review.

Population outcomes demonstrate how individual healthcare professionals achieve public health priorities within their practice. Whilst AHPs have made good progress and have been recognised for their contribution to the public health workforce, there is a continuing need for AHPs to "evaluate, improve and evidence the impact of their contribution" as a key priority [9]. Accordingly, the aim of this review was 'to identify AHP interventions (primary studies) that support public health outcomes' in order to assess the impact of the 2015–2018 AHP Public Health Framework. The initiative to identify and report evidence of AHP interventions aligns to the Royal Society of Public Health who suggest that healthcare professionals need to record and measure the impact of brief interventions [10].

2. Methods

A rapid literature review [11] was undertaken to identify how 12 Allied Health Professions' practices contribute to public health outcomes. The process consisted of literature searches, study selection, data extraction (which included data items to support critical appraisal), and data synthesis. The review is reported in accordance with the Preferred Reporting Items for Systematic review and Meta-Analysis (PRISMA) [12]. Rapid reviews have the potential to overcome a key barrier to the use of research evidence in decision making, namely that of the lack of timely and relevant research [13]. 'Shortcuts' include limiting the number of questions, limiting the scope of questions, searching fewer databases, limited use of grey literature; restricting the types of studies included (e.g. English only, most recent 5 years). These are permissible to enable the use of evidence in policy. Ethical approval is not required for a review of the literature.

The purpose of this review was to update an earlier study [4] that reported on the effect of the AHP intervention and/or the engagement with the person or population. Interventions with any type of population were eligible for inclusion, i.e. adult or child services and any professional specialty. All types of primary studies were considered, this included qualitative, quantitative, mixed method study types, with and without a control. This review used identical methods and scope from the previous study [4] except where stated. The range of AHPs in the UK is governed via a protected title by the Health and Care Professions Council (HCPC) and so the variation in educational registration qualifications was not a consideration in this study and did not inform the inclusion criteria. The commissioned study was undertaken to contribute to the policy impact assessment in Public Health England and identify whether AHP practice had extended their impact on public health. This was important to update the policy impact on practice in the four years since the previous review.

The information databases as follows were searched in this review: Allied Health and Complementary Medicine (Ovid), CINAHL (EBSCO), MEDLINE (EBSCO) and The Cochrane Library (Wiley). The searches were undertaken in August 2018. Grey literature was not sought. The search terms comprise three facets: (1) an NHS list of the 12 Allied Health Professions, (2) public health key domains as identified by Public Health England, and (3) a UK only context. Facet one and facet two were searched for in the title and abstract fields. Facet three was searched for in the author address field or equivalent. Controlled vocabulary terms were included. Boolean operators, phrases and truncated search syntax were used. Only papers published since 2014 and in the English language were eligible for inclusion. A copy of the search terms as written up for MEDLINE (EBSCO) is included in Appendix 1.

A combination of the bibliographic software, RefWorks (ProQuest), and Microsoft Excel 2010 were used to manage the results of the searches and the screening processes. Following on from a pilot exercise, all papers were screened for relevance using the title and abstract, and subsequently the full text. Screening was divided amongst the review team which comprised a range of AHPs, with all papers looked at by one reviewer and 10% checked by a second reviewer. Wherever possible, papers were screened by someone from the same profession or by someone with considerable experience of it. Finally, the principal investigator, looked through the screening decisions at the title and abstract, and the full-text screening stages to check a consistent approach had been applied. All papers determined to be relevant to the scope of the review were subjected to a data extraction process which included some data items to support critical appraisal. The data extraction template included data fields to capture the study design and the population, a description of the intervention, criteria to judge the inclusion of patient reported outcomes, specific evidence of effectiveness as an outcome, and the use of a standardised reporting framework. The data extraction template was designed to enable data extraction from quantitative, qualitative and mixed method primary studies. It was planned that all data types would be analysed alongside one another.

The nominal group method [14] was designed to include 10 different AHP participants in the final selection of articles based on a consensus of opinion across professions. Nominal group method is a structured technique that encourages contributions from participants with expertise in a topic area but often a diversity of experience. It can facilitate quick agreement on the relative importance and selection of solutions.A single event was used to (a) familiarise participants with the full text data extraction sheets (one per study), (b) exclude any articles that did not fulfil the eligibility criteria, and (c) to categorise the evidence-based intervention into domains according to the AHP Public Health strategy [5]. The quality of evidence, the application of the intervention across health systems and especially within AHP practice in the UK was considered fully within the process of selection. Once categorised, the papers were fully discussed and prioritised as examples of AHP contributions to public health, since the inception of the UK AHP Public Health Strategy in 2014.

3. Results

The literature searches yielded 4870 papers after the removal of duplicates. After screening the title and abstract of all the papers, 380 papers were retained. A second round of title and abstract screening resulted in the exclusion of a further 119 papers, 261 papers were retained based on a further refinement of the inclusion/exclusion criteria

and recognising that removing feasibility studies, conference abstracts was justified by a lack of reporting detail.

At the full text screening stage, it was also decided that all papers referring to practices outside the UK were excluded based on the core purpose which was to assess the impact of the 2015–2018 AHP Public Health Framework. The definition of the Allied health Professions varies between countries, including a difference in the professional disciplines classified as Allied Health Professions. Furthermore, there are variations in the roles undertaken by AHPs across countries, even in cases where the role title remains the same. In the case of UK studies, whilst location-based criterion was expressed in the search strategy, many studies undertaken outside of the UK were still yielded. Full text screening therefore resulted in 16 papers included in the review.

Data was extracted from 16 papers. A further five papers were excluded during the consensus exercise that was held after the data extraction to generate summaries of the findings. The reasons for exclusion were the paper being determined as an evaluation (as opposed to research), a lack of clarity about who delivered the intervention and how it was measured, and there not being an intervention. The evaluation papers yielded in this review were found to provide insufficient data, and/or were judged to have limited potential impact at population level. Eleven papers are included in this rapid review.

The PRISMA diagram summarises the search and screening processes in Fig. 1.

The data items extracted are shown in Table 1. A range of study types were retrieved. However, all qualitative studies were excluded during the screening stages.

A summary of the selected articles identifies the Allied Health Profession/s, and the population, along with the type of intervention, description of the intervention, the sample size and study design.

Details about the relative specific individual or population benefit, along with the description of any user experience reported, and finally the evidence of effectiveness are also shown.

4. Discussion

In the previous rapid review undertaken in 2015 [4], there were nine evidence-based interventions identified and selected as examples of current AHP good practice in public health, one example being orthoptists, screening for visual impairments in three- and four-year olds to ensure that poor eyesight would not impede progression at school [15] The study provided evidence for the AHP Public Health Strategy and demonstrated the contribution of AHPs to a number of populations across the life course. The current review was undertaken with a slightly extended search strategy but the same screening and selection methods, where there are several new and additional areas of practice. The analysis by an expert group of AHP was also similar; to identify AHP interventions where the research confirms that the intervention enhanced the well-being and/or the management of an existing health condition.

This research demonstrates three interventions where a specific clinical outcome was achieved in health improvement; the prevention of secondary problems and disability associated with a primary condition or multiple morbidity. In a further eight studies the benefit to the patient was in 'healthcare public health' which reflects a targeted focus on a

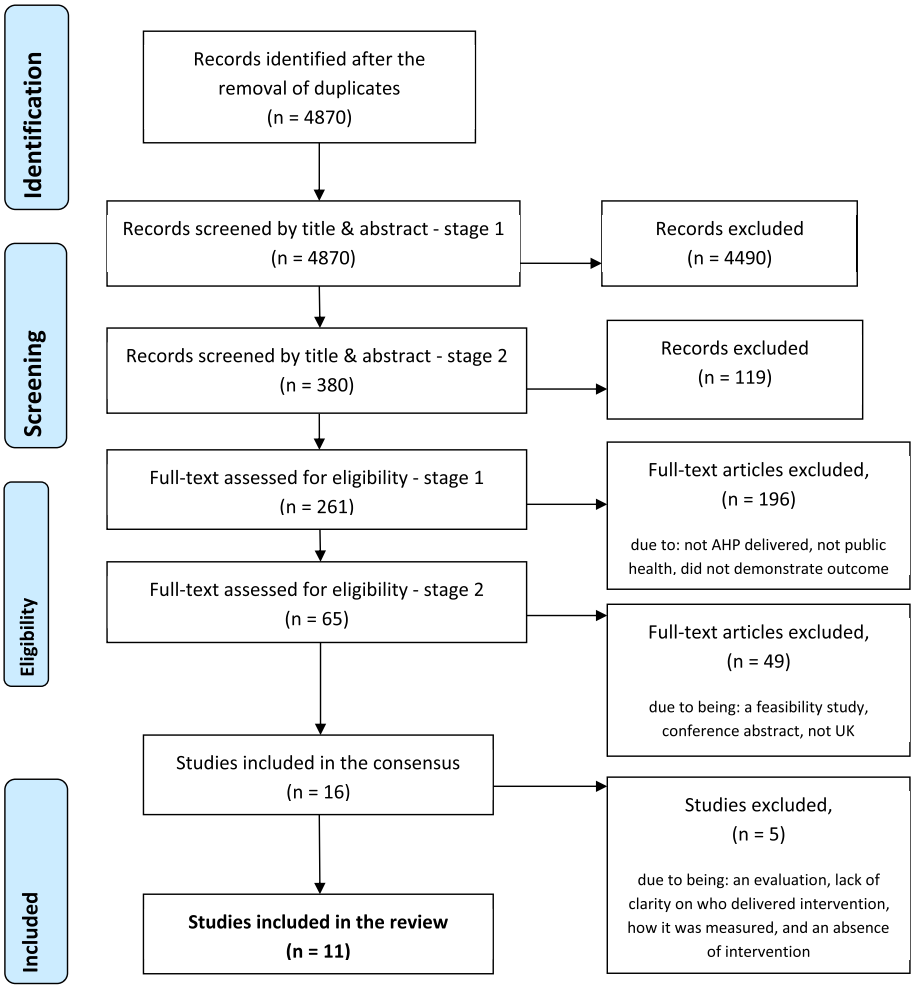

Fig. 1. PRISMA diagram adapted from Moher et al. (2009) [12].

Table 1
Summary of research studies (PICOS).

Reference & AHP Profession	Population	Intervention	Comparison	Outcome	Study design	Category of PH intervention
Russell et al. (2014) Physiotherapy	Primary care referrals of adults with idiopathic frozen shoulder to a physiotherapy department 75 randomly assigned to 3 groups	Group exercise class, individual physiotherapy, & home exercises alone	Home exercise alone	A hospital based exercise class can produce a rapid recovery from a frozen shoulder with a minimum number of visits to the hospital & is more effective than individual physiotherapy or a home exercise programme.	Blinded, RCT	Healthcare public health
Mellor et al. (2014) Dietetics	Adult men & women with a BMI 27–35 kg/m2. 114 participants randomised. 122 assessed for eligibility but 8 didn't meet inclusion criteria.	Meal provision of diet chief for 4 week study period with dietary advice provided by a dietician	Usual Care	From 4 to 12 weeks a significant difference in weight loss between all the meal provision group & the self-directed (control) group. Attrition rates more pronounced in control group 41% vs 7% with 3 times more of the all meal provision group achieving 5% weight loss.	RCT	health improvement
Bhopal et al. (2014) Dietetics	Men and women of Indian & Pakistani origin, aged 35 yrs or older, waist circumference 90 cm or greater in men or 80 cm or greater in women, and with impaired glucose tolerance or impaired fasting glucose determined by oral glucose tolerance test. Study used family clusters. 171 participants (with 124 family volunteers; 156 families), 84 & 83 in intervention & control group.	Weight management. Randomised. 15 visits from dieticians over 3 yrs. Control, standardised written & verbal advice on healthy eating, diabetes prevention, promotion of physical activity, accessing other weight control & physical activity services over 4 visits in same period.	Usual Care	The adjusted mean difference at 3 years was −1·64 kg (95% CI −2·83 to −0·44) for the intervention group, compared with the control group (p = 0·0076). 3 year dietician costs were £1190 for the intervention group and £575 for the control group.	RCT not blinded	health improvement
Sackley et al. (2015) Occupational Therapy	1042 care home residents with a history of stroke or TIA. 114 homes (n = 568 residents) were allocated to the intervention arm and 114 homes (n = 474 residents) to standard care (control arm). 64% of the participants were women and 93% were white, with a mean age of 82.9 years.	Stroke. Targeted 3 month programme of occupational therapy, delivered by Occupational Therapists & assistants, involving patient centred goal setting, education of care home staff, and adaptations to the Environment. Residents in the control arm received usual care; this did not involve an occupational therapy component. The occupational therapy intervention at the level of the care home resident followed a client centred approach, involving task specific training delivered by occupational therapists targeted towards maintaining abilities in functional activity; in particular, personal activities of daily living (ADL) such as feeding, dressing, toileting, transferring & mobilising. Overall, 2538 occupational therapy visits were made to 498 participants in the intervention arm (mean 5.1 visits per participant).	Standard Care	This large phase III study provided no evidence of benefit for the provision of a routine occupational therapy service, including staff training, for care home residents living with stroke related disabilities. The established 3 month individualized course of occupational therapy targeting stroke related disabilities did not have an impact on measures of functional activity, mobility, mood, or health related quality of life. Providing and targeting ameliorative care in this clinically complex population requires alternative strategies.	Phase III pragmatic, parallel group; cluster RCT in UK care homes.	healthcare public health
Dziedzic et al. (2015) Occupational Therapy	Adults 50 yrs or older, MSK reported hand pain in the last year, hand pain/aching/ stiffness on minimum some days in last month, AUSCAN pain score ≥5 or & function score≥ 9, no related OT/PT in last 6 months, no hand operation/ injection/injury in last 6 months eligible study population n = 12,297, excluded n = 397, respondents	All received standardised written information on self-management of hand osteoarthritis. 25% this intervention only, remaining 75% this plus one of three interventions: joint protection, hand exercises or combination of the two. Interventions delivered over 4 group sessions by OTs. Groups up to 6 participants and lasted max 1 h	Education leaflet only	Population of people with hand OA under treated. Participants who received the joint protection intervention were statistically significantly more likely to be classified more responsive to self-management than those not receiving joint protection (33% vs 21%). This was not maintained for over 12 months. Instruction in hand exercises was more effective in	RCT, randomised factorial trial	healthcare public health

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Table 1 (*continued*)

Reference & AHP Profession	Population	Intervention	Comparison	Outcome	Study design	Category of PH intervention
	to study n = 6972, excluded following response n = 5663, invited to baseline clinical assessment n = 1309, attended assessment n = 344, excluded n = 87, therefore **n = 257** participants randomised, mean age 66 yrs, female 66%, follow up was 85% n = 212.	(1.5 h for combined intervention) attendance adherence audited.		reducing hand pain & disability than no instruction in hand exercises, & found there was no statistically significant difference in the number of 'responders' between those receiving and not receiving hand exercises. Participants receiving joint protection education reported improved pain self-efficacy at 3, 6 & 12 months.		
Clare et al. (2017) Occupational Therapy	People any age with an ICD-10 diagnosis of Alzheimer's, vascular or mixed dementia & mild to moderate cognitive impairment as indicated by an MMSE score of 18 or above 1731 eligible for study, after screening n = 583, assessed at baseline, n = 475 randomised n = 236 intervention group, n = 239 control group.	10 weekly x 1 h individual sessions of goal-orientated cognitive rehabilitation over a 3 month period followed by 4 x 1 h maintenance sessions over subsequent 6 months.	Usual Care	Individual goal orientated cognitive rehabilitation enables people with dementia to function better and more independently in relation to goals targeted in the therapy.	RCT with qualitative evaluation after completion of the trial.	
Cockayne et al. (2017) Podiatry	Adults over 65 yrs who have fallen in the last 12 months or fallen in the last 24 months with a resulting hospital admission 1010, 493 intervention group, 517 usual care	Multi-faceted podiatry intervention including footwear advice, footwear provision, orthotics if needed, foot & ankle strengthening exercises & falls prevention leaflet	Usual care	The package of care was safe, acceptable & potentially effective intervention in reducing the proportion of older adults who experience a fall over 12 months. The intervention was safe & potentially effective. Although the primary outcome measure did not reach significance, a lower fall rate was observed in the intervention group. The reduction in the proportion of older adults who experienced a fall was of borderline statistical significance. The economic evaluation suggests that the intervention could be cost-effective.	A pragmatic multicentre cohort RCT with economic evaluation & embedded qualitative study	healthcare public health
Hammond et al. (2017) Occupational Therapy	Adults 18 yrs or older with rheumatoid arthritis, psoriatic, arthritis or undifferentiated inflammatory arthritis 55 from 539 screened. 29 in intervention group, 26 in control group	Vocational rehabilitation (VR) consists of up to 4.5 h of 1:1 meetings. A tailored, individualised programme including self-management at work.	Usual care	VR was more acceptable than written advice only & cost £135 per person. VR was better in reducing presenteeism, absenteeism, perceived risk of job loss and improving pain & health status.	A feasibility RCT	healthcare public health
Clark et al. (2017) Physiotherapy	Adults 18 yrs or older diagnosed with chronic fatigue syndrome. 211, 107 interventions, 104 control group.	Specialist medical care with guided graded exercise self-help	Specialist medical care	At 12 weeks those in the intervention group were more likely to have a positive change in overall health and chronic fatigue syndrome on the Clinical Global Impression scale compared with the control group. The intervention group had better work & social adjustment scores, depression & anxiety but not general physical symptoms. Significantly more participants exceeded predefined clinically meaningful changes for fatigue, physical functioning & both after guided graded exercise self-help plus specialist medical care, than after specialist medical care. In the guided graded exercise self-help group, a similar proportion of participants improved by a clinically meaningful amount on both primary outcomes (34%) & scored themselves in the high	Pragmatic RCT	healthcare public health

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Table 1 (*continued*)

Reference & AHP Profession	Population	Intervention	Comparison	Outcome	Study design	Category of PH intervention
				range of physical activity (IPAQ; 30%) at follow-up, which provides some support for these thresholds. The greatest improvements in physical functioning after guided graded exercise self-help occurred in those with more physical disability.		
Thomas et al. (2017) Physiotherapy	Adults diagnosed & currently treated for asthma from 34 primary UK NHS general practices. Inclusion criteria: full practice registration for 12 months prior to enrolment, age 16–70 yrs, one or more anti-asthma medication prescriptions in the previous year, impaired asthma-related health status [Asthma Quality of Life Questionnaire (AQLQ) score of <5.5], able to give informed consent. 655 adults randomly allocated to the DVD (n = 261), physiotherapist (n = 132), and control (usual care) (n = 262)arms in a 2 : 1: 2 ratio.	Breathing retraining programme delivered in DVD format with a breathing retraining programme delivered face-to-face by a physiotherapist & with a control of usual care	Usual Care	Only 10% of the potentially eligible population responded to the study invitation. Breathing retraining exercises improved QoL & reduced health-care costs in adults with asthma whose condition remains uncontrolled despite standard pharmacological therapy, were engaged with well by patients and can be delivered effectively as a self-guided intervention. The intervention should be transferred to an internet-based platform & implementation studies performed. Interventions for younger patients should be developed & trialled.	A pragmatic, observer-blinded, three-arm, parallel group RCT.	health improvement

specific and targeted population. No research studies were identified as of sufficient quality to address the other two domains of PH; the wider/social determinants of health and wellbeing and health protection. This is perhaps surprising, given that screening studies were present in the previous rapid review [4] and may reflect a change in the range of studies currently undertaken by AHPs and a more limited range of research into the practice of AHPs in the UK. The studies included in this review were perhaps less focussed on the specific long term needs of certain key populations and more on the different forms of rehabilitation in community services.

Rehabilitation is associated with the enablement of independence and AHP are internationally recognised as the professional groups who offer rehabilitation services to patients [16] and align to the achievement of intrinsic capacity or functional ability [17]. The categorisation of interventions is somewhat expected, given that AHPs are typically employed in roles within the National Health Service (NHS) and in local government and are concerned with interventions that support individual self-management particularly of those with chronic and long term conditions. Health care public health in the UK is taken to mean that the clinical or social intervention is undertaken to maximise value, equity and good outcomes by focusing on the needs of the population and delivering person-centred services across the entire health and care system. The deployment of AHPs across community services and particularly in roles that prevent illness and disability via screening and targeted intervention remains a potential and are currently under consideration [18].

Similarly, evidence-based interventions for health improvement depend on the deployment of AHP across the health and care system where they might enable person-centred approaches to population health management, to specifically address health inequalities by enabling and encouraging healthy lifestyle choices and by developing resilience [19].This is a more recent development in the professions' contribution and is promoted by different AHPs by their professional bodies; perhaps accounting for the different accounts of health improvement. It depends on the continuing capacity building in research for AHPs to develop interventions and research their practice [20].

AHP research did not evidence examples of health protection and this is likely to be related to the limited direct involvement in chemical/environmental hazards. Radiographers are an integral part of national cancer screening programmes, however research in these programmes does not focus on the specific role of the radiographer. Similarly, the opportunity for AHPs to engage in strategy and good practice associated with the wider determinants of health and the promotion of healthy environments is still at the 'growing edge' of professional activity; and generally has a multi-agency contribution rather than being provided by one AHP profession [21]. Further activity to identify and showcase AHPs working across communities to enable vulnerable populations to access services and community assets is a part of the new AHP strategic framework [8]. The examples selected and categorised under the definition of health improvement are notably led by dietitians working with working age adults and in one example, a sub-population of people of Pakistani origin [22]. In both cases, a significant weight reduction is maintained through multi-modal packages of care [22,23]. The example of the physiotherapy led intervention, highlights the effectiveness of a breathing training programme for people with asthma that was supported by face-to-face training and access to knowledge using a DVD training method [24].

The examples selected and categorised under the definition of healthcare public health represent several physiotherapy (PT) and occupational therapy (OT) interventions across several specific populations with clinically defined needs. An orthotic and a podiatry intervention are also included. The range of professional groups represented in this selection is narrower than expected and perhaps reflects the larger relative size of the PT and OT workforce across UK and also the larger clinical academic community within these professions. The podiatry led intervention [25], providing advice on footwear to older adults who have fallen is therefore exceptional for the scale and quality of the study although the outcomes and benefits failed to show significance at population level. It is perhaps important to note that further podiatry led studies have been generated and feasibility studies have been published since 2014. One example, a podiatry led study to enable the identification and treatment of people with peripheral arterial disease presents a strong case for trialling techniques in health promotion within health care [26]. This suggests that further large -scale trials may be forthcoming.

In the case of PT and OT led interventions, the selected studies range

across the lifespan including adults and older adults with a range of functional needs. The study deemed to demonstrate the best practice in relation to healthcare public health is a treatment for frozen shoulder delivered as a group and home based intervention [27]and three other studies also demonstrate the effective management of musculoskeletal conditions that are known to be severely life limiting in relation to pain and functional deterioration [28–30]. These interventions; graded exercise programmes for people with rheumatoid arthritis [2 and an occupational therapy led intervention for severe hand pain and functional maintenance caused by osteoarthritis [30] and finally the podiatry advice [25] associated with falls prevention; are all examples of the compelling need to engage patients in non-pharmacological treatments for musculoskeletal management that is well recognised in relation to the growing prevalence of musculoskeletal disability [31].

Clare et al. (2017) is an occupational therapy led intervention of goal orientated cognitive rehabilitation for people with a diagnosis of Alzheimer's disease [32]. The study demonstrates qualitative improvements; improved adjustment to living with dementia-resulting in less anxiety, better coping skills and improved well-being and quality of life (QOL). These findings measure the effectiveness of continuing rehabilitation that is valued highly by those families and communities living with dementia because of the focus on management of behavioural and psychological symptoms [33].

Other studies reflect interventions - packages of care delivered or led by orthotics and physiotherapy practitioners [34] to maintain and enhance mobility and functional walking; and an occupational therapy intervention [35] working in multi-disciplinary groups within stroke rehabilitation. These studies demonstrate the effectiveness of post-acute community and care home based care that may be considered secondary prevention because the aim is to maintain and improve functional independence and activities of daily living for individuals within a specific population of need. In these studies the "patient" is asked to engage for a set period or number of sessions, with an individualized programme with activation and advice with the goal of improvement in quality of life [36] as a primary objective. It is important to note that the serious and intended consequence of functional wellbeing and improved quality of life is to reduce cost of healthcare and this is no more evident than in vocational rehabilitation that can be evaluated as a cost effective mechanism of retaining a person in work [29]. Interventions may be even more cost effective if AHP have further research to show how they are able to lead health promotion within their professional activities.

This research uniquely reflects some limitations on opportunities for AHP in relation to research capacity and importantly suggests how a more standardised method of undertaking AHP research could result in better public health evidence for interventions and their effectiveness at population level. The review suggests a need to introduce a determined effort to focus on interventions where it might be possible to demonstration efficacy and effectiveness with robust methods, rather than perpetuating a multiplicity of smaller studies that don't meet the standards required to commission and fund services. The PHE Standard Evaluation Framework for Weight Management Services is an example of one such standardised method which has been used successfully to standardise and improve services [37]. There are several important criteria that need to be included in the planning and preparation of study design. These include; a clearly defined population that can be recognised and reproduced in different locations; for example, people with type two diabetes, community dwelling and aged between 50 and 60 years. The number of people in the total population can be difficult to define and it is important for a researcher to define the parameters of the study population with partners such as the NHS Clinical Commissioning Groups or Public Health Departments. Many studies also compared a novel health care intervention with 'usual care' but usual care was not well defined, for example a dietetic intervention for obese adolescence were randomised to the 'go for it treatment'; a multi-disciplinary care versus regular dietetic involvement [38].

The opportunity to reproduce the findings or to compare finding with another setting is limited. Some studies were not adequately powered and having screened out the feasibility studies it became clear that there were a very limited number of large RCTs. This may be due to the ability of AHPs to access large research grants. Finally, the use of standardised and universal outcome measures were not consistently used, leading to difficulties comparing the effect of interventions and in making any clear judgement about the health economics. The reality for AHP services is that they need to be able to assure patients that the treatment is effective and commissioners that the service is well targeted to the population and cost effective.

5. Limitations

This rapid mixed methods review follows up and extends previous understanding of AHP contribution to public health with a view to identification of impact at population level. Whilst there is an increase in the public health contribution from some professions and specialities, not all professional groups were equally represented in the review. Professional commitment to research and reporting population health outcomes is more developed in some AHPs.

The exclusion of international studies was based on the core purpose of the review which was to assess the impact of the AHP Public Health Framework. Whilst there is some benefit in identifying and learning from AHP practice associated with public health outcomes across the world, the increased variation in practice would be difficult to compare to UK Practice.

Grey literature was not sought due to time and resource limitations but grey literature may have identified further examples of AHP good practice in UK. The exclusion of feasibility studies and conference abstracts was due to a lack of detailed data reporting. Finally the review did not include a validated, separate critical appraisal instrument but the data extraction and nominal group method included aspects of critical appraisal.

The study included primary literature where the research was led by an AHP discipline and this therefore excluded studies of multi-agency interventions.

6. Conclusion

This study was undertaken to contribute to the impact assessment of the AHP Public Health Strategy (2015–2018) [5]in the UK. It replicates and updates the publication of the previous review [4] and similarly identifies a range of evidence-based interventions undertaken by AHP. The review uses 11 studies that demonstrate how AHPs make a significant contribution to the healthcare public health and health improvement domains of public health, enabling population health outcomes in two large population groups, those with musculoskeletal and orthopaedic conditions (i.e RA) and those with neurological conditions including Alzheimer's disease and Stokes. In all cases the focus on improved quality of life through the alleviation of painful symptoms or the prevention of deterioration and disability is evident. The selected interventions in this study were ledby a particular professional discipline for the purpose of assessing policy impact but many other examples of AHP practices are delivered through interdisciplinary and inter-agency teams.

In contrast to the previous review [4] no interventions that could be categorised as addressing wider/social determinants of health and wellbeing or health protection. It is probable that AHPs are contributing to these domains of public health in the UK but the outcomes are not formally reported in peer reviewed publications. For example, review team were aware of the contribution of radiographers to national screening programmes and radiation protection, although this was not evident in the literature and perhaps further research and evaluation is required in this as well as other areas. The recent AHP public health strategic framework [8] has one of five goals attributed to supporting AHP to demonstrate their contribution to improved population level health outcomes through robust evaluation and research and a number of

work streams are in progress to further enable this.

The 2019–2024 public health strategy is overseen by the UK AHP Public Health Strategy Board and an annual report is produced to capture key activity for each of the four nations and the individual professional bodies. In order to support increased AHP Public health research, the strategy board are also conducted a modified Delphi study to identify the UK AHP Public Health research priorities, the aim of this work is to present the research priorities that are identified collectively across the AHP

Disciplines with a view to applying for research funding to support larger scale research projects.

This paper provides a unique insight into the contribution of the AHP workforce to public health, demonstrating areas where individuals and populations can benefit from programmes and packages of care that reduce multiple morbidity and functional limitations of long-term conditions. In some cases, studies demonstrate how health outcomes are achieved within targeted populations. The review suggests that the strategic development of research and practice would benefit from a targeted approach to measuring outcomes of AHP interventions perhaps in some cases as uni-professional activity but more likely to be part of a multi-disciplinary or multi-agency approaches to health improvement and health care.

Author contributions

Authors SFD and HH designed the study that was commissioned by author LH who is AHP lead at Public Health England. The search strategy was compiled by DH and undertaken by staff within Public Health England the first draft of the paper was compiled by SFD, LN, LF All authors collaborated on the review by virtue of their professional knowledge and contributed to screening and critical appraisal of the literature and to the amendment and final draft of the article.

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Ethical approval

Ethical approval was neither required nor sought.

CRediT authorship contribution statement

S. Fowler Davis: Conceptualization, Writing - original draft, preparation, Methodology. **L. Farndon:** Writing - original draft. **D. Harrop:** Methodology, Data curation. **L. Nield:** Writing - original draft. **J. Manson:** Investigation, Writing - review & editing. **J. Lawrence:** Investigation, Writing - review & editing. **S. Tang:** Investigation, Writing - review & editing. **Sue Pownall:** Investigation, Writing - review & editing. **Jennifer Elliott:** Investigation, Writing - review & editing. **Laura Charlesworth:** Investigation, Writing - review & editing. **L. Hindle:** Conceptualization, Writing - original draft, preparation, Methodology.

Declaration of competing interest

There are no known conflict of interests.

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Appendix 1

Search Strategy

Explanation of search terms used: ti = title field; ab = abstract field; af = author affiliation; / = thesaurus term (MeSH); asterisk (*) denotes any character; "" = phrase search; N3 = adjacency within 3 words.

1. "allied health profession*".ti,ab.
2. ahp*.ti,ab.
3. "art therapist*".ti,ab.
4. "music therapist*.ti,ab.
5. dramatherapist*.ti,ab.
6. "drama therapist*".ti,ab.
7. chiropodist*.ti,ab.
8. podiatrist*.ti,ab.
9. dietitian*.ti.ab.
10. dietician*.ti,ab.
11. "occupational therapist*".ti,ab.
12. orthoptist*.ti,ab.
13. paramedic*.ti,ab.
14. physiotherapist*.ti,ab.
15. prosthetist*.ti,ab.
16. orthotist*.ti,ab.
17. radiographer*.ti,ab.
18. "speech and language therapist*".ti,ab.
19. "speech therapist*".ti,ab.
20. "language therapist*".ti,ab.
21. allied health personnel/
22. allied health occupations/
23. nutritionists/
24. physical therapists/
25. **or/1–24**
26. "mental health".ti,ab.
27. "mental wellbeing".ti,ab.
28. "mental well-being".ti,ab.
29. "mental wellness".ti,ab.
30. "mental illness".ti,ab.
31. "mentally ill".ti,ab.
32. "psychological wellbeing".ti,ab.
33. "psychological well-being".ti,ab.
34. "psychological ill-health".ti,ab.
35. "psychological health".ti,ab.
36. mental health/
37. obes*.ti,ab.
38. overweight.ti,ab.
39. BMI.ti,ab.
40. "body mass index".ti,ab.
41. waist* N3 hip* N3 ratio*.ti,ab.
42. bodyweight.ti,ab.
43. "body weight".ti,ab.
44. obesity/
45. obesity, morbid/
46. oveweight/
47. waist-hip-ratio/
48. body mass index/
49. body weight/
50. physical* N3 activ*.ti,ab.
51. exercis*.ti,ab.
52. physical* N3 fit*.ti,ab.
53. motor activity/
54. exercise/
55. physical fitness/
56. child*.ti,ab.
57. "young person*".ti,ab.

58. “young people".ti,ab.
59. “young adult*".ti,ab.
60. infant*.ti,ab.
61. adolescen*.ti,ab.
62. teenage*.ti,ab.
63. child/
64. infant/
65. adolescent/
66. elder*.ti,ab.
67. older.ti,ab.
68. aged.ti,ab.
69. geriatric*.ti,ab.
70. ageing.ti,ab.
71. aging.ti,ab.
72. “senior citizen*".ti,ab.
73. pensioner*.ti,ab.
74. retire*.ti,ab.
75. frail elderly/
76. geriatrics/
77. aged/
78. aged, 80 and over/
79. aging/
80. retirement/
81. dementia.ti,ab.
82. alzheimer*.ti,ab.
83. dementia/
84. alzheimer disease/
85. drug*.ti,ab.
86. narcotic*.ti.ab.
87. alcohol*.ti,ab.
88. “substance abuse*".ti,ab.
89. street drugs/
90. designer drugs/
91. alcohol drinking/
92. alcohol-related disorders/
93. substance-related disorders/
94. health N3 inequalit*.ti,ab.
95. health N3 inequit*.ti,ab.
96. “healthcare public health".ti,ab.
97. commission*.ti,ab.
98. **or/26–97**
99. “pain management".ti,ab.
100. “pain relief".ti,ab.
101. “pain control".ti,ab.
102. “pain reduction".ti,ab.
103. work.ti,ab.
104. workplace.ti,ab.
105. worksite.ti,ab.
106. employ*.ti,ab.
107. wellbeing.ti,ab.
108. well-being.ti,ab.
109. health.ti,ab.
110. stress.ti,ab.
111. wellness.ti,ab.
112. workplace/
113. or/103-106
114. or/107-112
115. 113 AND 114
116. cost.ti,ab.
117. costs.ti,ab.
118. costing*.ti,ab.
119. economic.ti,ab.
120. finance*.ti,ab.
121. financial.ti,ab.
122. fiscal.ti,ab.
123. expenditure*.ti,ab.
124. expense*.ti,ab.
125. budget*.ti,ab.
126. spend*.ti,ab.
127. cost savings/
128. financial support/
129. financial management, hospital/
130. economics/
131. models, economic/
132. economics, hospital/
133. health expenditures/
134. lumbar.ti,ab.
135. lumbo*.ti,ab.
136. spine.ti,ab.
137. spinal.ti,ab.
138. cervical.ti,ab.
139. flank.ti,ab.
140. buttock*.ti,ab.
141. knee*.ti,ab.
142. hip.ti,ab.
143. shoulder.ti,ab.
144. neck.ti,ab.
145. back.ti,ab.
146. wrist.ti,ab.
147. arm.ti,ab.
148. “upper limb*".ti,ab.
149. “upper extremit*".ti,ab.
150. elbow*.ti,ab.
151. forearm*.ti,ab.
152. finger*.ti,ab.
153. hand*.ti,ab.
154. muscul*.ti,ab.
155. joint*.ti,ab.
156. radicular.ti,ab.
157. ligament*.ti,ab.
158. tendon*.ti,ab.
159. or/134-158
160. pain*.ti,ab.
161. 159 N3 160
162. “musculoskeletal disease*".ti,ab.
163. osteoarthritis.ti,ab.
164. spondylitis.ti,ab.
165. spondylosis.ti,ab.
166. osteitis.ti,ab.
167. osteochondritis.ti,ab.
168. arthropathy.ti,ab.
169. bursitis.ti,ab.
170. “shoulder impingement*".ti,ab.
171. myalgia.ti,ab.
172. lordosis.ti,ab.
173. lumbago.ti,ab.
174. sciatica.ti,ab.
175. cervicogenic.ti,ab.
176. “adverse neural tension*".ti,ab.
177. dyskinesis.ti,ab.
178. tendinitis.ti,ab.
179. tendonopathy.ti,ab.
180. hyperalgesia.ti,ab.
181. sacroiliac.ti,ab.
182. subluxation.ti,ab.
183. allodynia.ti,ab.
184. osteopathic lesion*.ti,ab.
185. “frozen shoulder*".ti,ab.
186. “degenerative joint disease*".ti,ab.
187. neck pain/
188. shoulder pain/
189. hand injuries/

190. wrist injuries/
191. musculoskeletal diseases/
192. spondylitis/
193. osteitis/
194. osteochondritis/
195. arthropathy, neurogenic/
196. bursitis/
197. shoulder impingement syndrome/
198. myalgia/
199. lordosis/
200. low back pain/
201. sciatica/
202. flank pain/
203. tendinopathy/
204. hyperalgesia/
205. sacroiliac joint/
206. joint dislocations/
207. bone malalignment/
208. musculoskeletal pain/
209. arthralgia/
210. back pain/
211. neck pain/
212. neuralgia/
213. shoulder pain/
214. osteoarthritis/
215. joint diseases/
216. horticult*.ti,ab.
217. trees.ti,ab.
218. plant*.ti,ab.
219. flowers.ti,ab.
220. biophilia.ti,ab.
221. outdoor*.ti,ab.
222. green N3 space*.ti,ab.
223. garden*.ti,ab.
224. “natural environment*".ti,ab.
225. “natural world".ti,ab.
226. “natural landscape".ti,ab.
227. wildlife.ti,ab.
228. outside.ti,ab.
229. backyard*.ti,ab.
230. “back yard*".ti,ab.
231. courtyard.ti,ab.
232. yard*.ti,ab.
233. patio*.ti,ab.
234. allotment*.ti,ab.
235. trees/
236. plants/
237. gardens/
238. nature/
239. **or/99–102, 115, 116–133, 161, 162–238**
240. “northern ireland".af.
241. scotland.af.
242. wales.af.
243. britain.af.
244. uk.af.
245. united kingdom.af.
246. or/240-245
247. “new england".af.
248. “new south wales".af.
249. or/247-248
250. **246 not 249**
251. **a profession or group of professions as described in lines 1–24 and 98 and 250 (01/12/2014–31/07/2018)**
252. **a profession or group of professions as described in lines 1–24 and 239 and 250 (01/01/2010–31/07/2018)**
253. **or/251–252**

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