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## Developing occupational health services for active age management

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**In depth review Ageing and work**

**DEVELOPING OCCUPATIONAL HEALTH SERVICES FOR ACTIVE AGE  
MANAGEMENT**

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# **DEVELOPING OCCUPATIONAL HEALTH SERVICES FOR ACTIVE AGE MANAGEMENT**

**Running Title:** Occupational Health Services for Active Age Management

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## **ABSTRACT**

**Objective:** To review current occupational health (OH) approaches aimed at maintaining the health and work ability of older workers.

**Methods:** A literature review was undertaken to identify articles on occupational health interventions focussed on maintaining the health of older workers (published since 2000). The inclusion criteria included studies which 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 which identified types of workplace interventions that, if used with older workers, may benefit their health, well-being and work ability.

**Conclusions:** Very few occupational health interventions have addressed the health and work ability of older workers and there is considerable scope for developing occupational health provision which accounts for the needs of the older workforce.

Abstract word count: 129

Key words: Occupational health, interventions, older worker, work ability

## **INTRODUCTION**

In the United Kingdom (UK), as elsewhere in Europe, there are now twice as many workers aged 50 and over than those aged 25 years or younger [1]. Against a background of continued policy emphasis on the need to raise European Union (EU) 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 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 occupational health services in promoting the health of workers across the life course [5-8]. Occupational health initiatives are needed to address the challenges of an ageing workforce, including: the prevention of work-related diseases; reductions in work performance due to chronic diseases; and the promotion of

health and workability [7]. Occupational health services are likely to play a key role in 'healthy ageing management' in the workplace.

Effective occupational health 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 suggests that worksite health promotion initiatives may be particularly beneficial in terms of improving the health of older employees [5].

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

## **METHOD**

A literature review was undertaken to identify published papers on occupational health interventions aimed at maintaining the health and work ability of older workers, published since 2000. The inclusion criteria included studies which 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", "work ability", "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 6 articles in total published between 2004 and 2007 that met our inclusion criteria, 5 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 work place interventions that, if used with older workers, may benefit their health and well-being and work ability. 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 which 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 [11] involved a secondary intervention. One focused solely on employees aged over 40 years [9], one on workers aged over 45 years [10] and one on workers aged over 50 years [11]. The remaining three interventions included workers of all ages but these studies investigated age-related issues and report age-related findings [12-14].

Three of these interventions were aimed at improving the physical work environment through ergonomic/environmental interventions [9,12,13]. Cirila et al. evaluated an ergonomics training programme for employees aged over 40 years at risk of postural discomfort due to sedentary office work [9]. 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-Fel  targeted an intervention to improve physical, psychological and social working conditions for older health care workers [12]. 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. tested the effects of workstation improvements for clerical workers using computers for more than 4 hours a day [13]. 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 toward managing older workers aged 45 and over [10]. 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 minimise 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, 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 evaluated the effect of an occupational health intervention where older workers (aged 50 and over) were screened by occupational health physicians to identify those at risk of early retirement [11]. Those identified at risk were randomised into a control or intervention group. The intervention involved consultations and action plans to improve physical and mental work ability. 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.

[Table 1 here]

## **Interventions which 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 [15,16], increase physical activity [17-20], and prevent the onset of chronic disease [21-23]. Such outcomes represent obvious benefit for older workers.

Positive effects of a workplace physical exercise intervention were reported in four papers. White and Ransdell 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 week intervention [19]. However, 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 reported significant between group differences following a randomised controlled trial involving physical activity and a behaviour modification programme [20]. 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 & Ranta implemented an intervention consisting of supervised exercises during the work day [18]. The one year follow up results suggest improvements in dynamic muscle performance and endurance, and a decrease in body fat and body weight. At five year follow up the differences between controls and intervention group were still consistent. A further study measured stair use among a group of employees pre- and post the four month

intervention period [17]. Whilst 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, for example, conducted a randomised controlled trial to address smoking behaviour and reported significant positive results following a behaviour change programme implemented for smokers [22]. Graham 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 [23].

Aboud conducted a worksite intervention to modify health beliefs among employees at a university campus worksite [21]. 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. described a worksite obesity prevention and intervention trial where the primary outcome was change in BMI over a two year period [16]. Their intervention comprised a multi-component programme and whilst baseline data is fully reported, no outcome data is presented. It is therefore not possible to evaluate the effectiveness of this intervention.

Costa et al. 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 [15]. Utilising the Work Ability 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 as compared to their colleague day workers.

[Table 2 here]

### **Secondary interventions**

Three secondary interventions targeting occupational health issues relevant to older workers were identified and these are displayed in Table 3. Although not specifically aimed at older workers, all of 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, 25] and the other tested a screening programme for cardiovascular risk [26]. Both of the interventions addressing sickness absence or disability pensions were undertaken with participants from the construction industry. Taimela et al. 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 [24]. 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 month follow-up. The intermediate risk group 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. offered an occupational health assessment and an individual programme aimed at improving work functioning to an intervention group [25]. Follow-up was undertaken at 9, 18 and 26 months and the intervention was found to be effective in improving work ability but not in reducing work disability pensions.

Nilson et al. undertook a randomised lifestyle intervention with participants at high risk of cardiovascular disease [26]. Individual health checks and educational training was offered to the intervention group. A significant reduction in risk factors (BMI, diastolic blood pressure, heart rate, LDL and cholesterol) was observed in the intervention group at 12 and 18 months follow-up.

[Table 3 here]

### **Tertiary interventions**

Three tertiary interventions were identified as a result of the search. One evaluated a multidisciplinary rehabilitation programme for patients on long term sick leave with respect to their work ability [27], one 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. examined the effect of counselling and medication on work-loss and non-workplace

impairment among those with migraine [29]. The number of migraine-related lost working days reduced following the intervention. The intervention also reduced the total migraine productivity costs over a 7 month period post intervention.

The other two studies focused on sick leave. Braathen et al. introduced a multidisciplinary rehabilitation programme to help patients on long-term sick leave improve their functioning [27]. Follow-up measures were taken at 4 months post-intervention but these suggest that perceived work-ability 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. 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 [28].

[Table 4 here]

## **DISCUSSION**

The increasing age of the UK workforce is an important issue which raises significant challenges for occupational health services in terms of promoting the health and well-being of workers across the life course [5-8]. However, this review has highlighted a lack of interventions which specifically address the occupational health 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 which 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 are known to be important among older workers.

Ilmarinen also suggests that occupational health initiatives are needed to address the challenges of an ageing workforce, which includes the prevention of work-related diseases; reductions in work performance due to chronic diseases; and the promotion of health and workability [7]. 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 whilst none examined interventions for occupational diseases. A number of interventions focused on specific risk factors for chronic illness such as smoking [22,23], diet [21] and physical inactivity [17, 19, 20] 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, occupational health provision needs to take full 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 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 occupational health management, as suggested previously, would offer such an opportunity.

A further challenge for occupational health 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 work ability 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 work ability 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 mid life 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 occupational health.

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 eighteen months or more, with most reporting results after only a few months and only one intervention having a follow-up period of five years [18]. 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 [18]. Those participants leaving the study after the twelve month follow-up reported poorer perceived health status. Randomised 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 organisational outcomes such as higher profit margins and improved health and well-being among employees [31]. This study also found that in organisations with very good occupational safety and health management, employees were more committed to their organisation and showed greater satisfaction with their job [31]. These findings suggest that occupational health interventions are likely to be more successful within organisations 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 [25, 27, 28] reported inconsistent results which may be due to differences in organisational culture, an important influence which future interventions should consider. Securing management and organisational commitment or 'buy - in' is vital to the success of any occupational health initiative, leading to increased motivation and commitment of employees and ultimately leading to greater effectiveness.

The ageing UK labour force presents a number of challenges for occupational health professionals. This review has highlighted the paucity of interventions that specifically targeting older workers. The purpose of the second review was to highlight the kinds of interventions that would be beneficial to older workers. We have suggested that future occupational health interventions

need to adopt a life course perspective in addressing the health, well-being and workability of older workers. In addition, occupational health provision needs to take account of the factors which may limit workability among ageing workers which may ultimately be affected by organisational 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, organisations and the UK economy.

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**Table 1. Interventions for the older worker**

Author	Participants	Study design	Intervention	Outcome measure	Results
Cirla et al., (2005) (Italy)	56 employees from 2 organisations (males and females) aged over 40 years who were assessed as being 'at risk' for postural discomfort due to sedentary work.	Intervention. Within subjects design	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 hour of training in three subsequent afternoons. Group two received 3 hours of training in one afternoon.	Participants were assessed by self-report questionnaire immediately pre training and 3 months post training	At 3 months post training 21 participants reported an improvement following the intervention. Those that received training for one hour over 3 days reported greater improvement. The greatest effect of the training was found for neck complaints.
Anderson-Felé (2005) (Sweden)	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.	Work environment intervention. Within subjects design	Employees received training about life course, work and work ability. Changes in the development of routines and organisation of work were also encouraged during training. Participating wards were allocated a grant to make changes.	Participants were assessed by a work environment questionnaire pre- and post intervention (1 year). Environmental changes were also assessed. Organisational data on time management and costs for HR were analysed.	Authors unable to conclude that the work environment intervention had an impact on staff workload and job satisfaction, however at all participating work places, 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.

<p>May et al., (2004) (USA)</p>	<p>87 clerical employees (age range 21 – 61 years) with varying administrative responsibilities who used their computers for 4 hours or more a day. Participants were assigned to an intervention group (n=61) or a control group (n=26)</p>	<p>Quasi-experimental longitudinal field intervention (non-randomised). Between subjects design</p>	<p>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.</p>	<p>Participants were assessed by self-report questionnaire 4 months pre and post intervention.</p>	<p>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.</p>
<p>Skoglund &amp; Skoglund (2005) (Sweden)</p>	<p>A County Council and one Municipality (insufficient details of participants).</p>	<p>Systematic Age Management programme administered over 1 year in the public sector.</p>	<p>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-day seminars for middle managers: Age Management in Theory and Practice.</p>	<p>A freestanding scientific qualitative evaluation. (No further details provided)</p>	<p>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 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.</p>

			Open lectures of Inspiration (3hrs) for all employees. Professional support and Mentorship for middle managers.		
De Boer et al., (2004) (Holland)	116 employees within a large organisation aged over 50 years who were identified at risk for early retirement. Randomly assigned to an intervention (n=61) or control group (n=55)	Occupational Health intervention Between subjects design	Occupational health 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.	Questionnaire data obtained at baseline, after six months and after two years.	Fewer employees (11%) in the intervention group retired early than in the control group (28%). The total average number of sick leave days in two 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 work ability, less burn out, and better quality of life than employees in the control group. Two years after randomisation no differences between the two groups were found.

<p>Härmä et al., (2006) (Finland)</p>	<p>273 male technicians completed baseline measures. 31 male participants completed intervention. 116 participants in control group. Participants were divided into younger (24-44 years) and older (45-61 years) age groups.</p>	<p>Non-randomised controlled intervention. Repeated measures design, only partially matched.</p>	<p>Intervention to examine the effects of a rapidly forward rotating shift system on sleep, health and well being.</p>	<p>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.</p>	<p>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.</p>
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**Table 2. Primary interventions that could benefit the older worker**

Author	Participants	Study design	Intervention	Outcome measure	Results
Costa et al., (2005) (Italy)	867 health care workers (337 males and 530 females) aged between 23 and 65 years.	Within subjects design Workplace surveillance programme	Periodical health surveillance was undertaken on a sample group of employees to evaluate functional working capacity	Work Ability Index (WAI) questionnaire and general medical examination including routine blood and urine analysis. No follow up.	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
Armitage, C. (2007) (UK)	41 females and 49 males (smokers aged between 18 and 85 years of age).	Workplace intervention. Randomised control design	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.	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.	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.
Williams et al., (2007) (USA)	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)	Randomised clinical trial. Between groups design.	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 year on-site weight management group, off-site group for obese employees and various environmental initiative (insufficient details reported).	Primary outcome was change in BMI over 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.	Description of intervention aims and design only. No post-intervention results reported.

<p>Abood et al., (2003) (USA)</p>	<p>38 University employees formed the control group. 25 control subjects. Participants in the treatment group and control group were 'blinded'. Women comprised the majority of participants in each group.</p>	<p>Worksite nutrition education intervention. Between groups design.</p>	<p>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 8 one-hour 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 of.</p>	<p>A baseline/ post-test questionnaire was used that assessed: Health Belief Model constructs (health concerns, perceived susceptibility/ severity/benefits/barriers, self efficacy), risk assessment for CVD &amp; cancer, nutrition knowledge, dietary behaviours. Post-test measures taken at 8 weeks.</p>	<p>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 approximately 840 kcal/day, total fat intake decreased by 45g / day and saturated fat and cholesterol dropped by 18mg / day and 158mg / day respectively among treatment group.</p>
<p>Titze et al., (2001) (Switzerland)</p>	<p>338 male and female employees undertaking mostly sedentary work.</p>	<p>Workplace intervention</p>	<p>The provision of written information about physical activity recommendations to achieve health benefits was provided and action days were arranged encouraging the use of the stairs. Apples or other fruit was offered on the stairs and a game of chance was played for stair users. During one day the lift was symbolically 'closed'.</p>	<p>Stairway use during working hours was observed pre and post the four month intervention period. Observer recorded frequency of use, direction (up/down) and gender. Automatic measures were taken by a photoelectric barrier and magnetic switch counter on the lift doors.</p>	<p>Baseline measures suggest environmental factors influence stair use. Combined observational scores showed that that stair use increased from 61.8% to 67.1% (p=0.028). The pattern of stair use measured by automatic means was not as consistent. The intervention programme increased the percentage of women using the stairs. Interventions with 'rewarding' elements encourage individuals to use the stairs.</p>

<p>Pohjonen &amp; Ranta (2001) (Finland)</p>	<p>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 year follow up period.</p>	<p>Workplace intervention and surveillance programme. Between groups design.</p>	<p>Supervised physical exercise for one hour twice a week during a 9 month period. Exercise concentrated on aerobic exercise and muscular fitness. Individual feedback provided to participants by physiotherapist. Lectures also provided which focused on leisure time physical activity. The control group were asked to maintain their habitual exercise levels and were not given instructions for training.</p>	<p>Objective measures of muscular endurance, strength, flexibility and aerobic fitness. Anthropometric measurements and <math>\dot{V}O_{2max}</math>. Perceived health status, work ability and leisure time activity were assessed with a questionnaire. Follow up measures at 1 year and 5 years post intervention.</p>	<p>At 1 year follow up participants in the intervention group showed: -4% decrease in body fat, -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 year follow up the differences between controls and intervention were still consistent. In the control group the decline of work ability was 3 times faster.</p>
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Graham et al., (2007)  (USA)	1776 participants from a large, geographically dispersed (46 states) employee population (65% male). 482 surveyed at follow up (31.7%)	Internet-based smoking cessation programme.	Financial incentive for participation in a Internet-based smoking cessation programme – QuitNet.	Self reported 7 day point prevalence abstinence at 12 months and QuitNet database.	There was significant variability in web site utilisation patterns with higher website utilisation 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.
White & Ransdell (2003)  (USA)	30 female sedentary faculty staff. Mean age only reported (43.4) High levels of attrition.	Worksite intervention. No control group	12 week intervention combining intervention sessions twice a week. Behaviour change strategies were combined with various physical activities.	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 VO <sub>2max</sub> values. Outcome measures taken at 12 weeks	There was a significant increase in the amount of physical activity performed at the end of the intervention compared to prior the intervention. Participants showed an increase in muscular endurance, flexibility and predicted VO <sub>2max</sub> 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.

<p>Atlantis et al., (2006) (Australia)</p>	<p>73 healthy but sedentary casino staff (37 females, 36 males). Randomised to either treatment group (24 weeks) or wait list control (24 weeks treatment). 44 participants completed twenty four week intervention. High levels of attrition.</p>	<p>Randomised controlled trial. Between subjects design.</p>	<p>Treatment group prescribed 20 mins of moderate to high intensity aerobic exercise at least 3 days / week. Treatment group 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 wait-list control group received neither the exercise intervention or education or discouragement from increasing current activity levels.</p>	<p>Waist circumference measures. 7 day dietary recall questionnaire. Relative VO<sub>2max</sub> values. Outcome measures taken at 24 weeks.</p>	<p>Significant between-group differences were found in the mean waist circumference favouring the intervention. Both gender and age were related to predicted VO<sub>2max</sub> values at 24 weeks. There were no significant differences in changes in median body mass or body mass index. 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.</p>
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**Table 3. Secondary interventions that could benefit the older worker**

<b>Author</b>	<b>Participants</b>	<b>Study design</b>	<b>Intervention</b>	<b>Outcome measure</b>	<b>Results</b>
Taimela et al, (2007) (Finland)	1341 construction, service and maintenance employees (88% males). Employees were classified into low (n=386), intermediate (n=537) and high (n=418) risk of sickness absence based on a health survey.	Two randomised controlled trials. Longitudinal cohort study.	High risk intervention group invited for a consultation with occupational health 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.	Sickness absence during a 12-month follow up.	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.
Nilsson et al., (2001) (Sweden)	128 participants with a high risk of cardiovascular disease.	Randomised lifestyle intervention study	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.	Screening programme at 12 and 18 month follow-up.	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.

<p>de Boer et al., (2007) (Netherlands)</p>	<p>Employees from the construction industry with a high disability risk of 38% or more in the forthcoming four years.. Split into intervention group aged 18-64 years (n=83) or a control group that were 40-64 years (209)</p>	<p>Interventional study with a longitudinal follow-up.</p>	<p>Occupational health assessment and individual programme focusing on optimising work functioning.</p>	<p>Occupational health examination and questionnaire at 9, 12 and 26 months follow-up</p>	<p>The intervention was effective in improving work ability 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.</p>
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**Table 4. Tertiary interventions that could benefit the older worker**

<b>Author</b>	<b>Participants</b>	<b>Study design</b>	<b>Intervention</b>	<b>Outcome measure</b>	<b>Results</b>
Vicente-Herrero et al., (2004)  (Spain)	446 Spanish postal service employees with migraine	Pre-test post-test workplace intervention (No control group)	Counselling from occupational health physicians and rizatriptan 10mg for symptomatic treatment of two subsequent migraine headaches. Physicians also prescribed additional medications for migraine prophylaxis, treatment of tension headaches and rescue medications.	Self reported migraine-related work loss and non-workplace impairment over a 7 month period.	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.
Braathen et al., (2007)  (Norway)	183 employees on long term sick leave	Multidisciplinary rehabilitation programme	4 week intervention consisted of 6 hour-long sessions 5 days a week. The aim was to help patients on long term sick leave improve their functioning so as to regain and improve their work ability.	Outcome measures assessed in the intervention group at baseline, at the end of the programme and after 4 months. The primary outcome variables were work ability and return to work.	Perceived work ability 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.
Bonde et al., (2005)  (Denmark)	184 patients at risk of long-term sick leave or job dropout	Randomised controlled study	After randomisation 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.	Postal questionnaire including SF36 and employment status at 12 months follow-up.	The intervention did not increase the likelihood of gainful employment after 1 year or reduce the average number of sick days taken.

