IN-DEPTH REVIEW

Developing occupational health services for active age management

H. J. McDermott, A. Kazi, F. Munir and C. Haslam

Work and Health Research Centre, School of Sport, Exercise and Health Sciences, Loughborough University, Loughborough, Leicestershire LE11 3TU, UK.

Correspondence to: C. Haslam, Work and Health Research Centre, School of Sport, Exercise and Health Sciences, Loughborough University, Loughborough, Leicestershire LE11 3TU, UK. Tel: +44 (0)1509 223940; e-mail: c.o.haslam@lboro.ac.uk

Aims
To review current occupational health (OH) approaches aimed at maintaining the health and workability of older workers.

Methods
A literature review was undertaken to identify articles on OH interventions focused on maintaining the health of older workers (published since 2000). The inclusion criteria included studies that reported interventions aimed specifically at older workers.

Results
A limited number of interventions targeting older workers were identified. A second literature search was therefore conducted that identified types of workplace interventions that, if used with older workers, may benefit their health, well-being and workability.

Conclusions
Very few OH interventions have addressed the health and workability of older workers and there is considerable scope for developing OH provision, which accounts for the needs of the older workforce.

Key words
Interventions; occupational health; older worker; workability.

Introduction

In the UK, as elsewhere in Europe, there are now twice as many workers aged ≥50 than those aged ≤25 years [1]. Against a background of continued policy emphasis on the need to raise European Union employment rates among older workers [2], this trend looks set to continue well into the present century. The increasing age of the workforce presents new challenges for government, employers, occupational health (OH) services, individual employees and their families.

The ageing workforce creates a demand for research to support evidence-based policy and practice, which promotes the productivity, workability and quality of life of older workers and the economic competitiveness of the UK. New policies are needed to achieve the change in culture necessary to encourage and enable people to work longer [3]. Improved older worker integration and enhanced employment outcomes among older workers will be key means through which economies can adjust to the pressures of population ageing [4].

There is a growing recognition of the important role of OH services in promoting the health of workers across the life course [5–8]. OH initiatives are needed to address the challenges of an ageing workforce, including the prevention of work-related diseases, the reductions in work performance due to chronic diseases and the promotion of health and workability [7]. OH services are likely to play a key role in ‘healthy ageing management’ in the workplace.

Effective OH provision needs to be evidence based to promote the health and productivity of the workforce. Decreasing physical abilities and an increased susceptibility to acute and chronic diseases among older employees suggest that worksite health promotion initiatives may be particularly beneficial in terms of improving the health of older employees [5].

This paper reviews current OH approaches to maintaining and promoting health among older workers and presents an evaluation of these approaches to suggest directions for future intervention development.

Methods

A literature review was undertaken to identify published papers on OH interventions aimed at maintaining the health and workability of older workers, published since 2000. The inclusion criteria included studies that reported interventions aimed specifically at older workers.
The databases searched were Web of Science, PsycInfo, PubMed and Ergonomic Abstracts. Databases were searched combining the terms ‘older worker’ and ‘ageing worker’ and ‘aging worker’ with ‘occupational health’ and ‘intervention’ with the following keywords ‘exercise’, ‘physical activity’, ‘smoking’, ‘dietary’, ‘workability’, ‘disability’, ‘musculoskeletal pain’, ‘arthritis’, ‘heart disease’ and ‘diabetes’. The search strategy also involved examining the reference lists of the relevant articles found to check for further studies. The literature search resulted in six articles in total published between 2004 and 2007 that met our inclusion criteria, five were primary interventions and one was secondary (see Table 1).

Due to the limited number of interventions specifically targeting older workers, a second literature search was conducted to identify workplace interventions that, if used with older workers, may benefit their health, well-being and workability. The search criteria were identical to the first search, omitting the terms ‘older’, ‘ageing’ and ‘aging’. The second literature search resulted in a further 15 articles that were selected as representing interventions, which may benefit older workers. All 21 papers were independently reviewed by three members of the research team.

Results

Interventions for older workers

Six papers reporting interventions aimed at improving the health and well-being of older workers were identified and are presented in Table 1. Five studies constituted primary interventions and one study [13] involved a secondary intervention. One focused solely on employees aged >40 years [9], one on workers aged >45 years [12] and one on workers aged >50 years [13]. The remaining three interventions included workers of all ages but these studies investigated age-related issues and reported age-related findings [10,11,14].

Three of these interventions were aimed at improving the physical work environment through ergonomic/environmental interventions [9–11]. Cirla et al. [9] evaluated an ergomotricity training programme for employees aged >40 years at risk of postural discomfort due to sedentary office work. Training in anatomy, physiology and posture was provided to two groups of participants, the delivery of which varied between the groups. At 3 months follow-up, participants from both groups reported improvement with greatest improvement being reported where the training was delivered over consecutive days.

Andersson-Felé [10] targeted an intervention to improve physical, psychological and social working conditions for older health care workers. From their results at follow-up, they were unable to reliably conclude that the physical changes had an impact on staff workload or job satisfaction; however, participants did report a perceived increase in motivation and job satisfaction. Improvements were also found in psychosocial outcomes, e.g. reduced work stress.

May et al. [11] tested the effects of workstation improvements for clerical workers using computers for >4 h/day. They found that workstation improvements had a significant effect on employees’ perceptions of the ergonomic characteristics and qualities of the workstations, particularly for younger workers. Participants receiving changes to their workstations reported a significant decrease in upper back pain; however, no significant effect was found on the levels of persistent bodily pain or eye strain.

An age management intervention was aimed at improving the values and attitudes of line managers towards managing older workers aged ≥45 [12]. Although the authors report an improvement in the knowledge and role of line managers, the effect of this on older workers was not measured.

One paper reports an intervention to improve sleep, health and well-being by changing shift workers’ shift rotating system to minimize the perceived effects of changes in sleep patterns [14]. The change in shift system was associated with improved perception of the effects on sleep, health and well-being at work and free time activities. Age did not have a significant main effect and a greater improvement of general health was found among the young age group (24–44 years).

de Boer et al. [13] evaluated the effect of an OH intervention where older workers (aged ≥ 50) were screened by OH physicians to identify those at risk of early retirement. Those identified at risk were randomized into a control or intervention group. The intervention involved consultations and action plans to improve physical and mental workability. They found that fewer employees in the intervention group retired early than in the control group; however, at 2 years follow-up, no differences were found between the groups.

Interventions that may benefit the older worker

Primary interventions

Nine primary workplace health interventions addressing a variety of health issues relevant to older workers were identified and are reviewed in Table 2. These interventions aimed to improve health, lifestyle and workability [15,17], increase physical activity [19,20,22,23] and prevent the onset of chronic disease [16,18,21]. Such outcomes represent obvious benefit for older workers.

Positive effects of a workplace physical exercise intervention were reported in four papers. White and Ransdell [22] combined behaviour–change strategies with supervised physical activity sessions and found a significant increase in the amount of physical activity performed by participants following a 12 weeks intervention. However,
### Table 1. Interventions for the older worker

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<thead>
<tr>
<th>Author</th>
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<th>Study design</th>
<th>Intervention</th>
<th>Outcome measure</th>
<th>Results</th>
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<tbody>
<tr>
<td>Cirla et al. [9] (Italy)</td>
<td>56 employees from two organizations (males and females) aged &gt;40 years who were assessed as being ‘at risk’ for postural discomfort due to sedentary work.</td>
<td>Intervention. Within subjects design.</td>
<td>Participants received the same training in anatomy and physiology of posture and simple exercises (ergomotricity) to oppose posture adopted by sedentary office workers. Group one received 1 h of training in three subsequent afternoons. Group two received 3 h of training in one afternoon.</td>
<td>Participants were assessed by self-report questionnaire immediately pre-training and 3 months post-training.</td>
<td>At 3 months post-training, 21 participants reported an improvement following the intervention. Those who received training for 1 h over 3 days reported greater improvement. The greatest effect of the training was found for neck complaints. Authors were unable to conclude that the work environment intervention had an impact on staff workload and job satisfaction; however, at all participating workplaces, staff reported a perceived increase in motivation and increased job satisfaction. It was not possible to see any reduction in HR costs or changes in working time or sick leave.</td>
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<td>Andersson-Felé [10] (Sweden)</td>
<td>Health care staff, 39 participants from the rehabilitation ward, 28 from the gynaecological ward and 14 from the medical outpatient ward. No details on participants age.</td>
<td>Work environment intervention. Within subjects design.</td>
<td>Employees received training about life course, work and workability. Changes in the development of routines and organization of work were also encouraged during training. Participating wards were allocated a grant to make changes.</td>
<td>Participants were assessed by a work environment questionnaire pre- and post-intervention (1 year). Environmental changes were also assessed. Organizational data on time management and costs for HR were analysed.</td>
<td>Workstation improvements had a significant effect on employees’ perceptions of their ergonomic characteristics. Employees who experienced a redesign perceived a greater increase in the ergonomic qualities of their workstations. Workstation changes had no significant effect on the level of persistent bodily pain but those employees receiving improvements experienced a significant decrease in upper back pain. Workstation improvements had no significant effect on the levels of eye strain. Among those experiencing an improvement, the perceptions of workstation ergonomic qualities increased more for younger than older employees.</td>
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<tr>
<td>May et al. [11] (USA)</td>
<td>87 clerical employees (age range 21–61 years) with varying administrative responsibilities who used their computers for ≥4 h/day. Participants were assigned to an intervention group (n = 61) or a control group (n = 26).</td>
<td>Quasi-experimental longitudinal field intervention (non-randomized). Between subjects design.</td>
<td>An office ergonomics intervention. All participants received training in ergonomics and undertook a self-assessment of computer workstations. Those reporting some form of physical enhancement were assigned to the treatment group where the effects of the changes were monitored.</td>
<td>Participants were assessed by self-report questionnaire 4 months pre- and post-intervention.</td>
<td>Workstation improvements had a significant effect on employees’ perceptions of their ergonomic characteristics. Employees who experienced a redesign perceived a greater increase in the ergonomic qualities of their workstations. Workstation changes had no significant effect on the level of persistent bodily pain but those employees receiving improvements experienced a significant decrease in upper back pain. Workstation improvements had no significant effect on the levels of eye strain. Among those experiencing an improvement, the perceptions of workstation ergonomic qualities increased more for younger than older employees.</td>
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<td>Skoglund and Skoglund [12] (Sweden)</td>
<td>Systematic Age Management Programme administered &gt;1 year in the public sector.</td>
<td>12 month Age Management Programme consisting of the following components: interview study exploring the values and attitudes of managers and employees. One day seminar for senior managers, political leaders and labour unions on the theme Evidence-Based Management in the Perspective of an Ageing Workforce. Two days seminars for middle managers: Age Management in Theory and Practice. Open lectures of inspiration (3 h) for all employees. Professional support and mentorship for middle managers.</td>
<td>A freestanding scientific qualitative evaluation (no further details provided).</td>
<td>Participating managers gained information useful to their role and were using this information in practice. The managers received skills that would assist them to identify the needs and qualifications of older workers. Managers found that the age management principles could be applied to all employees regardless of age. A main obstacle to successful age management is described as attitudes based on a lack of knowledge.</td>
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<td>de Boer et al. [13] (Holland)</td>
<td>OH intervention. Between subjects design.</td>
<td>OH intervention programme comprised at least three consultations including an assessment interview. The procedure included the construction of a detailed action plan, consultation with the employee’s supervisors and personnel managers, and, if appropriate, referral to general practitioner, a medical specialist or psychologist.</td>
<td>Questionnaire data obtained at baseline, after 6 months and after 2 years.</td>
<td>Fewer employees (11%) in the intervention group retired early than in the control group (28%). The total average number of sick leave days in 2 years was 82.3 for the intervention group and 107.8 for the control group. Six months after baseline, employees in the intervention group had better workability, less burn out and better quality of life than employees in the control group. Two years after randomization, no differences between the two groups were found.</td>
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<td>Härmä et al. [14] (Finland)</td>
<td>Non-randomized controlled intervention. Repeated measures design, only partially matched.</td>
<td>Intervention to examine the effects of a rapidly forward rotating shift system on sleep, health and well-being.</td>
<td>Questionnaire assessing subjective sleep problems. Field measurements including actigraph data, Psychomotor Vigilance Task, sleep and social life diaries. Measures taken 1.5 years before and 6 months after installation of new system.</td>
<td>The change in shift system was associated with improved perception of the effects on sleep, health, well-being at work and free time activities. This change was dependent on age as demonstrated by a significant three-way interaction between the group, time and age. The improvement of general health was greater for the younger group. Perceived improvements of sleep and vigilance, general well-being at work, social life, family life and hobbies were more prominent among the older age group. Age did not have a significant main effect.</td>
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Table 2. Primary interventions that could benefit the older worker

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<tr>
<td>Costa et al. [15] (Italy)</td>
<td>867 health care workers (337 males and 530 females) aged between 23 and 65 years.</td>
<td>Within subjects design</td>
<td>Periodical health surveillance was undertaken on a sample group of employees to evaluate functional working capacity.</td>
<td>WAI questionnaire and general medical examination including routine blood and urine analysis. No follow-up.</td>
<td>Women showed significantly lower mean WAI than men in all age groups, particularly among registered nurses. Both men and women shift workers showed a more pronounced decrease of WAI over the years as compared to their colleague day workers. By increasing the number of illnesses suffered, WAI similarly decreased in all age groups.</td>
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<td>Armitage [16] (UK)</td>
<td>41 females and 49 males (smokers aged between 18 and 85 years of age).</td>
<td>Workplace intervention.</td>
<td>Experimental participants were asked (by standard written instructions) to form an ‘implementation intention’ of how they plan to quit smoking during the next 2 months.</td>
<td>Variables derived from Ajzen’s (1991) Theory of Planned Behaviour were used to measure motivation at baseline and follow-up at 2 months. Questionnaires assessing motivation to quit smoking, perceived control, temptations and behaviour were distributed to participants at baseline and 2 months follow-up.</td>
<td>Significantly more people quit smoking in the experimental condition than the control condition. Implementation intentions considerably changed smoking behaviours. The effect was even more significant if individuals wanted to quit at baseline.</td>
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<td>Williams et al. [17] (USA)</td>
<td>31 hotels employing 11 559 persons on the island of Oahu, Hawaii. Hotels were matched on workforce size, luxury status and union status. They were assigned to a minimal (Level 1) or intensive (Level 2) intervention. (4536 participants completed questionnaires, BMI and waist measurements).</td>
<td>Randomized clinical trial.</td>
<td>Work, Weight and Wellness (3W) study—a multi-component weight loss and obesity prevention program. Level 1: BMI and waist measures, questionnaire, raising participants awareness of weight, health habits and lifestyle and work environment. Level 2: as level 1 plus environmental interventions, a 2 years on-site weight management group, off-site group for obese employees and various environmental initiative (insufficient details reported).</td>
<td>Primary outcome was change in BMI over the course of the 2 year intervention. Questionnaire covering occupation, health habits, health care use, weight-related diagnosis and symptoms, attitudes towards the workplace and demographic variables. A subset of participants also completed a questionnaire covering health impact on work performance, social support for change in health habits, stage of change with respect to health habits, decision making style, absenteeism and perceived job performance.</td>
<td>Description of intervention aims and design only. No post-intervention results reported.</td>
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### Table 2. (Continued)

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<tr>
<td>Abood et al.</td>
<td>38 University employees formed the intervention group. 25 control subjects.</td>
<td>Worksite nutrition education intervention. Between groups design.</td>
<td>The tailored intervention used the Health Belief Model (HBM) as a theoretical framework to increase nutrition knowledge and improve dietary intake via instruction from dietician and dietary exercises. The treatment group participated in eight 1 h weekly educational sessions to promote knowledge and beliefs conducive to improving or maintaining positive dietary practices for prevention of CVD and cancer. Constructs from the HBM were integrated into each session.</td>
<td>A baseline/post-test questionnaire was used that assessed HBM constructs (health concerns, perceived susceptibility/severity/benefits/barriers and self-efficacy), risk assessment for CVD and cancer, nutrition knowledge, dietary behaviours. Post-test measures taken at 8 weeks.</td>
<td>Perceived benefits of healthy nutrition practices and nutrition knowledge related to cardiovascular disease and cancer significantly improved among the treatment group. Following the intervention energy intake decreased by ~840 kcal/day, total fat intake decreased by 45 g/day and saturated fat and cholesterol dropped by 18 mg/day and 158 mg/day, respectively, among treatment group.</td>
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<td>Pohjonen Ranta</td>
<td>87 female home care workers divided into an intervention group (n = 50) and a control group (n = 37). High levels of attrition (54%) during the 5 years follow-up period.</td>
<td>Workplace intervention and surveillance programme. Between groups design.</td>
<td>Supervised physical exercise for 1 h twice a week during a 9 months period. Exercise concentrated on aerobic exercise and muscular fitness. Individual feedback provided to participants by physiotherapist. Lectures also provided that focused on leisure time physical activity. The control groups were asked to maintain their habitual exercise levels and were not given instructions for training.</td>
<td>Objective measures of muscular endurance, strength, flexibility and aerobic fitness. Anthropometric measurements and VO_2max. Perceived health status, workability and leisure time activity were assessed with a questionnaire. Follow-up measures at 1 year and 5 years post-intervention.</td>
<td>At 1 year follow-up, participants in the intervention group showed −4% decrease in body fat and −1% decrease in body weight. Dynamic muscle performance/endurance and maximal oxygen consumption had also increased. Those who dropped out after 1 year follow-up perceived their health status as poorer. At 5 years follow-up, the differences between controls and intervention were still consistent. In the control group, the decline of workability was three times faster.</td>
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no control group was used in their study and the increase in the amount of physical activity observed may not have been due to the intervention alone. Atlantis et al. [23] reported significant between-group differences following a randomized controlled trial involving physical activity and a behaviour modification programme. Despite high attrition rates, the positive effects were explained by both the volume of exercise completed during the intervention and the additional behaviour change components. Pohjonen and Ranta [20] implemented an intervention consisting of supervised exercises during the workday. The 1 year follow-up results suggest

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<td>Graham et al. [21] (USA)</td>
<td>1776 participants from a large geographically dispersed (46 states) employee population (65% male). 482 surveyed at follow-up (31.7%).</td>
<td>Internet-based smoking cessation programme.</td>
<td>Financial incentive for participation in an Internet-based smoking cessation programme—QuitNet.</td>
<td>Self-reported 7 days point prevalence abstinence at 12 months and QuitNet database.</td>
<td>There was significant variability in Website utilization patterns with higher Website utilization being associated with better cessation outcomes, even after controlling for baseline motivation. Quit rates ranged from 13% using intention-to-treat analysis (responders counted as smokers) to 43% (responder-only analysis) at 12 months post-registration.</td>
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<td>White and Ransdell [22] (USA)</td>
<td>30 female sedentary faculty staff. Mean age only reported (43.4) High levels of attrition.</td>
<td>Worksite intervention. No control group.</td>
<td>12 weeks intervention combining intervention sessions twice a week. Behaviour change strategies were combined with various physical activities.</td>
<td>Demographic and health history questionnaire. Physical self-perception profile questionnaire. Exercise Benefits and Barriers Scale. Physiological measures including blood pressure, body fat, muscular endurance and flexibility. Predicted VO2max values. Outcome measures taken at 12 weeks</td>
<td>There was a significant increase in the amount of physical activity performed at the end of the intervention compared to before the intervention. Participants showed an increase in muscular endurance, flexibility and predicted VO2max values. A decrease in the number of barriers to physical activity was also reported. Changes in perceived physical competence and body attractiveness were not significant.</td>
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<td>Atlantis et al. [23] (Australia)</td>
<td>73 healthy but sedentary casino staff (37 females, 36 males). Randomized to either treatment group (24 weeks) or wait-list control (24 weeks control, 24 weeks treatment). 44 participants completed 24 weeks intervention. High levels of attrition.</td>
<td>Randomized controlled trial. Between subjects design.</td>
<td>Treatment group prescribed 20 min of moderate-to-high intensity aerobic exercise at least 3 days/week. Treatment groups were also prescribed moderate-to-high intensity whole-body weight training exercise. A behaviour modification programme was additionally delivered via group seminars, one-to-one counselling and through the provision of a worksite manual. The waitlist control group received neither the exercise intervention nor education nor discouragement from increasing current activity levels.</td>
<td>Waist circumference measures. 7 days dietary recall questionnaire. Relative VO2max values. Outcome measures taken at 24 weeks.</td>
<td>Significant between-group differences were found in the mean waist circumference favouring the intervention. Both gender and age were related to predicted VO2max values at 24 weeks. There were no significant differences in changes in median body mass or BMI. Much of the observed effects were explained by the volume of aerobic and weight training exercise completed over 24 weeks. A smaller proportion of the effects were caused by behavioural components.</td>
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CVD, cardiovascular disease; OH, occupational health.
improvements in dynamic muscle performance and endurance and a decrease in body fat and body weight. At 5 years follow-up, the differences between controls and intervention group were still consistent. A further study measured stair use among a group of employees before and after the 4 month intervention period [19]. While an increase in stair use was observed during the intervention period, baseline measures identified a potential influence of structural and environmental factors on this behaviour.

Interventions to reduce risk factors for chronic disease were also identified. Armitage [16], for example, conducted a randomized controlled trial to address smoking behaviour and reported significant positive results following a behaviour change programme implemented for smokers. Graham et al. [21] used a web-based tool to address smoking behaviour among a large sample of employees from geographically diverse worksites and reported positive quit rates post-intervention.

Abdoor et al. [18] conducted a worksite intervention to modify health beliefs among employees at a university campus worksite. This tailored intervention used the Health Belief Model to increase nutritional knowledge and improve dietary intake. The benefits of healthy nutrition practices and knowledge in relation to cardiovascular disease and cancer significantly improved among the treatment participants after 8 weeks. However, no longer term follow-up was conducted and therefore the long-term effects remain unknown.

Williams et al. [17] described a worksite obesity prevention and intervention trial where the primary outcome was change in body mass index (BMI) over a 2 year period. Their intervention comprised a multi-component programme and while baseline data are fully reported, no outcome data are presented. It is therefore not possible to evaluate the effectiveness of this intervention.

Costa et al. [15] implemented a health surveillance programme involving periodic health surveillance on a sample of employees to evaluate functional working capacity in order to plan preventative measures. Utilizing the Workability Index (WAI), they identified that women showed significantly lower mean WAI than men in all age groups. Both men and women shift workers showed a more pronounced decrease in WAI over the years when compared with their colleague day workers.

Secondary interventions

Three secondary interventions targeting OH issues relevant to older workers were identified and these are displayed in Table 3. Although not specifically aimed at older workers, all the secondary interventions identified included older workers within the sample. Two of these interventions were targeted at those at high risk of sickness absence or disability pensions [24,26] and the other tested a screening programme for cardiovascular risk [25]. Both the interventions addressing sickness absence or disability pensions were undertaken with participants from the construction industry. Taimela et al. [24] report on two interventions undertaken simultaneously, one with those identified as being at high risk of sickness absence and the other with those identified as being at intermediate risk of sickness absence. Action plans and, if necessary, specialist treatment was offered to the high-risk group and this proved to be effective in controlling sickness absence at 12 months follow-up. The intermediate-risk groups were invited to call a phone advice centre; however, the majority of participants in the intermediate-risk intervention did not use the telephone advice facility and its effectiveness remains unclear. de Boer et al. [26] offered an OH assessment and an individual programme aimed at improving work functioning to an intervention group. Follow-up was undertaken at 9, 18 and 26 months and the intervention was found to be effective in improving workability but not in reducing work disability pensions.

Nilsson et al. [25] undertook a randomized lifestyle intervention with participants at high risk of cardiovascular disease. Individual health checks and educational training was offered to the intervention group. A significant reduction in risk factors (BMI, diastolic blood pressure, heart rate, low density lipoprotein and cholesterol) was observed in the intervention group at 12 and 18 months follow-up.

Tertiary interventions

Three tertiary interventions were identified as a result of the search (Table 4). One evaluated a multidisciplinary rehabilitation programme for patients on long-term sick leave with respect to their workability [27] and second examined the effects of a counselling intervention programme on sick leave and return to work [28]. The third focused on the work loss due to migraine [29]. All three interventions included older workers. Vicente-Herrero et al. [29] examined the effect of counselling and medication on work loss and non-workplace impairment among those with migraine. The number of migraine-related lost working days reduced following the intervention. The intervention also reduced the total migraine productivity costs over a 7 months period post-intervention.

The other two studies focused on sick leave. Braathen et al. [27] introduced a multidisciplinary rehabilitation programme to help patients on long-term sick leave improve their functioning. Follow-up measures were taken at 4 months post-intervention but these suggest that perceived workability of the intervention group improved significantly. In addition, more people in the intervention group (80%) returned to work than in the control group (66%). Bonde et al. [28], however, found that support from a social worker to enhance goal setting, motivation
and planning for return to work did not increase the likelihood of gainful employment among patients with work-related disorders after 1 year.

**Discussion**

The increasing age of the UK workforce is an important issue that raises significant challenges for OH services in terms of promoting the health and well-being of workers across the life course [5–8]. Despite this fact, this review has highlighted that a lack of interventions currently exist, which specifically address the OH issues faced by older workers; only a small number of studies were identified (reported in Table 1), which were directly aimed at ageing workers or age-related issues.

Among those studies that did directly address age and age-related issues, we found that there was little consistency in defining an older worker. Ilmarinen suggests that policies should look at ageing workers rather than older workers, starting with those as young as 45. This would provide increased possibility for preventive measures [1]. Such an approach suggests that health interventions would benefit from a life course approach whereby risk factors for chronic disease and ill-health can be identified in early adulthood and prevention can continue throughout adult life. Indeed, the health interventions identified as a result of our second search targeted all age workers yet the health issues addressed by these interventions is known to be important among older workers. Ilmarinen [7] also suggests that OH initiatives are needed to address the challenges of an ageing workforce, which includes the prevention of work-related diseases; the reductions in work performance due to chronic diseases and the promotion of health and workability. However, the range of issues addressed by the interventions identified here was narrow. It is striking that many of the interventions identified in this review addressed health promotion and workability among workers, while none examined interventions for occupational diseases.

### Table 3. Secondary interventions that could benefit the older worker

<table>
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<tr>
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<tbody>
<tr>
<td>Taimela et al.</td>
<td>1341 construction, service and maintenance employees (88% males). Employers were classified into low (n = 386), intermediate (n = 537) and high (n = 418) risk of sickness absence based on a health survey.</td>
<td>Two randomized controlled trials. Longitudinal cohort study.</td>
<td>High-risk intervention group invited for a consultation with OH services. Action plans constructed and if appropriate, referral to specialist treatment. Intermediate-risk intervention group invited to call a phone advice centre for medical advice.</td>
<td>Sickness absence during a 12 months follow-up.</td>
<td>The intervention for the high-risk group was effective in controlling sickness absence. The intervention for the intermediate-risk group was not effective in reducing sickness absence.</td>
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<tr>
<td>Nilsson et al.</td>
<td>128 participants with a high risk of cardiovascular disease.</td>
<td>Randomized lifestyle intervention study.</td>
<td>Individual health check and physical examination by nurses. Blood samples were also taken. Intervention group additionally offered 16 group sessions a year with educational and practical content in addition to individual counselling by a nurse.</td>
<td>Screening programme at 12 and 18 months follow-up.</td>
<td>A significant reduction in BMI, diastolic blood pressure, heart rate, LDL and cholesterol was observed in the intervention group at 12 and 18 months follow-up. Smoking prevalence also decreased in this group.</td>
</tr>
<tr>
<td>de Boer et al.</td>
<td>Employees from the construction industry with a high disability risk of ≥38% in the forthcoming 4 years. Split into intervention group aged 18–64 years (n = 83) or a control group that were 40–64 years (209).</td>
<td>Intervetional study with a longitudinal follow-up.</td>
<td>OH assessment and individual programme focusing on optimizing work functioning.</td>
<td>OH examination and questionnaire at 9, 12 and 26 months follow-up.</td>
<td>The intervention was effective in improving workability but not in reducing work disability pensions. No differences in the age-adjusted percentages of employees receiving a disability pension were found between the groups at any measurement.</td>
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</table>
number of interventions focused on specific risk factors for chronic illness such as smoking [16,21], diet [18] and physical inactivity [19,22,23] all of which reported positive results. In order for work-based interventions to have a significant effect on the health and well-being of ageing workers, OH provision needs to take full

<table>
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<tr>
<th>Author</th>
<th>Participants</th>
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<th>Results</th>
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<tr>
<td>Vicente-Herrero et al.[29] (Spain)</td>
<td>446 Spanish postal service employees with migraine.</td>
<td>Pre-test and post-test workplace intervention (no control group).</td>
<td>Counselling from OH physicians and rizatriptan 10 mg for symptomatic treatment of two subsequent migraine headaches. Physicians also prescribed additional medications for migraine prophylaxis, treatment of tension headaches and rescue medications.</td>
<td>Self-reported migraine-related work loss and non-workplace impairment over a 7 months period.</td>
<td>The number of migraine-related lost working day equivalents per migraine attack were 0.48 days per migraine headache in the month before the intervention, decreasing to 0.20 days and 0.07 days per migraine headache during the first and second migraine headaches following the intervention. Total migraine productivity costs per migraine headache also decreased post-intervention.</td>
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<td>Braathen et al. [27] (Norway)</td>
<td>183 employees on long-term sick leave.</td>
<td>Multidisciplinary rehabilitation programme.</td>
<td>4 weeks intervention consisted of 6 h long sessions 5 days/week. The aim was to help patients on long-term sick leave improve their functioning so as to regain and improve their workability.</td>
<td>Outcome measures assessed in the intervention group at baseline, at the end of the programme and after 4 months. The primary outcome variables were workability and return to work.</td>
<td>Perceived workability of the intervention group improved significantly after 4 months compared with the control group. In the intervention group, 80% returned to work compared with 66% in the control group. The intervention did not increase the likelihood of gainful employment after 1 year or reduce the average number of sick days taken.</td>
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<tr>
<td>Bonde et al. [28] (Denmark)</td>
<td>184 patients at risk of long-term sick leave or job dropout.</td>
<td>Randomized controlled study.</td>
<td>After randomization to an intervention group (n = 92) and control group (n = 92), occupational physicians examined the participants in accordance with standard guidelines. The intervention group received additional support from a social worker in order to enhance goal setting, motivation and planning for return to work.</td>
<td>Postal questionnaire including SF36 and employment status at 12 months follow-up.</td>
<td>The intervention did not increase the likelihood of gainful employment after 1 year or reduce the average number of sick days taken.</td>
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</table>
account of the range of issues that limit the capacity to work among older people.

However, there is evidence to suggest that older workers manage their health differently compared with younger workers [30]. Therefore, there is a need for future interventions to be tailored according to the strategies used by the different age groups to manage their own health. Many of the interventions reviewed here reported older workers receiving the same intervention treatment as younger workers. However, the effectiveness of generic interventions may be limited if individuals from different age groups adopt different strategies for health management. Future initiatives might consider tailoring interventions to meet specific age-related health management strategies of different age groups. A life course approach to OH management, as suggested previously, would offer such an opportunity.

A further challenge for OH professionals when tailoring interventions is to consider what type of intervention is necessary to address a particular health issue. The primary interventions illustrated here show how reduced workability and work disability may be prevented yet there is a serious deficiency of secondary and tertiary interventions that may help to prevent further deterioration among those older workers who are at risk of poorer health, work disability and early retirement. This is an important consideration when taking into account declining workability and early retirement on the grounds of ill-health among older workers [5]. There is considerable scope to develop interventions that integrate primary, secondary and tertiary measures whereby the risk factors for disease and disability can be identified and addressed in midlife to prevent the risk of ill-health and disability in later life. As older workers are more at risk of long-term sick leave due to certain illnesses among this age group, tertiary interventions that are tailored to the needs of this group of workers would be highly beneficial. This fits in very well with a life course approach to OH.

Such an approach demands that longitudinal studies will become particularly important in ageing research. Of those studies reviewed here, a limited number reported a follow-up period of ≥18 months, with most reporting results after only a few months and only one intervention having a follow-up period of 5 years [20]. This lack of long-term follow-up makes it difficult to assess the effectiveness of these interventions over an extended duration. Moreover, high levels of attrition (54%) were reported where long-term follow-up was conducted [20]. Those participants leaving the study after the 12 months follow-up reported poorer perceived health status. Randomized controlled trials are powerful tools to examine treatment effects and it is therefore suggested that future intervention studies are designed to balance the aims of the research against the demands placed on participants. The high levels of attrition reported in the long-term follow-up also suggests that additional measures are required to ensure that participants remain motivated and engaged in the interventions.

Recent work has demonstrated that a proactive approach to health and safety management is linked to improved organizational outcomes such as higher profit margins and improved health and well-being among employees [31]. This study also found that in organizations with very good occupational safety and health management, employees were more committed to their organization and showed greater satisfaction with their job [31]. These findings suggest that OH interventions are likely to be more successful within organizations that adopt a proactive and integrated approach to occupational safety and health management.

Some of the papers reviewed here focused on sickness absence among employees and return to work, which are key government priority issues for the working age population within the UK [32]. These papers [26–28] reported inconsistent results that may be due to differences in organizational culture, an important influence that future interventions should consider. Securing management and organizational commitment or ‘buy-in’ is vital to the success of any OH initiative, leading to increased motivation and commitment of employees and ultimately leading to greater effectiveness.

The ageing UK labour force continues to present a number of challenges for OH professionals. In this review, it was not possible to assess the quality of the interventions reported, as there was an insufficient number of studies specifically targeting older workers. In addition, the purpose of the second review was to highlight the kinds of interventions that would be beneficial to older workers, rather than reviewing the quality of these interventions per se. We have suggested that future OH interventions need to adopt a life course perspective in addressing the health, well-being and workability of older workers. In addition, OH provision needs to take account of the factors that may limit workability among ageing workers, which may ultimately be affected by organizational culture as well as individual health issues. Such a life course approach would allow for early identification of risk factors for illness and provide enhanced opportunity for prevention, offering significant benefits to employees, organizations and the UK economy.

Conflicts of interest

None declared.

References