SYSTEMATIC REVIEW OF HEALTH OUTCOMES RESULTING FROM EXTENDED WORKING LIVES

Susan Baxter, Lindsay Blank, Anna Cantrell, Elizabeth Goyder

School for Health and Related Research

University of Sheffield

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Introduction

There has been increasing policy focus to retain older workers in the workforce.(1). Policy rationale frequently cites the fact that whilst retirement age has been getting higher since the 1990s, it has not kept up with increasing life expectancy so people spend more time retired despite retiring later.(2) The removal of a default retirement age in many countries around the world potentially gives employees more choice regarding when to retire, but choice may not be available to those with poor health or in poverty.(3-5) It has been estimated that by the age of 65, around a third of workers have already left employment, with ill health a key reason for this.(1) There is the potential for policies which extend working lives to adversely impact on health inequalities in older age, and act differentially in population sub-groups.(6)

While the case for extended working lives in terms of economic benefits to the public purse, employers and individual income has been established, the link between extended employment and health outcomes is less well understood, with suggestions of a two way causality underlying the relationship.(7) While the agenda to drive extended working has principally focused on the economic benefits, it is known that employees grapple with both "push" and "pull" factors in their decision-making about when to retire.(8)

The quality of a job is likely to be a key factor in determining whether extended working life has a positive or detrimental effect on an individual's health and well-being. In a time of rapidly changing working patterns, contextual factors may also have a substantial influence on the retention of older workers, and the outcomes and impacts of extending their working life.(9) Much of the literature on extended working lives has focused on the individual worker and their decision-making process.(10-13) However, there is potential for inequity and varying health outcomes between those who have choice in their decision-making, those who are forced to extend their working life, and those who are forced to leave work prematurely.

It is important to understand the health outcomes associated with increased retention of older workers (both positive and negative) to inform guidance so interventions maximise any health benefits of employment, and mitigate any potential harms. The overall aim of this review was to identify, appraise and synthesise existing research evidence on health outcomes resulting from the extension of working lives.

Methods

We carried out an initial mapping process to determine the volume and characteristics of literature potentially available, and to inform decision-making regarding the focus for the full review (the mapping review is outlined in a separate report). This mapping exercise indicated that there was likely to be sufficient volume of evidence to proceed to full systematic review;

and that exploring associations between extended working life and health outcomes (with a focus on potential sub-population effects), would add to the existing evidence base.

Review objectives

The objective of this systematic review was to identify UK and relevant international evidence relating to:

1. The health effects of extended working lives on individuals, communities and society at large including health determinants and inequalities.

2. The effectiveness of interventions which have the aim of optimising healthy extended working lives.

3. The health effects of extended working lives on different population sub-groups.

The review also aimed to identify and clarify where there are gaps in the existing evidence base, and to ascertain key questions for future research.

Search strategy

Searches were conducted in the following electronic databases: Medline, Applied Social Sciences Index and Abstracts (ASSIA) and PsycINFO.

The search strategy combined a number of terms relating to extended working life and relevant outcomes including workers wellbeing and health economic, community and society outcomes and inequalities. The search terms included both subject (MeSH) and free-text searches. The searches were limited to papers in English, published from 2011 to June 2020.

The full search strategy is provided in Appendix 1.

In addition to electronic database searching, we used supplementary methods of citation searches on authors of key included papers, and scrutiny of relevant websites for reports and other grey literature. Reference lists of included studies were also screened for potentially relevant citations. The list of websites searched is provided in Appendix 2.

Inclusion criteria

We included any type of study which reported empirical data, including primary studies and other systematic reviews. Other inclusion criteria are detailed below:

- Our population of interest was workers who were in paid employment beyond typical or statutory retirement age. We used age 64 or over as the criteria for being beyond typical or statutory retirement age, as the average effective age of labour market exit across OECD countries is 64.2 years of age.(14)

- We included studies which compared those who are retired from employment, to those who are continuing to work beyond statutory or typical retirement age. We included studies reporting any health or health-related outcome.
- We included relevant literature from the UK and other developed countries (members of the OECD) published since 2011 (the date of the removal of the default retirement age in the UK).
- We included grey literature in the form of relevant UK reports, guidance, or policy documents identified via relevant websites or cited in included studies.
- We included documents published in English.

Exclusion criteria

- We excluded studies which had a focus on the effects of retirement, and did not compare this with being in paid employment.
- We excluded studies where all those in the "employed" group were below aged 64, as less than this age would not be considered extended working in current worldwide employment practices. Similarly, we excluded studies which only contained retirees aged less than 64, as these individuals would not be directly comparable with those extending employment.
- We excluded studies which had populations of "older workers", but did not distinguish those workers of typical or statutory retirement age or older, from those who were of younger age.
- We excluded studies which had a focus on the process of deciding the timing of retirement, and factors which influenced this.
- We excluded studies which only reported outcomes for employers, businesses, or employee income/pensions.
- We excluded studies solely of voluntary work rather than paid employment.

Stakeholder involvement

We had input from a public advisory group established specifically for this study, with 12 members representing ages from mid 40s to 70s, with around half still in employment and half retired. Current or past employment included professional and non-professional, full and part time working, and those self-employed as well as employed. The advisory group met twice during the study. At the first meeting input was sought regarding key questions for the public, and discussion on the results of the mapping review. Key areas of interest for public advisors were: "who is working for longer"; "is poverty is the main driver for extended working life"; and

"which groups are most affected". At a second meeting we sought input on interpretation of the results of the review, and how to present the findings in accessible forms. Group members provided feedback on the draft summary, highlighted which findings were of most interest to members of the public and suggested presentation format and content.

During the protocol development stage we circulated drafts for feedback to relevant government and third sector stakeholders, and to other researchers with topic expertise in employment and older workers. Following completion of the mapping review, that report was also circulated for comments.

Quality appraisal

We considered the quality of included studies using checklists appropriate to the varying study designs using tools from the Critical Skills Programme.(15) During the processes of data extraction and synthesis we considered the relative weight that could be attached to individual research studies and where there might the potential for limitations in individual study findings. We also considered the robustness of the body of evidence as a whole in terms of volume, consistency and quality.(16)

Screening process

Search results were downloaded to a reference manager database (Endnote version X9). This database was screened by one reviewer, with 20% checked by a second reviewer, and potentially relevant citations were coded using the keyword function. In the first instance, coding was based on title and abstract where available only. Where the title and abstract did not give a clear indication of whether the paper should be considered or not, an inclusive approach was taken with the full paper being considered for potential inclusion. Papers which were identified as potentially meeting the inclusion criteria were then retrieved for review at full paper level.

Data extraction

The following data were extracted and tabulated using a form developed during other similar reviews: author/year; study design; population; outcomes; findings; and main conclusions.

Synthesis method

The findings were synthesised narratively, and characteristics of the literature were tabulated to provide a summary overview. We used Harvest Plots (17, 18) where there was sufficient body of literature, to summarise the weight of evidence (volume and consistency) relating to adverse, neutral or positive effects of extended working on particular outcomes.

Results

After de-duplication, the searches generated 772 records, of which 36 were retrieved as full papers. Of these, nine were found to meet the inclusion criteria. An additional four papers were identified from checking the reference lists of the included studies, and a further four papers were identified via citation searching.

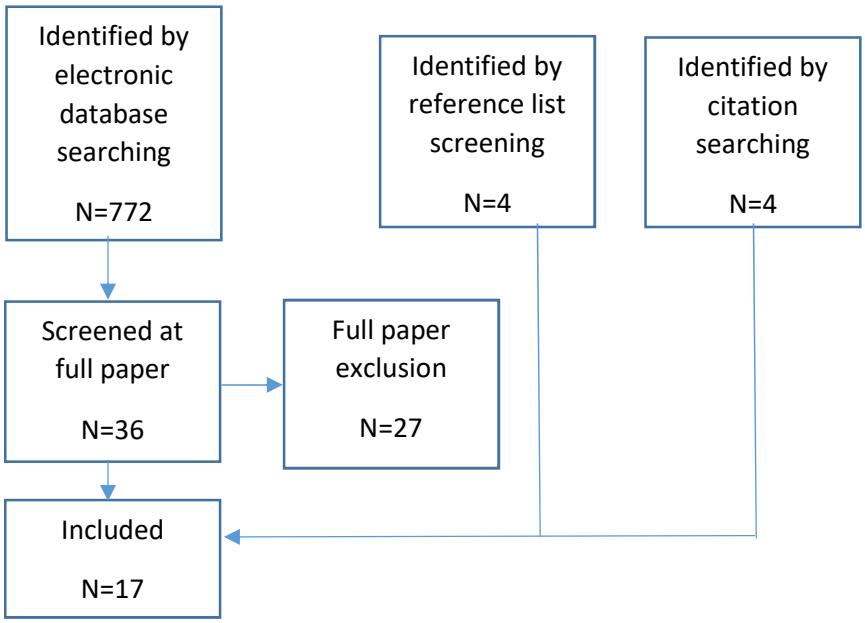

Figure 1. Diagram illustrating the process of study selection.

The reason for exclusion at full paper stage was typically one of the following: that the paper related to the retirement decision-making process rather than outcomes; that the study included outcomes related to employment rather than health; that the age of older employees was unclear; or in the case of interventions, that the intervention was aiming to improve the lifestyle of all employees or all older employees (for example healthy diet and exercise), rather than specifically aiming to address extended employment.

We found a substantial body of literature with a focus on examining the effects of retirement, but these studies were excluded where there was no comparison with the effect of working beyond typical retirement age. The list of 27 papers scrutinised at full document review but found to be outside the parameters of this study is provided in Appendix 3. The extraction table providing further details of the included studies can be found in Appendix 4.

Characteristics of the literature

Table 1 details the country of origin for the studies. As can be seen, the evidence is sourced from studies reporting data from six individual countries, and two studies included data from

multiple countries. Japan provided the largest volume of studies, followed by the UK. The evidence is therefore representative of populations with varying healthcare systems and employment practices.

The minimum age of drawing retirement benefits in Japan is currently 60 with incentives to delay to 65, and this age is expected to rise further. In the UK pension benefit age will be 66 from October 2020, rising to 67 in coming years. In the US for most people the age that benefits can be partially collected is 62 and fully collected at 67, although there is incentivisation to delay full retirement until up to age 70. In the Netherlands pension benefits are payable from age 66 rising to 67 in 2021. In Sweden workers born after 1963 can take benefits at age 64, and in Australia for most people currently in employment pension benefits will be able to be taken from 67. Across the European Union state pension age is typically age 65, with many countries planning rises to 67 or 68.

Table 1. Study country of origin

Japan	Fujiwara 2016 Kajitani 2011 Minami 2015 Okamoto 2018 Tomioka 2018
UK	Carrino 2018 (Italian study but UK data) Di Gessa 2017 Di Gessa 2018 Farrow 2012
US	McDonough 2017 (UK study but US data) Morelock 2017 Stenholm 2014 (Finland study but US data)
Netherlands	Blok 2011
Sweden	Anxo 2019
Australia	Welsh 2016
Multiple countries	Kalousova 2015 (Europe plus US) Potocknik 2013 (Europe)

The most common design within the included sources was a cohort study, either a prospective study, or a retrospective cohort study examining data from large national data sets such as the British Household Panel Survey (see Table 2). Follow up periods were from one year to nine years.

Table 2. Study designs

Cohort study	Anxo 2019 Carrino 2018 Di Gessa 2017 Di Gessa 2018 Fujiwara 2016

	Kalousova 2015 McDonough 2017 Okamoto 2018 Potocnik 2013 Stenholm 2014 Tomioka 2018 Welsh 2016
Review	Blok 2011 Farrow 2012
Intervention study	Morelock 2017
Cross-sectional	Kajitani 2011 Minami 2015

We identified two other systematic reviews. These synthesised evidence: on shift work tolerance (19); and injuries and accidents amongst older workers.(20) The majority of studies included both male and female employees, with two having only male participants (21, 22) and one researching only female employees.(23)

Evidence on associations between extended working life and health and health-related outcomes

Sixteen studies provided data on the effects of extended working life on health. Many of the studies provide complex findings, with differential effects reported for sub-groups of employees, for different patterns of working, or for different outcomes. We therefore present the synthesis with findings grouped by type of outcome, and provide a narrative summary of data relating to a positive, adverse or neutral effect for each. We also indicate for each outcome where the results apply to a particular population or working pattern. We have used Harvest plot methods to provide a visual summary of the volume and direction of evidence (see figure 2, figure 3, and figure 4). Where there are varying findings within a single study, these have been represented by multiple entries. Therefore the plots do not always provide a simple count of studies indicating positive, adverse or neutral effects.

In the plots, the solid grey columns represent findings which are not specific to particular population subgroups (gender, type of employment or working pattern). Findings relating to male participants only are indicated in blue, and to female participants only in green. Findings relating to part time working are indicated by upward diagonal lines, and findings relating to particular features of jobs are indicated by a dotted pattern. The studies which have smaller columns indicate those with cross-sectional rather than longitudinal design.

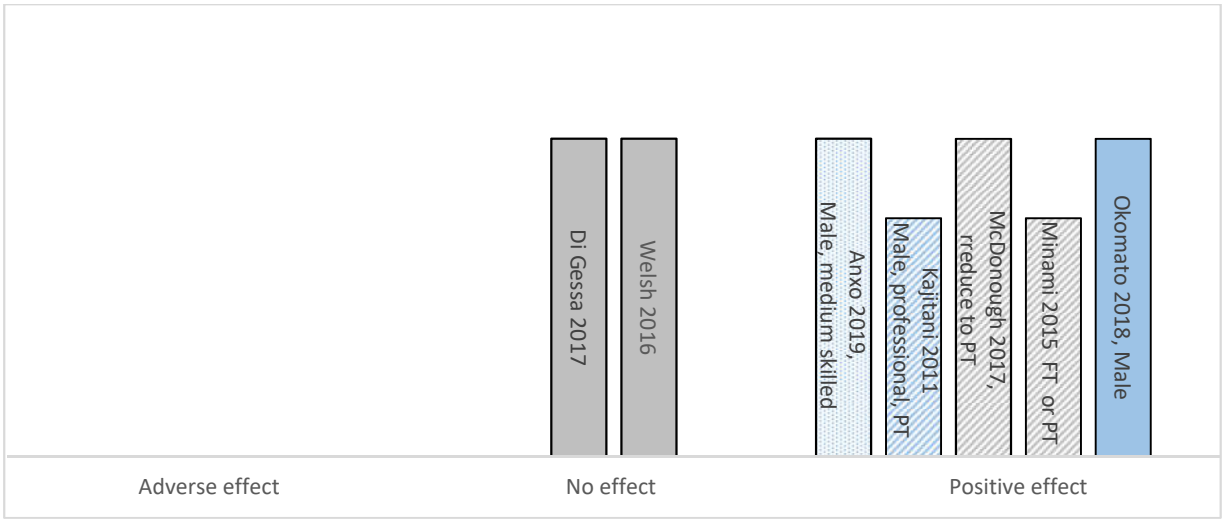

Figure 2. Harvest plot summarising results of studies reporting health outcomes

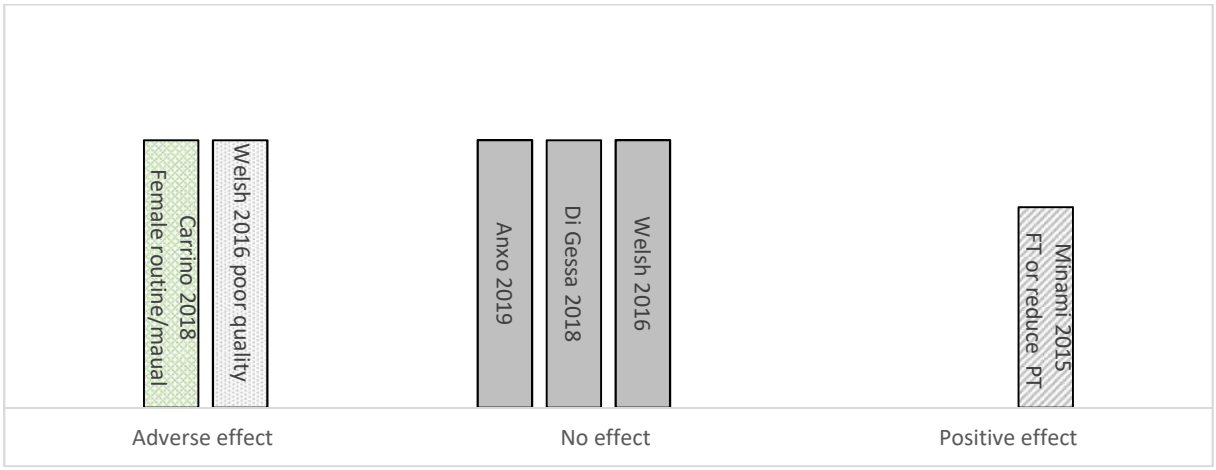

Figure 3. Harvest plot summarising results of studies reporting mental health outcomes

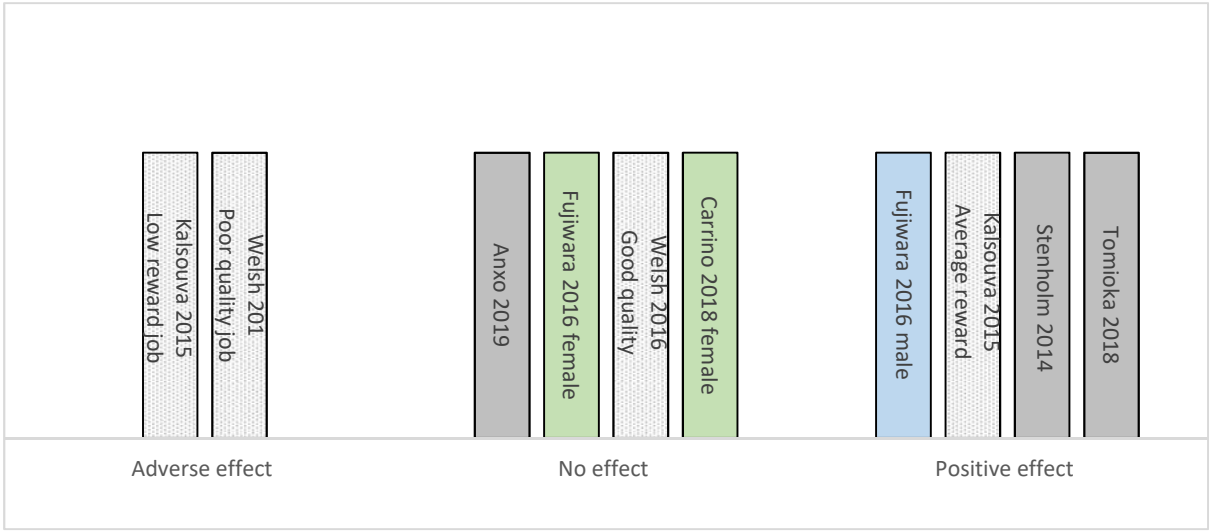

Figure 4. Harvest plot summarising the results of studies reporting physical health-related outcomes

1. *The effect of extended working life on health*

Seven studies measured overall health effects, described by authors as self-assessed health, self-rated health status, somatic health, or general health. All studies evaluated outcomes using self-reported questionnaires, and typically Likert scale ratings. As can be seen from Figure 2, by volume there are greater indications of positive rather than neutral or negative effects of extended working life on health. Five studies reported positive effects (all but one of these for particular sub-groups of workers), two neutral effects, and none adverse effects.

Of the five studies reporting positive effects, two of them were carried out with male participants only,(21, 22) and for a further study the evidence of positive effects relates to males only.(24) The first of these studies (of cross sectional design) sampled national survey data from 2032 Japanese males aged 60-79. (21) Around 40% of the study population were still in employment. Analysis using an estimation model found that working older men tended to be healthier than those who were not working (Pearson test 76.34 $p<0.01$). The second study, also from Japan(22) followed 1288 males aged 60 or older for 15 years and reported that subjective feelings of being in poor health were significantly higher for individuals not in employment than those in employment (average 17% versus 7%). The study also found other health advantages of being in employment in terms of reduced susceptibility to stroke (14% versus 20% $p=0.007$) and delayed stroke (8.03 years versus 5.84 years $p=0.0001$). There was no effect on the timing of onset or numbers affected by diabetes ($p=0.878$).

A study carried out in Sweden included both male and female participants, and reported that the positive effect of working longer on self-assessed health after age 65 was restricted to male participants (and also those who were married and medium skilled).(24) Linear probability modelling estimated that for males, having work experience after the retirement age of 65 would on average increase the probability of reporting better health during retirement by about 14% (adjusted to 11% when controlled for demographics and socio-economic characteristics). Of note, the analysis also indicated that there was a 6.8% probability of reporting better health in retirement by extending working beyond the age of 65, even after controlling for pre-retirement health (as healthier people are more likely to delay retirement) with an estimated effect of 0.068 ($p<0.01$). However, calculations estimated that the health advantage would be lost after six years of retirement. The difference in health effect for women who were working versus retired was not statistically significant, and there was no significant difference in health for those who workers were single or low/high skilled (although the authors highlighted that the number of observations for these latter groups was small).

Authors of a cross sectional study in male workers outlined above (21) highlighted the potential role of differing patterns of employment, in their conclusion that the Japanese elderly maintain

their health by working, but with a decrease in hours. In contrast however, a cohort study of Japanese adults aged over 65 (25) found that both part-time and full-time workers had significantly better self-rated health compared to non-workers ($p<0.001$).

A cohort study examining data from 6522 Americans aged 52 to early 70s also provides evidence that examining working hours may be important in evaluating the effects of extended working. It found that for both sexes, those in employment but reducing to part-time work around age 62 or 65 were less likely than almost all other groups (except women working part time throughout) to report poor health in their early 70s (men odds ratio (OR) OR 0.49 $p<0.01$; women OR 0.29 $p<0.001$).(26) The predicted probability of poor health for men reducing to part time at age 65 was 0.099 (95% CI 0.058-0.139) compared to the predicted probability for men working full time throughout of 0.186 (CI 0.151-0.221). Continuing to work full time or continuing to work part time both led to better health outcomes for men than working full time prior to retiring at age 65 (predicted probability of ill health of 0.220 CI 0.178-0.2623). Women had the best health if they remained employed part-time throughout (OR 0.21 $p<0.000$ predicted probability of poor health 0.099 95% CI 0.040-0.159) with next best health outcomes for women working full time who reduced to part time employment aged 62 or 65 (OR 0.29 $p<0.000$).

The first of the two studies reporting neutral health effects of extended working was a cohort study from Australia.(27) This study examined data over nine years from 836 individuals aged 50-59 at baseline, with 66% working throughout the study duration, 23% retiring voluntarily and 10% involuntarily. Analysis indicated no significant difference in self-rated health between those who were working and those who voluntarily retired ($p=0.825$). In the analysis, older workers who held poor quality jobs for part of the follow-up period did not differ statistically significantly from voluntary retirees in terms of their health, but the authors suggested that there was evidence of a trend between length of exposure to poor quality jobs and decline in health outcomes.

The second study reporting neutral general health outcomes carried out a retrospective analysis of UK national survey data from 1608 individuals aged over 60 (men aged 65 to 74 and women aged 60 to 69).(28) In this sample, around 25% of women and 15% of men were working beyond statutory pension age, with nearly half (45%) working less than 20 hours per week. Initial analyses suggested that men and women in paid work were more likely to report better health at follow-up than those who were not working (better somatic health ($\beta=0.323$ for men, and $\beta=0.292$ for women) and thus adds to the evidence of positive effects. However, once baseline socioeconomic characteristics as well as adulthood and baseline health and labour market histories were accounted for, the health benefits of working beyond statutory

pension age were no longer significant. The authors concluded that while those who report good health are more likely to be working, after adjusting for known confounders of this relationship, particularly baseline health, being in paid work beyond statutory pension age is not associated with better health.

2. *The effect of extended working on mental health*

Five studies reported mental health outcomes associated with extended working. The volume and direction of evidence for this outcome was mixed, with one study finding a positive effect, three a neutral effect, and two an adverse effect for some workers (see Figure 3).

The single study reporting a positive effect on mental health was a cohort study of Japanese adults aged over 65 (25). This study found that those working either full time or part time work had significantly better mental health (as measured by the Geriatric Depression Scale), compared to those who had retired. The study highlights differential effects of retirement from full time versus part time employment. It found that mental health worsened rapidly following retirement from full time employment, but did not worsen for those who changed from full-time jobs to part-time jobs. Those who retired from part-time jobs also deteriorated more gradually in their mental health, compared to those retiring from full-time jobs, therefore continuing in part-time work seemed to have a protective effect.

Two of three studies reporting neutral effects for mental health, also provided evidence of neutral effects on general health (outlined in the evidence on this outcome above). In a retrospective cohort study from the UK,(28) initial analysis indicated that respondents in paid work beyond statutory pension age were between 0.44 (men) and 0.57 (women) times less likely to be depressed, and between 0.64 (men) and 0.73 (women) times less likely to report sleep disturbance, but in the fully adjusted results the benefits were no longer significant. A Swedish study of those aged over 65 in which 25% were still working(24) found no statistically significant effect of working longer on self-reported depressive symptoms or well-being (life satisfaction).

An Australian cohort study (27) also reported no significant difference in mental health ($p=0.123$) between those who were working and those who were voluntarily retired. The study highlights the importance of the quality of employment when considering outcomes however, as additional analyses based on the characteristics of employment (good quality jobs versus poor quality jobs) found that older workers who continued to be employed in jobs of poor quality reported significantly larger declines in mental health compared to those who voluntarily retired. Voluntary retirees reported a 3.32% (CI 1.58–5.06) improvement in their

mental health, whereas older workers who had mostly held poor quality jobs during their working life reported a deterioration of 1.35 % (−3.66–0.96).

A study which examined the effects of a change in state pension age for women in the UK found adverse effects in terms of reductions in mental health (-3%), and higher depression scores (+10%).(23) The authors of this study which included women aged 60 and aged 64 also highlighted differential effects based on the characteristics of employment. The study found that those in routine manual occupations were more negatively affected than those in professional occupations.

3. The effect of extended working on physical health-related outcomes

In regard to physical-related effects of extended working, the evidence indicates mixed findings, with several studies reporting differing sub-group specific outcomes (these findings are indicated in the different categories in the Harvest plot). The types of physical health-related outcomes reported in these studies were activities of daily living, long term care, frailty and physical fitness/activity. Two studies reported a positive effect and two further studies found a positive effect for some workers. One study reported a neutral effect, and three further studies reported a neutral effect for some workers. Two studies reported adverse effects for some workers.

The first of the studies finding positive effects was a cohort study with three year follow up of 6417 people over the age of 65 in Japan.(29) While the study participants had an age range of 65 to 99 years, the mean age at baseline was 73 years so represents an older cohort than many of the other included studies (although 19% of participants reported still being in paid employment). Men who continued working past 65 had less likelihood of requiring long term care (but more likelihood of decline in activities of daily living) than those who retired (OR 0.22 95% CI 0.09-0.54). Women who continued working past 65 had less likelihood both of requiring long term care (0.32 CI 0.15-0.68) and lower risk of decline in activities of daily living (0.39 95%CI 0.16-0.99) than those who retired. The authors concluded that encouraging older people to stay in the workforce contributes to increasing healthy life expectancy.

Of interest was the analysis of a group of workers who acquired new paid work during the study period, in addition to sub-groups of those who had retired and those continuing in work. The study also found that both older men and older women who were not working at baseline but sought work had a decreased likelihood of requiring long term care (0.41 CI 0.17-0.98 men; 0.24 CI 0.09-0.66 women) than those who had retired. Men and women who started working after the age of 65 also had a lower decline in activities of daily living than both those who retired or those who continued to work (men 0.42 CI 0.22-0.78; women 0.39 CI 0.16-0.99).

An analysis of US data from 17844 individuals aged between 65 and 85 years (mean age 69 in the continued full time working group and 74 in the retired group) also found a positive effect on physical functioning scores (a composite of mobility and activities of daily living measures).(30) The study found that the number of physical functioning difficulties was higher with increasing age, but the increase was significantly smaller for those in full-time work than those who had retired (test of interaction p=0.002). The number of physical functioning difficulties increased by 0.49 (95% CI 0.31 to 0.67) per every 10 years increase in age for those in full-time work, compared to a lesser increase of 0.63 (95% CI 0.54 to 0.72) for those who were retired.

The authors noted that the absence of chronic diseases and lifestyle-related risks amongst full time workers did not completely explain the differences found. However, the potential for other sub-population differences was indicated, as the number of physical functioning difficulties in both workers and retirees was higher amongst women, those with low education, and those with low non-housing financial wealth. The authors concluded that physical functioning declines faster in retirement than in full-time work, and recommended that extending working life may help to maintain physical functioning even among very old adults.

A positive effect for males only was reported by an eight year cohort study of 981 residents of Tokyo and rural surrounding areas aged 65 to 84 years.(31) This study reported that around 68% of their participants were still in employment, with a notable difference of 70% and 78% female and male respectively employment in urban areas compared to 58% and 57% male and female employment in rural areas. The study found that in both areas, males who were working were less likely to decline in activities of daily living than those who were not working (21.2% decline versus 50% decline $p < 0.05$ in urban area, 41.6% versus 65.5% in rural area $p<0.01$). Women in rural areas who were working also declined less than those who were not working (43% versus 61% $p<0.01$) but the difference was not significant for women in the urban area ($p=0.98$). A fully adjusted model indicated that work might have a protective effect on the ability to carry out activities of daily living for males, but there was evidence of a neutral effect on females.

Another study reported differential outcomes based on type of employment. The study reported that while there may be positive physical effects by extending working for those in average reward jobs (predicted increase in frailty of 0.31 at retirement versus increase of 0.28 if not retired), for those in low reward jobs there is a predicted increase in frailty of 0.28 for retirees compared to 0.48 for those staying in the labour force.(32) This study examined US and European datasets on 2475 older workers over a seven year follow up, with nearly half (43%) retiring during the study period. The authors concluded that while the effects may be

positive for individuals who have jobs with adequate reward, retirement may help with tempering adverse health consequences for those in low reward employment.

Another study echoed that while physical effects may be neutral for some, extended working life may have adverse effects for those in poor quality employment. (27) This evaluation of 836 older workers in Australia aged 50-59 years who were followed up for nine years included assessment of physical functioning outcomes (self-rated physical health and physical activity). Regression analysis indicated no evidence of a significant difference in physical functioning between those who were working, and those who were voluntarily retired (p=0.687). For workers in poor quality jobs (lack of control over work time, skill use or fair reward) however, physical health declined more than for those who were voluntarily retired (−4.90, 8.52–−1.29). This effect was only seen in those holding poor quality jobs for most (rather than some) of the follow up period. There was evidence of a trend among continuing workers (compared to voluntary retirees) for reduced levels of physical activity over time (p=0.056).

Another study provided evidence of a neutral effect of working longer on physical fitness (climbing the stairs to different floors).(24) This study using probability modelling drew on data from 8022 individuals, and controlled for both individual health status and financial position. The study found a non-significant difference in physical fitness between those who voluntarily retired and those who continued working after age 65. A study of women found that physical health outcomes amongst those who had delayed retirement due to changing statutory pension age, were not statistically significantly different from those who had retired at the previous typical retirement age. (23)

4. The effect of extended working on quality of life

One study reported quality of life as an outcome, with differential effects (positive or negative) for different groups of workers.(3) This retrospective analysis of English longitudinal data from men aged 56 to 74 and women aged 60 to 69 used the CASP-19 tool to measure control, autonomy, self-realisation and pleasure.

Around 20% of participants reported working beyond statutory pension age. This study drew a distinction between participants who were still in paid employment voluntarily to keep active or who enjoyed working (13%), and those who were in employment for financial reasons (7%). Those who were in paid work voluntarily reported higher quality of life (CASP-19 = 45.4 β = 1.62) than those who had voluntarily or involuntarily retired at the expected age. These workers also experienced marginal improvements in quality of life when they eventually left the labour market (β = 1.12). In contrast, being in paid work out of financial necessity beyond typical retirement age was significantly associated with worse quality of life compared to being retired at the expected/usual age (significant only when scores were adjusted for health status,

β = −1.21). The authors noted that caring for someone eroded the reported positive effect on quality of life.

5. *The effect of extended working life on other health-related outcomes*

Other health-related outcomes reported by studies were: problems sleeping and tolerance of shift work;(19) and type of job or work injuries and accidents.(20) The first of these studies(19) was a review of 19 papers on shift work tolerance in workers aged over 64, which concluded that there was no evidence overall for a negative effect of working shifts amongst older employees. Another study (20) reviewed evidence on injuries and accidents amongst employees who were aged over 60 (three papers related to those aged over 65). Studies reported that sickness absence following work injury increased in each decade, with a median of 5 days for those aged 20–24 years and 18 days for those aged 65 years or over. Workers over 65 were at particular risk from injuries associated with transportation/driving. The authors concluded however, that there is almost no explicit research data which analyses injuries and accidents in workers over age 65.

The effectiveness of interventions

We identified only one primary study which evaluated an intervention.(33) This 2017 study carried out in the United States with healthcare workers aged 50 and over including some in their late 60s, evaluated a "time and place management" intervention which enabled employees to adopt flexible working options, and also provides training programmes and processes to enable desired work/life balance. The study evaluated the outcome of "workability" which was defined as encompassing competence, health, and mental and physical requirements to carry out a job. Participants were asked to rate their ability to continue to work at their current job for the next five years. The results indicated that those who had low workability responded to the intervention in terms of maintaining their rating of ability to do their job (rather than falling).

A cohort study which examined a European dataset on health outcomes in retirees and older employees, provides information relevant to components of potential interventions.(34) The study reported that volunteering or engaging in sporting and social clubs had no impact on older employees. However, for older employees with low levels of depression taking part in political or community organisations was associated with decreased depression (although there was little effect on those with higher levels of depression).

Discussion and conclusions

1. What are the health effects of extended working lives on individuals, communities and society at large including health determinants and inequalities, and for different population sub-groups?

We identified 16 studies which provide evidence regarding the effects of extended working life beyond typical or statutory retirement age. The outcomes considered within this body of literature related to overall health, mental health, physical health, quality of life, accidents and injuries, and sleep quality. The volume of studies reporting positive effects, no significant effect, or negative effects indicates that while there is some inconsistency, the greater weight of evidence is of positive or neutral outcomes from extended working. This evidence is particularly in regard to overall health status and physical health, with the volume of evidence regarding outcomes for mental health, and quality of life being smaller and inconsistent.

Further analysis of these headline findings however, indicates that the benefits reported are most likely to be for males, those reducing to part time working, and those employees who are in jobs which are not low quality or low reward.

Differences in health

Some authors highlighted the potential for varying effects to be due to differences between the health of those extending working and those retiring, with only those with better health able to extend their working life.(28) The two studies which adjusted for health found either no difference in outcomes between those working and retired, or a lower magnitude of positive effect on extended working. This indicates that the influence of existing health on decision-making whether to retire or continue in employment, is important to consider in interpretation of outcomes.(28, 30)

Few papers distinguished between those who had retired voluntarily by choice, and those whose decision-making was constrained by economic, health, or personal situations. Choice may be important, as one study provided evidence that those who choose to remain in employment benefit to a greater degree than those in employment due to financial necessity.(3)

Gender differences

The literature highlights that different health outcomes may be linked to differing career pathways and employment patterns for men versus women. In one study for example women were more likely to have been employed part time during their career.(26) Another study described how pathways to retirement may vary by gender, for example the rate of women reporting being sick, disabled or caring for family/home increases in those who are extending working lives.(23)

Pattern of employment

A key area of difference in outcomes appeared to be the pattern of employment, with the value of part time employment highlighted. Decreased working hours in older age seemed to be beneficial in comparison to extended full time employment or complete retirement from full time work. While some studies directly compared the effects of different working patterns and provided evidence regarding the benefits of part time working, it was not clear in others whether the participants who extended their employment had continued or reduced their hours. It can be conjectured that where it is not detailed, that a sizeable number of study participants in "extended employment" groups were not working full time, given that one study reported that of those continuing employment 45% worked less than 20 hours per week,(28) Authors of a UK study found that only around 14% of men and 10% of women worked full time until aged 65 then retired,(26) further suggesting that much of the evidence included in this review is not comparing health outcomes from extended full time working versus retirement, but working part time versus retiring.

Of potential concern to the widening of inequities, one included study reported that men and women who continued to work full time tended to be less educated and be from an ethnic minority group and have lower wealth, than those who were part time or reduced to part time.(26)

Type of employment

The type of employment is important in the differential outcomes reported. In one study the authors found that the elderly whose longest-held occupation was professional tended to be healthier than those in other industries ($p<0.01$). Those in managerial, sales, or manual work experienced a greater deterioration of health as they age.(21) Employment involving transport and machinery may be particularly at risk of leading to injuries and accidents in older workers.(20) There was also a suggestion that adverse effects from poor work may be cumulative,(27) Another study concluded that the effect of increasing retirement age for women was largely confined to those from routine occupations.(23) In another study it was reported that around one third of those who worked beyond statutory pension age were in managerial positions.(28)

2. What is the evidence regarding the effectiveness of interventions which have the aim of optimising healthy extended working lives?

We identified only one relevant primary study evaluating an intervention which aimed to extend the healthy working life of older workers. This programme was intended to give workers more choice and control over the time and place of their employment, and therefore addresses the need for more flexible employment patterns recommended by the evidence identified.(33)

While the intervention appeared promising, positive outcomes were only achieved for a sub-group of workers who were assessed as having low workability (the competence, health, mental and physical requirements to carry out a job).

3. What are the gaps in the evidence base, and what might be key questions for future research?

- Our searches identified limited qualitative literature in the topic area, and none of the studies that we screened in depth met our inclusion criteria. The qualitative literature we found predominantly related to retirement decision-making and the factors influencing the timing of workforce exit. Key questions for future studies would be exploring the views and experiences of extended working, in particular what may be required to mitigate any potential adverse effects or enhance positive outcomes?
- We found that in order to fully evaluate the effects of extended working, it is important for studies to provide clear information regarding the ages of their participants, and whether they are working full time or part time. The evidence suggests that reductions in working hours may be beneficial, and this detail is therefore key for study authors to provide (rather than simply comparing those in employment with those in retirement) if the effects of extended working are to be further evaluated.
- There is a clear gap in regard to interventions which have the aim of enabling older workers to extend their healthy working life. Interventions to better enable flexible and/or reduced working as part of a life course approach seem to have promise, with this of particular importance for workers in employment with greater risk of adverse outcomes.
- Few studies provided information regarding the characteristics of employment, for example whether participants were drawn from particular industries or professions. Given the suggestion that features of work such as level of control, rewards, skills, activities and risk of accident are important in outcomes, further work to examine the effects of extended employment by work type would be helpful.
- Few studies made a distinction between those who have extended employment voluntarily, and those who had been forced to continue for financial reasons. The one study which investigated this, indicated that choice was a factor influencing health outcomes.(3) It would be helpful for future study authors to distinguish these groups in the reporting of outcomes, as there is the potential for widening health inequalities between those who can opt to retire, and those who need to continue working for financial necessity.
- There was little evidence regarding the effect on quality of life. The one study measuring this outcome, reported varying effects depending on whether employment

was by choice or financial necessity. Further studies evaluating this outcome are needed.

Strength and limitations

This work examined extended working after typical or statutory retirement age, and we acknowledge the challenges in defining a "typical retirement age". Our definition of extended working as employment beyond age 64 was based on the average age threshold for receiving state retirement benefits in developed countries, but this may have excluded literature with relevant findings. However, we believe that by focusing only on this age group, that we were able to best examine evidence regarding the potential health effects of the worldwide trend to extend employment and increase the age at which state retirement benefits are paid.

Many studies which we identified but rejected, recruited wide age ranges of people who were working or retired. We acknowledge that many people retire before state pension age, so studies reporting findings from populations in a younger age range may have provided data of relevance. However, we would argue that outcomes relating to the health of young retirees and workers in their 50s, would not have been comparable with those who extend working beyond statutory or typical retirement. We believe that a strength of this work was the age limitation, which provided specificity of evidence only to those who would be classified as extending working, rather than all older workers.

A sizeable volume of studies were excluded from this review due to a focus on the effects of retirement, rather than outcomes from extended working. While this may seem to be a somewhat arbitrary distinction, our research focus was on comparing working versus not working in those above retirement age, rather than exploring the effects of retirement on health or the effects of being unemployed while of working age. There is a substantial body of literature available which has specifically examined withdrawing from the labour market, for example a review in 2013 of retirement and health,(35) a review in 2018 of the effects of leaving employment on different socio-economic groups,(6) and an analysis of reasons for leaving the labour market.(1).

Conclusions

This review found indications of benefits to self-reported health from extending working life beyond typical or statutory retirement age. There were suggestions however, that benefits would be experienced most by those who are in part-time employment, who are male, and employees in jobs which are not highly demanding or offer poor rewards. The evidence of neutral effects on health could be viewed as further supporting conclusions of a positive outcome as it is known that working longer improves personal finances in retirement.

Therefore if employment can be continued with no adverse health effects, then this could be a gain for those with limited pensions. Evidence regarding the effect on mental health and physical health was more mixed than overall self-rated health, but indicated neutral or positive effects for most workers (although not all). There was little evidence regarding the effects on quality of life.

The potential for adverse health outcomes amongst some population sub-groups however, was notable. Adverse effects for some workers highlights the potential for widening gaps in health inequalities, with the potential for adverse effects on workers in jobs which have high levels of demand and/or low reward, and in some industries such as transport or where there may be greater risk of accidents and injuries. The role of existing health, and other constraints on an individual's choice whether to continue or retire, suggests that while extended working (particularly part-time) may be positive for some, there may be adverse effects on others.

Interventions to mitigate the effects of extended working seem to be needed particularly for those whose financial circumstances require them to continue in full time employment, and those in poor quality jobs. This may be particularly important given the suggestion of a cumulative disadvantage from extending employment in poor quality jobs.

References

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Appendix 1. Search strategy

Database: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily <1946 to February 11, 2020>

Search Strategy:

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1 older work$.ab,ti. (1332)

2 elderly work$.ab,ti. (104)

3 late employment.kw. (1)

4 (older workers or older working population).kw. (127)

5 elderly workers.kw. (5)

6 "extending working life".ab,ti. (13)

7 "Extending working life".kw. (5)

8 1 or 2 or 3 or 4 or 5 or 6 or 7 (1483)

9 health.ab,ti. (1786973)

10 (wellbeing or well being or wellness).ab,ti. (94017)

11 health status/ or health status disparities/ (93684)

12 inequalit$.ab,ti. (28791)

13 economic$ outcome$.ab,ti. (3061)

14 societ$ outcomes.ab,ti. (121)

15 community outcome$.ab,ti. (144)

16 "Community functioning".kw. (18)

17 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 (1864677)

18 8 and 17 (703)

19 limit 18 to (english language and humans and yr="2011 -Current") (284)

Appendix 2. Websites searched for grey literature

Department for Work and Pensions

https://www.gov.uk/government/organisations/department-for-work-pensions

A new vision for older workers: retain retrain recruit
https://www.gov.uk/government/publications/a-new-vision-for-older-workers-retain-retrain-recruit

Fuller working lives a partnership approach
https://www.gov.uk/government/publications/fuller-working-lives-a-partnership-approach

Fuller working lives evidence base 2017 https://www.gov.uk/government/publications/fuller-working-lives-evidence-base-2017

Fuller working lives: a framework for action
https://www.gov.uk/government/publications/fuller-working-lives-a-framework-for-action

Attitudes to working in later life British social attitudes 2015
https://www.gov.uk/government/publications/attitudes-to-working-in-later-life-british-social-attitudes-2015

Older workers and the workplace evidence from the workplace employment relations survey
https://www.gov.uk/government/publications/older-workers-and-the-workplace-evidence-from-the-workplace-employment-relations-survey

Age Action Alliance and DWP Employer Toolkit
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/411428/older-workers-employer-toolkit-summary.pdf

Employer experiences of recruiting retaining and retraining older workers qualitative research https://www.gov.uk/government/publications/employer-experiences-of-recruiting-retaining-and-retraining-older-workers-qualitative-research

Management of an ageing workforce
https://www.gov.uk/government/publications/management-of-an-ageing-workforce

Future of ageing seminar on older workers
https://www.gov.uk/government/publications/future-of-ageing-seminar-on-older-workers

Future of ageing workplace infrastructure
https://www.gov.uk/government/publications/future-of-ageing-workplace-infrastructure

Future of ageing changing work requirements and environments https://www.gov.uk/government/publications/future-of-ageing-changing-work-requirements-and-environments

Sector based work academics and work experience trials for older claimants combined quantitative and qualitative findings https://www.gov.uk/government/publications/sector-based-work-academies-and-work-experience-trials-for-older-claimants-combined-quantitative-and-qualitative-findings

Extending working life sector initiative https://www.gov.uk/government/publications/extending-working-life-sector-initiative

Attitudes to age in Britain in house research no 7 https://www.gov.uk/government/publications/attitudes-to-age-in-britain-201011-in-house-research-no-7

Default retirement age employer qualitative research https://www.gov.uk/government/publications/default-retirement-age-employer-qualitative-research-rr672

Review of the default retirement age summary of the stakeholder evidence https://www.gov.uk/government/publications/review-of-the-default-retirement-age-summary-of-the-stakeholder-evidence-rr675

2010 to 2015 government policy: older people https://www.gov.uk/government/publications/2010-to-2015-government-policy-older-people

Centre for Ageing Better https://www.ageing-better.org.uk/

The State of Ageing in 2019: adding life to our years https://www.ageing-better.org.uk/publications/state-of-ageing-2019

Supporting carers back into work: insights form the working potential project https://www.ageing-better.org.uk/publications/supporting-carers-back-to-work-insights-working-potential-project

Priorities for government: transforming later lives https://www.ageing-better.org.uk/sites/default/files/2019-10/Priorities-for-government-Transforming-later-lives.pdf

Mid-life support: insights for employers https://www.ageing-better.org.uk/publications/mid-life-support-insights-employers

Employment support for over 50s: rapid evidence review https://www.ageing-better.org.uk/publications/employment-support-over-50s-evidence-review

The experience of the transition to retirement: rapid evidence review https://www.ageing-better.org.uk/publications/transition-to-retirement-rapid-evidence-review

Thinking ahead: exploring support provided by employers to help staff plan for their future https://www.ageing-better.org.uk/publications/thinking-ahead-exploring-support

Developing the mid-life MOT https://www.ageing-better.org.uk/publications/developing-mid-life-mot

Becoming an age-friendly employer https://www.ageing-better.org.uk/publications/becoming-age-friendly-employer

Health warning for employers: supporting older workers with health conditions https://www.ageing-better.org.uk/publications/health-warning-employers

A silver lining for the UK economy? The intergenerational case for supporting longer working lives https://www.ageing-better.org.uk/publications/silver-lining-uk-economy

Inequalities in later life https://www.ageing-better.org.uk/publications/inequalities-later-life

Inequalities in later life: the issue and the implications for policy and practice https://www.ageing-better.org.uk/publications/inequalities-later-life-issue-and-implications-policy-and-practice

Addressing worklessness and job insecurity amongst people aged 50 and over in Greater Manchester https://www.ageing-better.org.uk/publications/addressing-worklessness-and-job-insecurity-amongst-people-aged-50-and-over-greater

Fulfilling work: what do older workers value about work and why? https://www.ageing-better.org.uk/publications/fulfilling-work-what-do-older-workers-value-about-work-and-why

Later life in 2015: an analysis of the views and experiences of people aged 50 years and over https://www.ageing-better.org.uk/publications/later-life-2015-analysis-views-and-experiences-people-aged-50-and-over

Age UK www.ageuk.org.uk

Behind the headlines: why the employment rate does not tell the whole story about working longer https://www.ageuk.org.uk/globalassets/age-uk/documents/reports-and-publications/reports-and-briefings/active-communities/rb_april17_behind_the_headlines_-hours_worked.pdf

Walking the tightrope the challenges of combining work and care in later life https://www.ageuk.org.uk/globalassets/age-uk/documents/reports-and-publications/reports-and-briefings/active-communities/rb_july16_walking_the_tightrope.pdf

A means to many end older workers' experiences of flexible working https://www.ageuk.org.uk/globalassets/age-uk/documents/reports-and-publications/reports-and-briefings/active-communities/rb_sept12_a_means_to_many_ends_older_workers_experiences_of_flexible_working.pdf

The Centre for research into the older workforce https://www.agediversity.org/

What are the supply (workforce) and demand (product) implications of an ageing society https://www.agediversity.org/wp-content/uploads/2019/03/Foresight-future-ageing-workforces-manufacturing.pdf

Wellbeing, Health, Retirement and the Lifecourse https://wherl.ac.uk/about/findings/ finding from the 3 year research project

The Progressive Policy Think Tank. 2017. Extending working lives Report https://www.ippr.org/publications/extending-working-lives

University of Kent Extending Working lives https://www.kent.ac.uk/extendingworkinglives/

The International Longevity Centre UK. 2013. Extending working lives: a provocation https://ilcuk.org.uk/wp-content/uploads/2018/10/Extending-working-lives-a-provocation.pdf

MRC Lifelong Health and Wellbeing extending working lives awards https://mrc.ukri.org/documents/pdf/extending-working-lives-awards/

Eurofund. 2017. Extending working lives: what do workers want? https://www.eurofound.europa.eu/publications/report/2017/eu-member-states/extending-working-life-what-do-workers-want

NHS

Working Longer Review. 2014. Preliminary findings and recommendations report for the health departments https://www.nhsemployers.org/-/media/Employers/Documents/Pay-and-reward/WLR-Preliminary-findings-and-recommendations-report.pdf?la=en&hash=6DEF00660C4B5B612E671163A500B603CA20F431

University College London. renEWL Publications. https://www.ucl.ac.uk/epidemiology-health-care/research/epidemiology-and-public-health/research/renewl/publications

UK Research and Innovation. EXTEND: Social inequalities in extending working lives of an ageing workforce Publications. https://gtr.ukri.org/projects?ref=ES%2FP000177%2F1

Institute for employment studies (ies) https://www.employment-studies.co.uk/publications

Managing extended working life https://www.employment-studies.co.uk/resource/managing-extended-working-life

Appendix 3. Studies excluded at full paper scrutiny

1. Ackerman PL, Kanfer R. Work in the 21st century: New directions for aging and adult development. American Psychologist. 2020;75(4):486-98.

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10. Demou E, Bhaskar A, Xu T, Mackay DF, Hunt K. Health, lifestyle and employment beyond state-pension age. BMC Public Health. 2017;17.

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12. Gommans FG, Jansen NW, Mackey MG, Stynen D, de Grip A, Kant IJ. The Impact of Physical Work Demands on Need for Recovery, Employment Status, Retirement Intentions, and Ability to Extend Working Careers: A Longitudinal Study Among Older Workers. J Occup Environ Med. 2016;58(4):e140-51.

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18. Nahum-Shani I, Bamberger PA. Work hours, retirement, and supportive relations among older adults. Journal of Organizational Behavior. 2011;32(2):345-69.

19. Nilsson K. Interventions to reduce injuries among older workers in agriculture: A review of evaluated intervention projects. Work. 2016;55(2):471-80.

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26. Staudinger UM, Finkelstein R, Calvo E, Sivaramakrishnan K. A Global View on the Effects of Work on Health in Later Life. Gerontologist. 2016;56 Suppl 2:S281-92.

27. van Zon SK, Bultmann U, Reijneveld SA, de Leon CF. Functional health decline before and after retirement: A longitudinal analysis of the Health and Retirement Study. Soc Sci Med. 2016;170:26-34.

Appendix 4. Extraction table

Author Year Location Health outcomes /Intervention	Population	Study design	Outcomes	Main findings	Conclusion and other notes
Anxo 2019 Sweden	Age 65+ retirees Survey n= 8022 retired individuals. 34% retired before 65, 41% retired at 65 and 25% retired after 65.	Longitudinal routine data (Longitudinal Integration Database for Health Insurance and Labour Market Studies) plus a postal survey sent to 20,000. Probability model (standard linear model adjusted for SES). Compared retired vs. stayed in workplace @65 Total sick days used to proxy health before age 65. Treatment group defined as worked at	Self-assessed health via postal survey, 5 point Likert scale very bad to excellent. Also self-reported physical fitness, self-reported depressive symptoms, well-being.	6.8% higher probability in reporting better health in retirement for those who continued to work after 65 compared to those retired at 65. But advantage estimated would be lost after 6 years. Mean health difference between the two groups 0.213 $p<0.01$. Linear probability model estimated treatment effect 0.139, suggesting that having work experience after the retirement age of 65 would on average increase the probability of reporting a better health during retirement by about 14%. This figure adjusted to 0.109 controlled for demographics and socio-economic characteristics. The prolonging working life after age of 65 and better health association remains even after controlling for pre-retirement health condition. Estimated effect 0.068 $p<0.01$, those delaying retirement had about 6.8% probability of reporting better health in retirement. No statistically significant effect of working longer on other outcomes physical fitness, self-reported depressive symptoms or well-being (life satisfaction). Those working longer had average higher educational attainment, higher labour and capital income, fewer unemployment days (average 6.7 days over 5 years), and took average 6 fewer days sickness per year. The positive health effect of working after 65 is restricted to male respondents, married people, and medium skilled	Explores the relationship between the prolongation of working life and subjective health. Better self-reported overall health in retirement for those who work beyond 65 (males, married, middle skilled), a weak and transitory but positive effect. Healthier people more likely to delay retirement.

		least half a year after 65		workers. Not statistically significant for females, single, or low/high skilled (although small number of observations for these two skill groups).	
Ardito 2016 Italy	Male retired (defined as receiving an occupational pension) and those still in employment after pension age. Males employed and self-employed workers in private sector. Aged 68-70. (N=94,52).	Retrospective analysis of routine data: WHIP&Health database – social security and hospital discharge data. Study used a random 7% sample.	Cardio vascular disease incidence	Retirees who, during their careers, were lower income earners, and manual workers are likely to experience the impact of pension age on CVD to a greater extent (increase of 4.4%, $p<0.01$) A one-year delay in retirement increases the incidence of hospitalization for cardiovascular diseases (CVD) at 68-70 years old by 2.4 percentage points (p-value<0.01).	Results show a significant health detrimental effect of extended working life. Retirees exposed to more disadvantageous working conditions face higher CVD risks as a result of retiring at older age. Effects of pension reform and seasonal working in Italy on retirement age noted. Note: mean pension age in group was 59 years.
Blok 2011 Netherlands	Older than 64	Review 19 papers Shift work tolerance in older workers. English language. Two intervention studies all others	Age-shift work interaction effect on sleep, fatigue, performance, accidents and health. Studies on age–shift (morning, afternoon, night) and age–shift system (roster)	Did not find evidence overall for the suggestion of more shift work problems in older workers. Two studies reported more problems in older people, four studies reported opposite results, while in five studies no significant age–shift work interaction was observed. Older compared with younger workers have more sleep problems with night shifts, while the opposite is true for morning shifts. Many papers reported high inter-individual differences in tolerance.	Effects of shift work not increased overall with older workers.

		associational studies, various sectors of industries.			
Carmichael 2013 UK	50-68 years N=56 (M+F) North West England, recruited via community venues and groups. Just over half male, most married or co-habiting, 30% retired, 39% in paid employment. Median household income £20,000-£30,000.	Qualitative interviews and some quantitative analysis (British Household Panel Survey)	Physical/mental health Labour market participation Both relationships	Two-way causality in relationships between health, work and worklessness in older age. Type of job and workplace conditions matter. Impact of ill health on work participation accentuated by age for women only. The impact of age on health can be detrimental to employment, potentially limiting the type of job or work an older worker can do, how well they can do it and possibly influencing employers' attitude to their employability.	Relationship between health and work is two way. Pension age rises should be accompanied by interventions to improve health and change workplace practices to facilitate longer working lives.
Carrino 2018 Italy (Data from UK)	Women aged 60-64 average age 62.5, 70% had a partner, 80% at least GCSE. 40% manual-routine work, 30% intermediate, 30% higher occupations. Excluded	Retrospective analysis of survey data (Understanding Society) comparing women who were eligible for pensions at age 60-62 with those who had to work longer before	General Health Questionnaire depression score SF-12 mental and physical health (self-reported, Likert scale). Self-reported employment status – paid worker, unemployed, retired, looking	Increasing state pension age estimated to have increased employment rates by 11%, 41% of women reported being in employment, 2.8% in sickness, 3.2% in caring for family/home, and 1% in unemployment. Being below the SPA as a result of the reform leads to a reduction of £220 in monthly individual income, generated by a decrease in pension income which is not compensated by earnings from increased labour supply. The impact of reform varies by type of employment, with those in routine manual occupations more negatively affected than those in professional occupations. There	Women in routine occupations who had a delayed statutory pension age as a result of reform had significantly higher GHQ depression scores and a decline in the SF-12 mental well-being score. Longer postponement of state pension age

	those who had never worked. N=3452	eligibility for pension. Linear probability models.	after family or home, long term sick/disabled	was no statistically significant impact of the reform on any outcome for intermediate and managerial categories. The probability of alternative pathways to retirement (through sickness, home/family-caring and unemployment) were larger for women in routine-class occupations than for women in managerial occupations. A one-month increase in the SPA increases the probability of depression by 0.2 points for women from routine occupations, with an elasticity of 0.7%. The effect is not significant for women in the intermediate and managerial categories. The probability of alternative pathways to retirement (through sickness, home/family-caring and unemployment) are larger for women in routine-class occupations than for women in managerial occupations. Longer postponement of SPA leads to worse depression scores for those affected compared to those not affected (GHQ increases by 0.57 points for those with an increase of 6-24 months (elasticity 5%), 0.81 for those with an increase of 24-36 months (+7.3%), and 1.19 for those with an increase of 36 or more months (+10.7%)). Longer extensions of SPA also lead to larger reductions in the index of mental well-being. The largest effects are found for women with a postponement of three or more years (cohort 1953-1955, with an average SPA increase of 55 months): a GHQ elasticity of +10.7%, and a MCS elasticity of -3.7%. The reform has no clear consistent impact on intermediate and managerial classes, with the effect being largely confined to women from routine	leads to worse mental wellbeing and depression scores for women from routine occupations (not intermediate or managerial).

				occupations. The increase in SPA led to a divergence in health between occupational groups. The rate of women reporting being sick, disabled or caring for family/home increases for cohorts who are affected by the increased state pension age.	
Di Gessa 2017 UK	Men 65-74, women 60-69 in 2006/7 N=2039 analysed (n=1608 data collected at all time points) Significant difference at p<0.05 or 0.01 between those not working versus working at baseline– worse depression, reduced somatic health, not having education, not highest wealth (men only), care provided (women only)	Retrospective analysis of survey data (English Longitudinal Study of Ageing survey of individuals in private households aged over 50) 2004/5 2006/7, 2008/9. Life history interviews for a sample. Logistic regression.	Depression, measured by self-reported depressive symptoms in week prior. Somatic health (combination of self-reported health and presence of one or more limitations with activities of daily living, long standing illness, self-report of doctor diagnosed heart disease/stroke, mobility limitations) Sleep disturbance self-reported in month prior. Nurse measured grip strength Employment histories.	About 25% of women and 15% of men worked beyond state pension age. Around one third of those who worked beyond SPA were in managerial positions, 45% worked less than 20 hours per week and a third of men and 41% of women had sedentary jobs. Initial analyses suggested that men and women in paid work were more likely to report better health at follow-up. Respondents in paid work beyond SPA were between 0.44 (men) and 0.57 (women) times less likely to be depressed, and between 0.64 (men) and 0.73 (women) times less likely to report sleep disturbance. They were also significantly more likely to report better somatic health (β=0.323 for men, and β=0.292 for women). However, once baseline socioeconomic characteristics as well as adulthood and baseline health and labour market histories were accounted for, the health benefits of working beyond SPA were no longer significant. Fully adjusted results also suggest that paid work beyond SPA does not have differential effects on health depending on characteristics of the job such as physical demand, hours worked or social class.	The results suggest that being in paid work beyond SPA is not associated with better (or detrimental) health. Those who report good health and are more socioeconomically advantaged are more likely to be working beyond SPA to begin with. Only a select group of healthy older adults works beyond SPA.

Di Gessa 2018 UK	Men 65-74, women 60-69 at baseline. 56% female, 445 male, 74% some education, 24% in highest wealth quartile, 33% managerial and professionals, 40% routine and managerial, 13% carer, 73% married. Groups of those working for financial reasons, those working voluntarily and those normal retirement, involuntary retirement or voluntary retirement. Excluded those who had never worked. N=2502 (longitudinal analysis) 1823	Retrospective analysis of survey data (English Longitudinal Study of Ageing, surveys individuals over 50 years) 2008/9 and 2014/15	CASP-19 self-completion survey - dimensions of control, autonomy, self-realisation and pleasure. 0-57 scoring. Employment status and reasons. Activities of daily living Long standing illness Depression Social relationships and contacts	Around 20% were in paid employment beyond state pension age, with two thirds of these in paid work voluntarily (13% of total sample) giving the reason that they either enjoyed working or were working to keep active and fit, the other third (7% of total sample) reported being in employment for financial reasons. Respondents who were in paid work voluntarily (13%) reported the highest QoL (CASP-19 = 45.4) whereas the lowest QoL was reported by those who retired involuntarily (24%) (CASP-19 = 38.9). On average respondents experienced a decrease in QoL: about a quarter experienced a decrease of 5 points or more whereas just over 16% experienced an improvement of 5 or more points. Respondents who transitioned from employment 'for financial reasons' to retirement were the only subgroup who experienced an increase in their CASP-19 scores. Being in paid work out of financial necessity was significantly associated with worse QoL compared to being retired at the expected/usual age (significant only when scores were adjusted for health status (β = −1.21). Those who continue to work for positive reasons (about two-thirds of workers) report the highest levels of QoL, (β = 1.62). These workers also experience marginal improvements in QoL when they eventually leave the labour market. Among retirees, those who reported voluntary retirement were significantly more likely to report higher QoL (β = 1.12). Caring for someone significantly reduced QoL. In contrast, those who continue working beyond SPA out of financial necessity (one third of workers) report a CASP-19 score of about 4 points lower at baseline, and this level does not rebound upon eventual retirement.	Paid work beyond SPA out of economic necessity is associated with lower quality of life (average 4 points lower CASP-19 scores).

	(cross sectional analysis) Only n=19 were still in paid work at follow up survey.			Those involuntary retired have the poorest health profile (27% were depressed; 38% had functional limitations; 52% reported limiting LSI) whereas those in work voluntarily tended to report better health (13% depressed; 15% with limiting LSI; 8% had functional limitation), with those retired at the normal age and in work for financial reasons somewhere in between.	
Farrow 2012 UK	60+	Systematic Review 36 studies – only 6 papers included participants who were working beyond age 65	Injuries and accidents Sickness absence	One study reported that sickness absence following work injury increased in each decade, with a median of 5 days for those aged 20–24 years and 18 days for those aged 65 years or over. Workers over 65 were at particular risk from injuries associated with transportation/driving and had more disabling fracture injuries compared with younger workers. Reported injuries were not limited to 'dangerous' jobs, driving or heavy manual work. A US survey of occupational fatalities reported that workers aged 65 or over had 6,471 fatalities (13.7 per 100,000 workers), a rate almost three times that of workers below 65 (5.1 per 100,000). This was echoed in another US survey which reported three times the risk of of fatalities in over 65s. The main causes of death for workers in the over 65 age group were machinery (28%), motor vehicles (19%), falls (13%) and homicide (13%). Machinery-related fatalities for males aged 65 or over were almost six times greater than the rate for pre-retirement age males. The fatality rate for falls amongst females aged 65 years and over was 14 times that of females aged 16–64 years. Other studies predominantly compared people in their 60s with younger workers rather than those post statutory retirement age. Those employed over the age of 60 may be a self-selected se the healthy worker. Relatively little is known about people who work beyond the age of 60.	There is almost no explicit research data with analysis of workers over age 65 and workplace factors associated with injury or accident.

Fujiwara 2016 Japan	306 (urban Tokyo suburb) and 675 (rural village area) Aged 65–84 years N=981 411 males 570 females In Tokyo 65% employees, in rural area 68% men employees, 73% women termed family workers. Rural area mostly agriculture, forestry and fishery, in Tokyo most administrative, managerial or professional.	8-year longitudinal study	Activities of daily living (ADL) via self-reported TMIG Index of Competence, smoking status, exercise habits, Life Satisfaction Index, usual walking speed and serum albumin Working status and frequency Medical history	78.8% of men and 70.4% of women were working in the urban area compared with 58.3% men and 57.0% women in the rural area. In both areas, participants who were not working were more likely to decline in ADL than those working ($P < 0.05$), except for women in the urban area. Male participants who did not engage in paid work had a higher adjusted hazard ratio of onset of BADL disability, compared with those working, but this was not seen for female participants. Both male and female participants in the rural area had a higher risk of onset of ADL disability than the urban area. But this was no longer significant after being adjusted for usual walking speed and serum albumin (those in rural areas had lower).	Working might be protective from a decline in BADL but only for men.
Kajitani 2011 Japan	Age 60+ Male N=2032 58.5% aged 60-69 and 33.4% aged 70-79.	Estimation model Routine data National Surveys of the Japanese Elderly 1990-1996	Self-assessed health status Physical limitations Diseases, Nutrition, Mental status, Life expectancy	Around 40% of those aged 60 and over employed, just under half of these are self-employed. Pension age in Japan was 60 during 1990-1993. Working older men tend to be healthier than those not working (Pearson test 76.34 $p<0.01$) The elderly whose longest-held occupation was professional tend to be healthier than those in other industries ($p<0.01$). 15–25% of the elderly whose longest-	The elderly maintain their health by working, but with a relative decrease in working hours.

				held job was sales, work in agriculture, the forestry and fisheries industry, or a blue-collar job self-rated their health as ‘‘Not very good’’ or ‘‘Poor.’’ The people whose longest-held job was managerial, sales, or manual work would experience a greater deterioration of health as they age, Japanese men prefer to work for fewer hours as they grow older. A relative decrease in labour hours, are related to the fact that the working Japanese elderly tend to be healthier.	
Kalousova 2015 European + US data	Older workers N=2475 Mean age 55 at baseline, employed or self-employed, 58% male, 43% retired between baseline and follow up, 40% high effort employment, 28% low reward, 29% low education, 33% high.	Cohort study 2004 and 20011, Survey of Health Ageing and Retirement in Europe, included US Health and Retirement Survey and English Longitudinal Study of Ageing Multi-level regression modelling	Frailty measured by self-report and handgrip at interview, walking speed	For those in an average reward job at baseline there is a predicted increase in frailty of 0.31 at retirement. The predicted increase in frailty would be smaller for this person if he had not retired of 0.28. For those in low reward employment at baseline there is a predicted increase in frailty of 0.28 for retirees and 0.48 for those who stayed in the labour force. For individuals who have jobs with little reward, retirement may help with tempering their consequences for physical health.	Low reward had the most detrimental consequences for health when a respondent did not retire. Persons in average or high reward positions did not benefit from retirement.
McDonough 2017 UK authors using US data	Aged 52-69 and early 70s (US retirement age 62) N=6522	Cohort study, data from Health and Retirement Study (1992-2012) Americans aged 50+	Self-rated health (5 point scale poor, fair good, very good, excellent) Functional limitations	Only around 14% of men and 10% of women worked full time until aged 65 then retired. Around 24% of women and 38% of men extended working (full time or part time). Only 2% of men worked part time early in careers. Women tended to have different career trajectories with around 13% working part time and 12% not in employment during all the years analysed. Those not in	Those reducing from full time to part time working at age 65 have less risk of poor health in 70s than those retiring from full time work.

		Logistic regression Life course approach		employment throughout had highest percentage reporting poor health. Across both sexes those reducing to part-time work around age 62 or 65 were less likely than almost all other groups (except women working part time throughout) to report poor health in their early 70s (men OR 0.49 p<0.01; women OR 0.29 p<0.001) Predicted probability of poor health for men reducing to part time at 65 =0.099 95% CI 0.058-0.139. For those working full time then retiring at 65 it was 0.220 CI 0.178-0.2623). For men working full time throughout it was 0.186 CI 0.151-0.221. For women reducing to part time predicted probability of poor health was 0.139 CI 0.081-0.196 (reduced aged 65) and 0.133 CI 0.080-0.185 (reduced aged 62). For those working full time then retiring at 65 it was 0.228 CI 0.181-0.275. For women all employment pathways were associated with reduced risk of poorer health than non-employment. Women had the best health if they remained employed part-time throughout (OR 0.21 p<0.000 predicted probability of poor health 0.099 95% CI 0.040-0.159) Next least likely were full time reduced to part time aged 62 or 65 (OR 0.29 p<0.000). Fourth least likely were those working full time throughout (OR 0.32 p<0.000) Men who reduced to part time around age 65 are among the most advantaged. They are more likely to be white, college-educated and in better health in their late 40s/early 50s and early 60s; and have greater household wealth and income than most other groups. Men and women who continued to work full time tended to be less educated and be from an ethnic minority group	There is a need for flexible employment policies that foster opportunities to work part-time.

				and have lower wealth than those who were part time or reduced to part time. Poor health may have led to early exit around aged 57 or ongoing non-employment throughout 50's and 60's. Note: overlapping 95% confidence intervals across some of the groups preclude definitive statements. A range of marital, parental and work histories over the prime adult years had no impact on the employment-health relationship (results not shown).	
Minami 2015 Japan	Age 65+ (mean 73.4) n=1768 Full-time worker (n=220), part-time worker (n=273), and non-worker (n=1275) Population of a city near Tokyo, over half of workers commute to Tokyo for employment, 11% agricultural lands around the city. Excluded those in care homes or needing basic care. 42%	Cohort study, mailed survey at three points 2008, 2010, 2012 ANCOVA analysis	Self-rated health, Mental health (Geriatric Depression Scale 15), Higher-Level Functional Capacity Tokyo Metropolitan Institute of Gerontology Index of Competence (activities of daily living)	Full-time and part-time workers were almost at a same level but significantly better than non-workers at self-rated health, GDS15, and TMIG-IC ($p<0.001$) Estimated from chart – full time workers self-rated health 0.9, part time 0.85, non-workers 0.7. Very wide confidence interval for non-workers. Estimated from chart - full time workers depression 4, part time 4, non-workers 5. Wide confidence interval for non-workers. Estimated from chart functional capacity – full time 12, part time 12, non-workers 11. Wide confidence intervals. Both mental health and HLFC in people aged 65 years and over significantly worse in those retired; especially, mental health worsened rapidly and HLFC gradually. However, these indicators didn't worsen in subjects who changed from full-time jobs to part-time jobs. Quitting from part-time jobs deteriorated mental health gradually and HLFC moderately compared to full-time jobs.	Adults who retire from full time jobs deteriorate in their mental health and functioning. Work is an effective way of social participation for the over 65s.

	male, 25% college degree or above, 16% self-employed, 64% in lowest income bracket.				
Morelock 2017 US	Older workers healthcare n=437	Time and place management intervention (management of choice and control processes not only flexible working options)	Workability – competence, health, mental and physical requirements to carry out a job. Survey data and telephone interviews.	The research team and Modern Medical personnel developed a 30-min learning module. The learning module encouraged greater discussion among managers and employees about making TPM fit requests, or requests to change schedules for a better fit between work and personal responsibilities. The intervention had a positive effect on the relationship between age and workability. Baseline workability and outcome workability are positively correlated at r = .507 ($p < .05$), age is negatively correlated with outcome workability, at r = −.143 ($p < .05$). There was slight evidence that occupation was a factor in workability in this sample. Several main effects (treatment, b = −.451, $p < .01$; baseline workability, b = 0.436, $p < .001$), two-way interactions (Treatment × Baseline Workability, b = 0.276, $p < .01$; age and baseline workability, and b = 0.026, $p < .05$), and threeway interactions (Treatment × Age Squared × Baseline Workability, b = −0.006, $p < .05$) have significant effects.	The intervention is promising for older workers with low workability
Okamoto 2018 Japan	Aged 60 or older males N=1288	Cohort study. Followed for up to 15 years. Survey samples men and women, followed up every three years, data	Death, cognitive decline via mental status questionnaire, self-reported symptoms of stroke, diabetes	Men in paid employment lived 1.91 years longer (95% confidence interval, CI: 0.70 to 3.11). Difference in onset time $p<0.001$. Those in employment had an additional 2.22 years (95% CI: 0.27 to 4.17) before experiencing cognitive decline $p=0.003$ (unemployed = 7.58 years to onset, while men with employment had 11.20 years). Significantly fewer percentage in employment affected 3% versus 6% $p<0.001$.	Being in paid work past the current age of retirement has positive effects on health.

		collected via face to face interviews. National Survey of the Japanese Elderly. Propensity score method of analysis.		Those in employment had a longer period before the onset of stroke 8.03 years versus 5.84 years p=0.0001. Difference in percentage affected p=0.007 14% versus 20% stroke. No difference in time to onset (3.96 versus 4.06 years) or percentage affected for diabetes both 23% p=0.878. Subjective feelings of being in poor health were significantly higher for individuals not in employment (average 17% versus 7%). Those who were self-employed had longer life expectancy than employees, but adverse diabetes/stroke outcomes.	
Potocnik 2013 European dataset	Retirees and older employees: 2,813 retirees and 1,372 older employees. Average age was 69.79 years, with a range of 50–99 (SD = 7.61). Retirees had a mean of 9.92 (SD = 4.43)years of education.	Cohort study, 2 year follow up: survey of health, ageing and retirement in Europe (SHARE) project – aged 50+	Engaging in activities Depression Quality of life	Volunteering or engaging in sporting and social clubs improved quality of life of retirees baseline to follow up. These activities had no impact on older employees. For older employees with low levels of depression though, taking part in political or community organisations was associated with decreased depression at follow up (although those with higher depression at baseline had reduced effect).	Intervention programmes and preventive measures should stimulate engagement in community and leisure activities
Stenholm 2014 Finland (data from US)	Aged 65-85 years average age 69 in working group	Cohort study Data from US Health and Retirement Study 1992-	Self-reported physical functioning (0-10 score) included mobility and	The number of physical functioning difficulties was higher with increasing age, but the increase was significantly smaller while in full-time work than in retirement (test of interaction p=0.002). The number of physical functioning difficulties increased 0.49 (95% CI 0.31 to 0.67) per every	Physical functioning declines faster in retirement than in full-time work, The absence of chronic

	and 74 in retired group. N=17,844 Those in full time employment, not disabled or those full time retired. Greater proportion males than females in all full time work groups (61-74%), similar age of retirees. 81-90% White, around 50% high school educated, spread of wealth, around 40% never smoked, around 40% normal weight, around 33-40% at least one disease, 45% of those retired two or more diseases.	2010, collected every 2 years. Average length of follow up 5.6 years. Linear regression analysis.	activities of daily living	10 years increase in age when in full-time work, and by 0.63 (95% CI 0.54 to 0.72) when in retirement. The number of physical functioning difficulties was higher amongst women, those with low education or low non-housing financial wealth, both among the full-time workers and retirees.	diseases and lifestyle-related risks amongst full time workers did not completely explain the differences. Extending working life may help to maintain physical functioning even among very old adults.

Tomioka 2018 Japan	N=6417 Aged over 65 years Four groups – those not working, those retired during study, those not previously working but acquired new paid work, those continued paid work	Cohort study, three year follow up. Postal questionnaire. Mean age at baseline was 72.9 years (range 65–99 years), 47.9% were men and 19.0% reported having paid work at baseline.	Care needs Cognitive decline Activities of daily living	Older men who were not working at baseline but sought work had a decreased likelihood of having long term care (0.41 CI 0.17-0.98) than those retired. Men who continued working had less likelihood of requiring long term care (OR 0.22 95% CI 0.09-0.54) and cognitive decline (OR 0.69 95% CI 0.09-0.66) than those retired or who started employment. Men who sought work had less likelihood of decline in activities of daily living (0.42 CI 0.22-0.78) than those retired or continuing to work. Older women who started working were less likely to require long term care (0.24 CI 0.09-0.66) and have lower risk of decline in activities of daily living (0.39 CI 0.16-0.99) than those retired or continuing to work. Older women who continued to work had a lower risk of decline in activities of daily living (0.39 95%CI 0.16-0.99), cognitive performance (0.40 CI -.22-0.71) and long term care (0.32 CI 0.15-0.68) than those who retired. Note: the Crude ORs for those retired had wide Cis crossing 1.	Encouraging older people to stay in the workforce contributes to increasing healthy life expectancy
Welsh 2016 Australia	836 older workers (440 men and 396 women) aged 50–59 years at baseline (2002). 556 (66.5 %) were classified as continuing workers, 192 (22.9 %) as voluntary retirees and 88 (10.5 %) as	Cohort study, 9 year follow up. Household, Income and Labour Dynamics in Australia (HILDA) Survey. Interview data supplemented with postal survey for “sensitive questions”.	Self-rated physical and mental health, health behaviour: within-person change in self-rated, physical and mental health and one health behaviour (physical activity) at two time points over a nine year follow-up period.	Little difference in health outcomes between those working and those who voluntarily retired. The models showed no evidence of significant difference for self-rated health (p=0.825), physical functioning (p=0.687) or mental health (p=0.123). However when employment was considered as separate terms of job quality, health outcomes diverged. Compared to voluntary retirees, older workers who had worked in good quality jobs reported marginally better self-rated health (0.14−0.02–0.29); but did not differ in their physical (2.31,−1.09–5.72) or mental health (0.51,−1.84–2.87). In contrast, older workers who held poor quality jobs for most of the follow-up period declined in their self-rated (−1.13−0.28–−0.02), physical (−4.90, 8.52–−1.29) and mental health (−4.67, 7.69–−1.66) relative to	Ensuring older workers have access to secure jobs which allow for control over work time, skill use and fair rewards is essential if policy goals to boost participation and productivity, as well as reduce the health and care costs of the elderly, are to be met

	involuntary retirees.	Regression analysis		voluntary retirees. Older workers who held poor quality jobs part of the follow-up period did not differ from voluntary retirees in terms of their health. But there was evidence of a linear relationship between length of exposure to poor quality jobs and decline in health outcomes. There was a trend among continuing workers (compared to voluntary retirees) for reduced levels of physical activity over time (p=0.056).	

Appendix 5: Completed quality appraisals

Reviews

Author/year	1 Focused question	2 Right type of papers	3 All relevant included	4 Quality appraisal	5 Results combined reasonable?	6 Precision of results	7 Local population	8 Outcomes considered	9 Benefits / harms	Notes
Blok 2011	Y	Y	Y	NR	Y	Y	NA	Y	NA	
Farrow 2012	Y	Y	Y	NR	Y	Y	NA	Y	NA	

Randomised controlled trials

Title/ author	1 Focused question	2 Random assignment	3 Ppt accounted for	4 Blinded	5 Groups similar	6 Groups treated same	7 Treatment effect size	8 Treatment effect precision	9 Local context	10 Outcomes considered	11 Benefits worth costs?	Notes
Morelock 2017	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	

Cohort and cross sectional studies

Author/year	1 Clearly focused issue	2 Recruitment acceptable	3 Exposure	4 Outcome	5 Confo unders	6 Follow up	7 Precision of results	8 Believe results	9 Local help	10 Fit	11 Prac-tice	Notes
Anxo 2019	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	
Carrino 2018	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	
Di Gessa 2017	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	
Di Gessa 2018	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	
Fujiwara 2016	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	
Kajitani 2011	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	
Kalousova 2015	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	
McDonough 2017	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	
Minami 2015	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	NA	Cross sectional no follow up
Okamoto 2018	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	
Potocnik 2013	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	

Stenholm 2014	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	
Tomioka 2018	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	
Welsh 2016	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	