Title: Labour force transitions and changes in quality of life at age 50 to 55 years: evidence from a birth cohort study.

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Abstract

In the context of an ageing population and longer working lives, the impact of increasing rates of early exit from the labour force on quality of life is a particularly current concern. However, relatively little is known about the impact on quality of life of later life labour force transitions and various forms of early exit from the labour force, compared to remaining in employment.   This paper examines life course labour force trajectories and transitions in relation to change in quality of life prior to the State Pension Age. Life course data on early life circumstances, labour force trajectories and labour force transitions from 3,894 women and 3,528 men in the National Child Development Study (1958 British Birth Cohort) were examined in relation to change in quality of life, measured by a short-form version of CASP, between ages 50 and 55 years. Women and men differed in the types of labour force transition associated with positive change in quality of life, with men more frequent beneficiaries. For both men and women, labour force exit due to being sick or disabled was associated with a negative change in quality of life, whereas joining the labour force was associated with a positive change in quality of life. Moving into retirement was associated with a positive change in men's quality of life, but not women's. Moving from full-time to part-time employment was associated with a positive change in women's quality of life, but not men's. The findings that stand out for their policy relevance are: the threat to the quality of life of both women and men from early labour force exit due to limiting longstanding illness; and, women are less likely to experience beneficial labour force exit in

the later years of their working life, but are more likely to benefit from a reduction in working hours.

Introduction

Increasing rates of early, involuntary and permanent exits from the labour force prior to State Pension Age (Department for Work and Pensions, 2014; OECD, 2011), which have been intensified by the impact of the Covid-19 pandemic on the labour force (ONS, 2022a), make the impact of labour force transitions prior to State Pension Age on quality of life a particularly current concern. Adults below the State Pension Age who are classified as unemployed or unable to work due to illness or disability experience worse health and wellbeing outcomes and report a poorer quality of life (McKee-Ryan et al., 2005; Norström et al., 2014; Roelfs et al., 2011; Wanberg, 2012). Illness or disability itself may be a reason for non-participation in the labour force (Wanberg, 2012), but evidence from numerous studies points towards a likely influence of labour force participation on health, wellbeing and quality of life (van der Noordt et al., 2014). There is also evidence from international labour force surveys demonstrating that adults below the State Pension Age with a long term limiting illness or a disability can successfully participate in the labour force (Powell, 2021), and that continued employment or a return to employment may be beneficial to health and wellbeing (Etuknwa et al., 2019; Kamdar et al., 2020). However, relatively little is known about the impact on quality of life of various forms of early labour force exits and transitions, compared to those who remain employed.

The impact of early labour force exit on quality of life is particularly important in the context of the increases in life expectancy during recent decades and current increases in the State

Pension Age. Moreover, figures from the Over 50s Lifestyle Study in the UK show that for most adults aged 50 to 59 years old (77%), departure from their previous employment was sooner than expected (ONS, 2022a), and the proportion of those aged 50 to 59 who have not returned to employment has increased since pre-Covid-19 pandemic levels (ONS, 2022a). Analyses by Shelton et al. (2019) have revealed that approximately 10% of workers leave the labour force between the ages of 50 and 55. This represents a significant proportion of the population and a figure that may currently be higher due to increased rates of permanent labour force exit during the Covid-19 pandemic (ONS, 2022a). The age period 50-55 years represents the earliest point at which both a significant proportion of the population leaves the labour force and the prevalence of limiting longstanding illness rises, although relatively little is known about the impact on quality of life on labour force transitions at this life stage.

There are several "push and pull" factors that influence different types of voluntary and involuntary labour force transitions at this age. For example, personal and family financial circumstances including levels of savings and pension provision may influence decisions to exit the labour force voluntarily by taking early retirement (Topa et al., 2018). Cultural factors such as normative gender roles may provide barriers or facilitators to remaining in employment at this life stage due to expectations about family and care responsibilities (Patrick et al., 2016). In addition, workplace and economic contexts may influence involuntary transitions that are imposed upon workers due to the financial situation of the employer, or external factors such as a global financial crisis or a pandemic (ONS, 2022a). By their nature, these factors suggest either a negative (push) or positive (pull) influence on an individual experiencing the labour force transition. There is therefore, likely to be a

corresponding negative or positive impact on the quality of life experienced by this individual.

Office for National Statistics Data in the UK suggests that women and men aged 50 to 55 leave the labour force at similar rates (Shelton et al., 2019), although there are likely to be substantial gender differences in the "push and pull" factors impacting labour force transitions at this life stage. Moreover, there may be gender differences in the impacts of these transitions on quality of life. The aim of the present paper is therefore to utilise detailed data from the from the National Child Development Study (NCDS) to analyse impact on quality of life of labour force transitions at this life stage, life course labour force participation and other pertinent life course factors such as early childhood disadvantage.

Literature review

There is a limited amount of evidence to suggest that voluntary exit from the labour force prior to State Pension Age via early or partial retirement can result in positive changes in quality of life due to increased autonomy and pleasure (Topa et al., 2018). However, most adults who exit the labour force before State Pension Age do not do so voluntarily (Department for Work and Pensions, 2014; ONS, 2022a). Involuntary early labour force exit due to unemployment or onset of an illness may negatively impact quality of life by limiting autonomy, pleasure and self-realisation (van Rijn et al., 2014).

There are substantial differences between women and men in the reasons for early labour force exit. Recent data from the UK shows that men are more likely to leave employment voluntarily because they no longer need the money, while women are substantially more likely to exit the labour force early to care for family members or look after their home (ONS, 2022a). It is also likely that the impacts of leaving or joining the labour force on quality of

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life before State Pension Age are not independent of labour force experiences throughout the life course (Nicholls et al., 2009). In the present paper, we focus on the impact of these life course factors and labour force transitions on changes in quality of life for women and men before State Pension Age, specifically between 50 and 55 years old, using data from the National Child Development Study (Power & Elliott, 2006).

A measure of quality of life in later life has been developed (Hyde et al., 2003) and tested (Wiggins et al., 2008). The original version of this CASP measure, the acronym of Control, Autonomy, Self-realisation and Pleasure, consisted of 19 Likert Scale items, hence CASP-19 (Higgs et al., 2003), with subsequently a variety of short-form versions custom-made for use in large scale social surveys CASP-12, CASP-6v.1, CASP-6v.2 (Hyde et al., 2015). The CASP measure uses a needs-satisfaction approach, with a focus on needs towards the top of Maslow's hierarchy of needs (Maslow & Lewis, 1987). The assumptions of the needs-satisfaction approach are that quality of life is determined by the extent to which these higher-level needs are satisfied. A strength of the CASP measure is its grounding in the theory of subjective wellbeing. The measure follows the three criteria of subjective wellbeing described by Diener (Diener, 1994): i) Subjectivity – based on the experience of the individual; ii) Includes positive factors that go beyond the absence of negative factors; ii) A global assessment – including multiple domains. The four domains measured by CASP are the origin of the acronym: **C**ontrol, **A**utonomy, **S**elf-realisation and **P**leasure.

The psychometric properties of the CASP measure have been tested extensively in different contexts. Various versions of the CASP measure have been used in studies across more than twenty countries and it has been translated into several other languages (Hyde et al., 2015). The 19-item version of the CASP measure has been shown to have the power to

discriminate between population subgroups and to detect longitudinal change in quality of life (Howel, 2012). Analyses of the 6-item CASP measure using a sample of 55 year old NCDS cohort members found that its measurement properties were robust even when using different modes of data collection such as telephone and web-based surveys (Wiggins et al., 2017).

Studies using CASP as an outcome measure have revealed that quality of life at age 50 had life course precursors such as deprivation and family discord in childhood (Blane et al., 2012) and that such relationships could be mediated by labour market factors. Advantaged circumstances during childhood were associated with both lower levels of labour market disadvantage in adulthood and higher quality of life at older ages; and part of the association between childhood circumstances and later quality of life was explained by labour market disadvantage (Wahrendorf & Blane, 2015).

There are multiple reasons why an adult may exit the labour force either voluntarily or involuntarily before reaching State Pension Age. However, the focus of many studies has been on how poor health status can lead to labour force exit (Riekhoff & Vaalavuo, 2021). Much less is known about how leaving the labour force due to early- or partial- retirement, involuntary unemployment or long-term illness can impact the quality of life of adults before they reach State Pension Age. Furthermore, few studies have examined the impact of changing jobs or joining the labour force later in life on subsequent quality of life.

Full or partial retirement is common in mid to late career and is often motivated by the potential health and wellbeing benefits of disengaging from working life (Schalk & Desmette, 2015), although a review of longitudinal studies found inconclusive evidence of the positive or negative impacts of early retirement on health or quality of life (Topa et al., 2018). There

is a lack of consensus in the theoretical literature on whether early full- or partial retirement may be beneficial to health and quality of life through reductions in stress and health risk behaviours or whether the retirement process may be a risk factor for illness and frailty (Brockmann et al., 2009).

In addition to seeking a reduction in working hours, many adults aged 50+ experience voluntary or involuntary job transitions (Mcnair et al., 2004). A job transition or a return to employment in the period before State Pension Age is commonly motivated by a desire to change social environment, lifestyle, financial circumstances, or improve physical and mental health (ONS, 2022b). However, the impact on quality of life of job transition or re-entry into the labour force in early old age has been studied less frequently than the impact of labour force exit. The focus of many previous studies has been return to work as an outcome following a period of unemployment or absence due to ill health (Kamdar et al., 2020). For example, a longitudinal study by Carlier *et al*., (2013) found that return to work following unemployment was associated with improvements in quality of life and self rated health in a sample of adults aged 18+ years. There remains a scarcity of studies examining the impact of labour force entry on quality of life in the period preceding State Pension Age.

Much is known about the negative impact of being unable to work due to job loss or long-term illness or disability, but relatively little is known about the impact of leaving the labour force for these reasons during the later stages of an adult's career. A longitudinal study by Halleröd, Örestig and Stattin (2012) examined the impact of early labour force exit due to long-term illness or disability force on a multi-dimensional health and wellbeing measure in adults aged 55 to 75 years. Their main finding was that moving into health- and unemployment-related social benefit programmes prior to retirement did not have a

negative impact on health and wellbeing after controlling for health and wellbeing prior to labour force exit. Another longitudinal study by Hyde *et al.* (2015) reported increased odds of depression for adults aged 50+ whose labour force exit was involuntary after controlling for factors including baseline depression.

Labour force trajectories and transitions across the life course have been shown to vary substantially between men and women (Madero-Cabib et al., 2021). Indeed, life course employment and family experiences are strongly interconnected (Madero-Cabib et al., 2022; Tosi & Grundy, 2021). At the stage of life that precedes State Pension Age, many adults take on additional caregiving roles for older relatives, partners or grandchildren (Bauer & Sousa-Poza, 2015). Informal caregiving for these adults is associated with reduced working hours and a greater chance of leaving the labour force permanently (Carmichael et al., 2008). There is a substantial evidence base pointing to the negative mental health and wellbeing outcomes experienced by informal caregivers (Bom et al., 2019), although there is little evidence on the influence of this type of labour force exit on quality of life prior to the Stage Pension age.

To understand the impact of labour force participation, entry and exit on quality of life, it is important to consider how careers unfold over the whole life course, including the timing of entry to and exit from the labour force. Research on the health and wellbeing impacts of life course employment trajectories is an emerging field of research (Devillanova et al., 2019; Ek et al., 2021; Madero-Cabib et al., 2022; Tambellini, 2021). Examining employment histories between age 15 and 45, Devillanova, Raitano and Struffolino (2019) found that employment histories featuring periods of intermittent work were associated with poorer self reported health at age 45. Ek *et al.* (2021) studied the impact of employment

trajectories on work-related wellbeing at age 46, finding higher levels of wellbeing among those who had the longest spells in employment and self-employment, compared with those who had shorter periods in long term employment.

In addition to the impact of labour force participation on health and quality of life, evidence from longitudinal studies points to the enduring influence of early life circumstances on healthy ageing (Brandt et al., 2012). Life course theories in epidemiology are used to explain how early life exposures can influence health and wellbeing across an individual's life course (Blane et al., 2007). Two prominent life course theories are used to explain how exposures from early childhood onwards can impact health and quality of life: i) The 'accumulation model' suggests that as the duration, frequency and severity of adverse exposures increase, damage accumulates in systems relevant to health and wellbeing; ii) The 'critical period' model identifies specific 'time windows' such as early childhood in which exposures present the greatest risk of damaging systems relevant to health and wellbeing (Kuh et al., 2003).

Much research has been focussed on the association between early life exposure to low socio-economic status and later life and health outcomes including obesity (Cameron et al., 2015; Monasta et al., 2010), cardiovascular disease (Galobardes et al., 2006), and mortality (Galobardes, 2004). Labour force disadvantage over the life course and childhood circumstances were analysed in relation to quality of life at older ages in a study by (Wahrendorf & Blane, 2015) using data from SHARE (Study of Health, Ageing and Retirement in Europe). The main findings of this study were that disadvantaged circumstances during childhood and higher levels of life course labour force disadvantage were associated with

lower quality of life (measured by a 12 item version of CASP) in a sample with a mean age of 67 years for women and 69 years for men.

The present study builds on these findings using the National Child Development Study (NCDS) labour force activity histories dataset and detailed measures of childhood circumstances to examine the association between early life and working age exposures and change in quality of life between 50 and 55 years. The most significant differences between the present study and previous longitudinal studies is the focus on change in quality of life at this life stage prior to pension age, whereas previous studies have focussed on quality of life measured at one point in time (Blane et al., 2012) or have measured quality of life at a later stage of old age (Eva et al., 2015; Wildman et al., 2018).

As well as their substantive scientific interest, the present analyses have policy relevance. The UK Parliament has legislated increases in the age of entitlement to the State Pension, to date by six years for women (from 60 to 66 years) and one year for men (from 65 to 66 years), with further increases planned for both women and men to 67 years in 2027 and 68 years in 2038. Many other countries have done something similar. Whether this prolonged exposure to an extended working life will impact quality of life remains to be seen, as does whether objective physical health is equally unaffected and whether those already in poor health are at increased risk of deterioration. The present NCDS analyses will examine pre-existing factors in the run-up to the NCDS cohort's extended working life.

Research Questions

Building on this literature and with the intention to fill the identified gaps in knowledge, the presently reported analyses ask which labour force trajectories during ages 16-49 years, and types of labour force transitions between 50 and 55 years are associated with change in

quality of life between 50 and 55 years; and as a corollary, what other life course factors are influential.

Methods

Data

The National Child Development Study (NCDS) is a birth cohort study of children born in Scotland, Wales and England in one week of 1958 (Power & Elliott, 2006). This initial survey was followed-up by survey sweeps at ages 7, 11, 16, 23, 33, 42, 44, 46, 50 and 55 years (Din, 2014). The survey sweeps include information on educational and social development in early life, health outcomes and labour force participation throughout the life course and measures of quality of life at ages 50 and 55. Data from these survey sweeps is supplemented by a retrospective activity history dataset containing detailed information on employment histories, labour force participation, and non-work activities covering each month of the lives of participants from ages 16 to 55 (University of London, Institute of Education, Centre for Longitudinal Studies, 2020).

The presently reported analyses utilise NCDS life course data on early life circumstances (ages 0 to 16 years), employment histories (ages 16 to 55) and quality of life measured at ages 50 and 55 years. Of the 17,415 NCDS participants at birth in 1958, 9,789 completed the survey at age 50 and 9,137 at age 55. The analytic sample for the present study consisted of the 7,422 participants who had full data on quality of life at ages 50 and 55 years.

Measures

Quality of life: The outcome for this study was measured using a six-item quality of life measure derived from CASP-19 at ages 50 and 55 (Wiggins et al., 2017). CASP is a widely used survey measure of quality of life designed to capture more positive experiences in the early stages of later life than previous quality of life measures that have focussed on poor health (Hyde et al., 2003). CASP is the acronym of its four domains: **C**ontrol, **A**utonomy, **S**elf-realisation and **P**leasure. The reduced six-item version contains three items from the Control domain (*My age prevents me from doing the things I would like to do; I feel what happens to me is out of my control*; *I feel left out of things*) and three from the Self-realisation domain (*I feel full of energy these days*; *I feel that life is full of opportunities*; *I feel that the future looks good for me*). All six items are ordinal with four options (0=*Never*; 1=*Not Often*; 2=*Sometimes*; 3=*Often*) with negatively worded items reverse coded so that higher values on all items represent better quality of life - we summed these items to create an overall quality of life scale with a maximum possible score of 18 and a minimum of zero. We then created a scale to represent change in the quality of life by subtracting the scores at age 50 from the score at age 55.

Early life influences: We used data from the NCDS survey sweeps at birth and ages 7, 11 and 16 years to generate the following early life variables: 1) Socio-economic circumstances at birth using a binary measure of the social class of the father's occupation, as allocated (manual or non-manual) by the Registrar General's classification;   2) A binary measure of childhood disadvantage was defined as exposure to one or more of the following disadvantages: a) At NCDS participant's birth whether the father was employed in an occupation allocated to Registrar General's social class IV or V; b) At age 7 the NCDS participants' parents report having financial difficulties; c) At age 11 the NCDS participants received free school meals; d) At age 16 the NCDS participants' parents self-reported financial difficulties; 3) At NCDS participants' age 7, parental discord was reported by a health visitor (Yes=1; No=0); 4) At NCDS participants' age 7, a parent had died or the parents had separated (Yes=1; No=0).

Labour force participation: The NCDS retrospective activity history data set was used to generate variables representing employment status at every year from ages 16 to 49. A binary variable for each year was created to represent whether the participant was in employment or not in employment for the majority of each year. These variables were created by using the reported activity during each year with the longest duration (e.g. if a participant reported being in full time employment for seven months and in education for five months of a year, they would be classified as 'in employment'). If participants reported two or more activities of the same duration, the later activity was recorded.

Change in labour force participation: A nominal variable was created to represent change or continuation in labour force participation between ages 50 and 55 years: (1) Continuously employed; (2) Moved from full-time to part-time employment; (3) Changed employer; (4) Exited labour force before age 50 or never joined; (5) Became unemployed (seeking work) between 50 and 55; (6) Became temporarily or permanently sick or disabled between 50 and 55; (7) Began looking after home or family full-time or on maternity leave between 50 and 55; (8) Wholly retired, joined education or training or began travelling or an extended holiday between 50 and 55; (9) Joined the labour force between 50 and 55.

Covariates: Covariates measured at age 55: Female or male; Marital status; Presence of a limiting longstanding illness (Yes / No); Socio-economic circumstances at age 55 measured by the three category National Statistics Socio-Economic Classification (NS-SEC) of occupations.

[Figure 1 near here]

Statistical Analyses

Figure 1 shows the approach used to simultaneously examine relationships between three sets of exposures: 1) early life influences (birth to 16 years); 2) labour force trajectory classes (age 16 to 49), and; 3) change in labour force participation (age 50 to 55), and change in the quality of life (QoL) outcome between age 50 and 55. All analyses were conducted separately for women and men, reflecting the anticipated substantial gender differences in life course labour force participation (Engels et al., 2019; Madero-Cabib et al., 2021). First, a Latent Class Growth Analysis (LCGA) (Berlin et al., 2014) was used to classify participants into sub-populations (latent classes) based on similarities in their patterns of employment history between ages 16 and 49 years using a binary indicator variable

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representing employment status at each year (the indicator variables for ages 18 to 47 are omitted from Figure 1 for simplicity). The LGCA part of the model was estimated first to identify the number of latent trajectory classes for men and women. The most likely class memberships were saved for use in the final analytic models where linear regression models were used to estimate associations between all exposure variables and the change in the QoL outcome scores between age 50 and 55. Missing data were accounted for using a Full Information Maximum Likelihood (FIML) approach in Mplus (Muthén & Muthén, 2017). All data preparation and analyses were conducted in Stata version 15.1 and Mplus version 8.1.

Results

A total of 3,894 women and 3,528 men born in 1958 were included in our analytic sample, which was more likely than the general population to be employed at ages 50 and 55 years and less likely to be either unemployed or economically inactive (see Supplementary Table 1).

We tested, separately for women and men, Latent Class Growth Analysis models using one up to eight latent classes of employment trajectory between ages 16 and 49 years. A range of model fit criteria were considered alongside the interpretability of the number of classes. Both the Vuong-Lo-Mendell-Rubin likelihood ratio test (VLMR-LRT) and the Lo-Mendell-Rubin adjusted likelihood ratio test (LMR-ALRT) indicated that a six class model for women and a five class model for men was optimal (Supplementary Table 2). We selected models on the basis of these criteria and the model's interpretability relative to models with an alternative number of classes (Weller et al., 2020). The employment status trajectories classes are shown in Figure 2 (women) and Figure 3 (men), labelled descriptively according to their employment pattens as follows: (1) 'Mostly employed'; (2) 'Early joiners'; (3) 'Later

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joiners'; (4) 'Latest joiners'; (5) 'Mostly not employed', and (6) 'Early leavers' - this sixth class exists for women only.

Table 1 shows descriptive statistics for this sample, proportions of missing data and the mean values for the change in QoL score between age 50 and 55. To give some context for the interpretation of these mean changes in QoL, the mean difference in QoL score between top and bottom deciles of the income distribution at age 55 is 1.96. The proportions of women and men exposed to disadvantaged circumstances in early life were broadly similar on all measures (Table 1). The employment trajectory classes were substantively different for men and women, not only in the number of classes but in the distribution of class membership (Figure 2 and Figure 3). Class membership for men was predominantly characterised by the timing of entry into the labour force whereas the trajectory class membership for women suggested more complex patterns of entry and exit from the labour force between 16 and 49 years old. A higher proportion of women had left the labour force prior to age 50 and left the labour force between 50 and 55 to look after home or family (Table 1).

[Table 1 near here]

[Figure 2 and Figure 3 near here]

Table 2 (women) and Table 3 (men) show the unadjusted and fully adjusted associations between change in quality of life between ages 50-55 years and life course characteristics: changes in labour force participation between 50 and 55 years; employment history trajectories (16-49 years), and: early life exposures (birth to 16 years). Two types of labour force transition between 50 and 55 years were associated with changes in quality of life for both women and men. Firstly, labour force exit due to being sick or disabled between 50

and 55 was associated with a negative change in QoL score for both women (coeff = -1.365, 95% CI: -2.490 to -0.152) and men (coeff = -2.065, 95% CI: -3.449 to -0.652). Secondly, for both women and men, joining the labour force between 50 and 55 was associated with a positive change in QoL score (Women: coeff = 0.721, 95% CI: 0.051 to 1.368; Men: coeff = 1.091, 95% CI: 0.363 to 1.850).

We found gender differences in the impact on QoL of two forms of labour force transition. Firstly, for men, but not for women, labour force exit between 50 and 55 years was associated with a positive change in QoL score if it was due to moving into retirement, education, training, travel or extended holiday (Men: coeff = 0.808, 95% CI: 0.073 to 1.585; Women: coeff = 0.526, 95% CI: -0.103 to 1.128). Secondly, moving from full-time to part-time employment was associated with a positive change in women's QoL, but not men's (Women: coeff = 0.508, 95% CI: 0.074 to 0.956; Men: coeff = -0.162, 95% CI: -0.681 to 0.390). Other types of labour force transitions between ages 50 and 55 were not associated with changes in quality of life (see Tables 2 and 3).

[Tables 2 and 3 near here]

Labour force trajectory classes had limited impact on change in quality of life. Specifically, we found that being a member of the *latest joiners* employment trajectory class was associated with a positive change in QoL score for women (coeff = 0.307, 95% CI: 0.053 to 0.569), but not for men (coeff = 0.078, 95% CI: -0.382 to 0.470). Other employment trajectory classes were not associated with changes in QoL for women or men between ages 50 and 55, although further analyses found they were associated with QoL at age 50 years (see Supplementary Table 3). Early life exposures were not associated with a change in QoL for men or for women.

Discussion

Based on the work described above, the answers to our research questions are: (1) employment trajectories are not an important influence on change in quality of life during the later years of working life; (2) exit from the labour force due to developing a limiting longstanding illness is a major negative influence on quality of life for both women and men; (3) exit from the labour force due to moving in to retirement education, training or travel is associated with a positive change in quality of life for men, but not associated with a change in quality of life for women; (4) for both women and men, re-joining the labour force after age 50 is associated with a positive change in quality of life; (5) moving from full-time to part-time employment after age 50 is associated with a positive change on quality of life for women, but is not associated with a change in quality of life for men. These findings are based on data collected prospectively across the life course, so far to age 55 years, from an initially population-representative sample which any selective attrition will have biased in a conservative direction. In other words, our results probably under-estimate the situation in the wider British population. It is also worth remembering that the CASP quality of life measure predicts mortality risk, at least in the short term (Netuveli et al., 2012).

The findings that suggest gender differences in the impact of two types of labour force transition warrant some further discussion. The first finding was that moving into retirement at this life stage is associated with positive changes in quality of life for men, but not for women. Gender differences in the antecedents of early retirement, summarised by Topa et al., (2018), provide potential explanations for gender differences in their impact on quality of life: i) women have, on average, lower levels of savings for retirement; ii) women are more likely than men to experience work-related depression and anxiety; iii) women are

more likely than men to adopt multiple social roles, activities and responsibilities before, during and after the transition to retirement. The second finding that differed by gender was that moving from full-time to part-time employment after age 50 is associated with positive changes to quality of life for women, but not for men. A potential explanation for this difference is that a transition to part time work for women may more often be associated with improvement in work life balance (when adopting multiple social roles), while for men this transition may more often be for negative reasons such as poor health or difficulty retaining full time employment (Lyonette, 2015).

The NCDS activity history data provides detailed information on employment activities, and we were able to derive from these data detailed information on labour force transitions between ages 50 and 55. However, we do not have detailed information about the "push and pull" factors that may prompt labour force transitions at this stage. For example, levels of available pension provision, workplace incentives for staying in employment and barriers to labour force participation (Shelton et al., 2019).   Further research is needed to understand how these push and pull factors influence voluntary and involuntary labour force transitions, subsequent impacts on quality of life and whether these impacts differ by gender (Patrick et al., 2016).

Employment trajectories, it would seem, are not the most relevant aspect of labour market disadvantage. Perhaps future studies should consider more structural factors like the social class of the occupation in which a person is employed or more biologically targeted measures like Johannes Siegrist's Effort-Reward Imbalance Model (Siegrist, 2017), which focusses on the health impacts of recurrent stressful employment conditions under which relatively few rewards are returned.   These results may also help narrow down possible

explanations for Wahrendorf and Blane's (2015) finding that labour market disadvantage partly explains the association between early life socio-economic circumstances and quality of life in early old age. However, it is important to note that while we found these labour force trajectories to play a less important role in change in quality of life between 50 and 55 years, further analyses revealed that these trajectories were associated with quality of life at age 50 (Supplementary Table 3).

The most significant differences between the present study and previous longitudinal studies is the focus on *change* in quality of life at this life stage prior to pension age. Previous studies have used measures of quality of life at one point in time, at a later stage of old age and used different measure of socioeconomic status and labour force participation. For example, Wildman et al., (2018) examined life course socioeconomic factors associated with quality of life in adults ages 62 to 64, finding that higher occupational socioeconomic status in mid-life, consistent employment and freedom form a mortgage in adulthood were associated with better quality of life. Bielderman et al., (2015) found that socioeconomic status measured by monthly net income and highest education level was not directly associated with the quality of life of adults aged 65 and older in the Netherlands. These studies by Wildman et al., (2018) and (Bielderman et al., 2015) both used CASP-19 as a quality of life measure, but differences in participant ages, and the measurement of exposure variables are likely to explain differences in findings.

The detailed life course data that the NCDS collects on social and economic circumstances across the life course are a strength of this study. In particular, the opportunity to utilise the NCDS activity history dataset is a strength, allowing us to examine labour force participation for each year from age 16 to 55 (University of London, Institute of Education, Centre for

Longitudinal Studies, 2020). In addition, our findings show that the outcome measure in the present study, a six-item quality of life measure derived from CASP-19, is an important measure for capturing the impact of labour force participation on quality of life at this life stage. This six item measure captures the Control and Self-realisation domains of the original CASP-19 tool, but does not include items measuring the Autonomy and Pleasure quality of life domains. There is potential for future research to understand the impact of labour force participation on specific domains of quality of life, possibly revealing how life course labour force participation influences these quality of life domains differentially.

There are also some limitations that should be considered when interpreting the results of our study. Despite an overall large sample size, conducting analyses separately for women and men resulted in some relatively low numbers of participants in the categories representing types of labour force exit between 50 and 55 years. We combined the categories 'Exited labour force before age 50' and 'Never joined' because the 'Never joined' group contained a small number of participants (N=38). Moreover, as the categorisation is based on participant reported histories of all employment activities, it may be difficult to make a clear distinction between participants who have never joined the labour force and those who were active in the labour force only very briefly. Low sample sizes in some categories may have implications for statistical power to detect an association between categories of labour force transition between ages 50 and 55 and the quality of life outcome measure. We have therefore conducted a further pooled analyses combining data for women and men together. We conducted the pooled analyses both with and without the sixth trajectory class that was exclusive to women. In both cases, the increased statistical power in the pooled analyses for categories with a low sample size did not produce any

substantive differences in results. We have presented the results of the pooled analyses in Supplementary table 4. Future studies following these participants beyond age 55 are less likely to have this sample size limitation as voluntary and involuntary exit from the labour force will be more common with increasing age.

The present study has focussed on labour force participation as the primary exposure during adult life. While labour force participation clearly plays an important role, there may be other important exposures during adult life that interact with labour force participation such as material deprivation (Terraneo, 2021), quality of employment (Fujishiro et al., 2021) and work-related stress (Nilsen et al., 2021). As is common to all cohort studies, we cannot make strong inferences about causal associations between exposures and outcomes due to the possible influence of unmeasured confounders (Ananth & Schisterman, 2018).

The levels of attrition we have reported in our study sample are common in longitudinal studies (Gustavson et al., 2012) and in previous studies using NCDS cohort data (Mostafa et al., 2021). By age 55, of the 17,415 original cohort members, 1,659 (9.5%) were known to have died and 1,286 (7.4%) were known to have emigrated. Between age 50 and 55, 200 cohort members were known to have died. Further detail on levels of attrition due to non-response is detailed in the NCDS user guides (Johnson & Brown, 2015). We cannot rule out the risk of bias due to selective attrition, however, simulation studies have shown that with similar levels of attrition, estimated associations between variables have good reliability (Gustavson et al., 2012). It is also important to consider levels of missing data and attrition that are specific to our quality of life outcome variable (CASP). We compared participants with CASP data at both ages 50 and 55 with those who had CASP data at age 50, but not age 55. We found that there were only small differences (<1%) in the distribution of these

participants by sex, limiting longstanding illness and NS-SEC social class (see supplementary Table 5). There were some more substantial differences by sex and NS-SEC social class when comparing participants with some CASP data to those without any CASP data at age 50 or 55. Specifically, a higher proportion of male participants and participants in NS-SEC social classes 3 to 7 had CASP data at neither age 50 nor 55. We cannot rule out the possibility that these differences may be a source of bias in the present study. The FIML approach used to account for missing data in the study sample is recommended for longitudinal data where growth models are used and has been shown to be less biased than other approaches such as pairwise or list wise deletion (Silverwood et al., 2021), however, we cannot rule out the risk of bias due to missing data.

The demonstrated importance of limiting longstanding illness is a useful reminder that the life course is both a social and biological phenomenon (Blane et al., 2016). Furthermore, the importance of limiting longstanding illness also has policy relevance. The increase in the State Pension Age will each year add an estimated three-quarters of a million employees to the work force, of whom at least 10 per cent will be in poor health (Bartley et al., 2020). This considerable challenge to scarce occupational health services and over-stretched general practice services requires mitigation through the identification of triage criteria, pending which limiting longstanding illness is probably the best interim measure. Future research could focus on how changes to the State Pension Age impact quality of life for older adults transitioning into and out of the labour force prior to reaching State Pension Age. Our findings suggest that the impact of this policy on those who have developed limiting longstanding illness is a priority. Future analyses may be able to answer whether

life course labour force participation influences the relationship between limiting longstanding illness and quality of life at this life stage.

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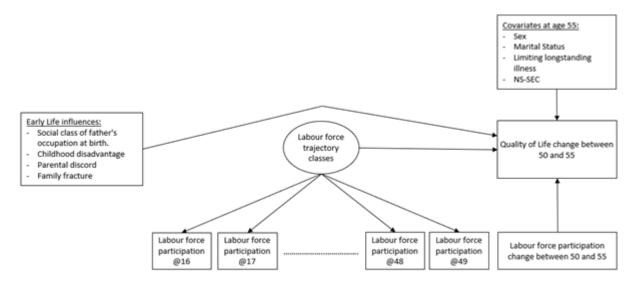
Figures:

Figure 1. Overall approach to analysis

Figure 2. Latent classes of employment trajectories (women aged 16 to 49).

Figure 3. Latent classes of employment trajectories (men aged 16 to 49).

Table 1. Descriptive statistics for exposures and mean change in quality of life between age 50 and 55.

Variable or measure	Women				Men			
			Mean CASP6				Mean CASP6	
	N	%	Change	SD	N	%	Change	SD
All	3,894	100.0	0.14	2.99	3,528	100.0	0.21	3.04
Social class of father's occupation at birth								
Manual	2,362	60.7	0.07	3.04	2,107	59.7	0.19	3.14
Non manual	1,212	31.1	0.28	2.82	1,128	32.0	0.20	2.87
Missing	320	8.2	0.11	3.31	293	8.3	0.45	2.91
Childhood disadvantage								
None recorded	2,746	70.5	0.22	2.92	2,559	72.5	0.28	2.93
At least one item recorded	1,132	29.1	-0.07	3.15	955	27.1	0.02	3.30
Missing	16	0.4	0.12	3.36	14	0.4	1.07	3.79
Parental discord at age 7								
No	3,435	88.0	0.15	2.95	3,117	88.4	0.20	3.04
Yes	139	3.6	-0.14	3.26	118	3.3	-0.10	3.38
Missing	320	8.2	0.11	3.31	293	8.3	0.44	2.91
Parents divorce, separate or died by age 7								
No	3,417	87.75	0.15	2.96	3,121	88.5	0.21	3.06
Yes	157	4.03	-0.01	3.14	114	3.2	-0.36	2.93
Missing	320	8.22	0.11	3.31	293	8.3	0.45	2.91
Employment trajectory classes (16 to 49)								
Mostly employed	1,292	33.2	0.60	3.02	596	16.9	-0.01	3.19
Early joiners	661	17.0	0.21	2.87	1,556	44.1	0.31	2.94
Later joiners	492	12.6	0.16	2.72	825	23.4	0.38	2.85
Latest joiners	689	17.7	0.35	2.97	372	10.5	0.13	3.38
Mostly not employed	451	11.6	-0.27	3.55	179	5.1	-0.53	3.39
Early leavers*	309	7.9	0.19	3.00				
Missing	0	0.0			0	0.0		
Labour force participation (50 to 55)								
Employed from age 50 to 55	2,825	72.6	1.78	2.89	2,930	83.1	0.26	2.93
Moved from full-time to part-time employment	169	4.3	0.60	2.98	115	3.3	0.06	2.87
Changed employer	67	1.7	0.75	2.95	25	0.7	0.16	3.63
Exit before 2008 (age 50) or never joined	488	12.5	-0.09	3.42	190	5.4	-0.67	3.52
Exit: Unemployed - seeking work	33	0.9	0.24	2.89	45	1.3	-0.89	3.93
Exit: Temp or permanently sick/disabled	43	1.1	-1.79	3.66	36	1.0	-2.61	4.24
Exit: Looking after home / family	108	2.8	-0.65	3.28	28	0.8	0.43	3.43
Exit: Wholly retired / education / training / travel	76	2.0	0.70	2.76	81	2.3	1.07	3.35
Joined labour force after 2008	85	2.2	0.71	3.03	78	2.2	1.26	3.27
Missing	0	0.0			0	0.0		
Marital status (age 55)								
Married / civil partnership	2,769	71.1	0.16	2.88	74	74.4	0.17	2.95
Single, never married / civil partnership	322	8.3	-0.16	2.90	383	10.9	0.38	3.11
Separated / divorced	663	17.0	0.21	3.33	477	13.6	0.30	3.34
Widowed	138	3.5	0.15	3.73	42	1.0	0.12	4.13
Missing	2	0.1	1.00	1.41	3	0.1	0.33	3.51
Limiting longstanding illness (age 55)								
No	2,558	65.7	0.31	2.84	2,425	68.7	0.44	2.87
Yes	1,323	34.0	-0.18	3.24	1,096	31.1	-0.28	3.35
Missing	13	0.3	-1.62	3.88	7	0.2	-0.57	2.37
Social class at age 55 (NS-SEC)								
NS-SEC social classes 1 & 2	1,295	33.3	0.24	2.84	1,392	39.5	0.24	2.86
NS-SEC social classes 3 & 4	1,000	25.7	0.17	2.83	1,135	32.2	0.44	2.93
NS-SEC social classes 5, 6 & 7	604	15.5	0.11	3.10	468	13.3	0.13	3.11
Missing	995	25.5	-0.01	3.27	533	15.0	-0.29	3.56

*Note: The 'Early leavers' employment trajectory class exists only for women.

Table 2. Associations between life course exposures and the change in quality of life for women between age 50 and 55.

Variable or measure	Unadjusted model (Women)				Fully adjusted model (Women)			
	Coeff	**LCI**	**UCI**	**P-value**	**Coeff**	**LCI**	**UCI**	**P-value**
Social class of father's occupation at birth								
Manual	Ref				Ref			
Non manual	**0.205**	**0.001**	**0.409**	**0.045**	0.096	-0.126	0.322	0.414
Childhood disadvantage								
None recorded	Ref				Ref			
At least one item recorded	**-0.293**	**-0.493**	**-0.081**	**0.006**	0.189	-0.414	0.041	0.118
Parental discord at age 7								
No	Ref				Ref			
Yes	-0.301	-0.850	0.235	0.288	-0.208	-0.785	0.377	0.479
Parents divorce, separate or died before age 7								
No	Ref				Ref			
Yes	-0.156	-0.610	0.264	0.534	0.096	-0.413	0.596	0.714
Employment trajectory classes (16 to 49)								
Mostly employed	Ref				Ref			
Early joiners	0.148	-0.139	0.442	0.309	0.179	-0.099	0.473	0.222
Later joiners	0.098	-0.196	0.361	0.524	0.068	-0.241	0.388	0.667
Latest joiners	**0.289**	**0.027**	**0.560**	**0.032**	**0.308**	**0.056**	**0.566**	**0.022**
Mostly not employed	0.128	-0.184	0.466	0.437	0.174	-0.169	0.540	0.343
Early leavers	-0.326	-0.755	0.080	0.136	-0.188	-0.733	0.359	0.501
Labour force participation (50 to 55)								
Employed from age 50 to 55	Ref				Ref			
Moved from full-time to part-time employment	**0.458**	**0.017**	**0.890**	**0.047**	**0.508**	**0.074**	**0.956**	**0.025**
Changed employer	0.607	-0.136	1.367	0.098	0.681	-0.084	1.410	0.065
Exit before 2008 (age 50) or never joined	-0.266	-0.573	0.026	0.093	0.154	-0.305	0.580	0.505
Exit: Unemployed - seeking work	0.065	-0.891	1.044	0.893	0.137	-0.865	1.105	0.793
Exit: Temp or perm sick / disabled	**-1.968**	**-3.119**	**-0.808**	**<0.001**	**-1.324**	**-2.448**	**-0.126**	**0.029**
Exit: Looking after home / family	-0.243	-0.915	0.339	0.452	-0.169	-0.845	0.417	0.598
Exit: Wholly retired / education / training / travel	0.520	-0.099	1.122	0.095	0.526	-0.103	1.128	0.100
Joined labour force after 2008	0.528	-0.112	1.151	0.111	**0.721**	**0.051**	**1.368**	**0.030**
Marital status (age 55)								
Married / civil partnership	Ref				Ref			
Single, never married / civil partnership	-0.317	-0.658	0.015	0.051	-0.279	-0.608	0.031	0.086
Separated / divorced	0.049	-0.229	0.321	0.722	0.112	-0.173	0.383	0.418
Widowed	-0.003	-0.664	0.593	0.991	0.095	-0.560	0.693	0.764
Limiting longstanding illness (age 55)								
No	Ref				Ref			
Yes	**-0.828**	**-1.102**	**-0.560**	**<0.001**	**-0.764**	**-1.048**	**-0.480**	**<0.001**
Social class at age 55 (NS-SEC)								
NS-SEC social classes 1 & 2	Ref				Ref			
NS-SEC social classes 3 & 4	-0.080	-0.329	0.168	0.516	-0.074	-0.321	0.171	0.552
NS-SEC social classes 5, 6 & 7	-0.149	-0.476	0.151	0.362	-0.158	-0.482	0.140	0.340

Table 3. Associations between life course exposures and the change in quality of life for men between age 50 and 55.

Variable or Measure	Unadjusted model (Men)				Fully adjusted model (Men)			
	Coeff	LCI	UCI	P-value	Coeff	LCI	UCI	P-value
Social class of father's occupation at birth								
Manual	Ref				Ref			
Non manual	0.019	-0.193	0.246	0.864	-0.116	-0.334	0.123	0.322
Childhood disadvantage								
None recorded	Ref				Ref			
At least one item recorded	**-0.258**	**-0.519**	**-0.062**	**0.033**	-0.161	-0.436	0.090	0.228
Parental discord at age 7								
No	Ref				Ref			
Yes	-0.300	-0.901	0.305	0.327	-0.132	-0.806	0.464	0.689
Parents divorce, separate or died before age 7								
No	Ref				Ref			
Yes	**-0.570**	**-1.106**	**-0.048**	**0.036**	-0.355	-0.969	0.258	0.242
Employment trajectory classes (16 to 49)								
Mostly employed	Ref				Ref			
Early joiners	**0.315**	**0.022**	**0.607**	**0.037**	0.106	-0.207	0.385	0.503
Later joiners	**0.385**	**0.050**	**0.687**	**0.017**	0.254	-0.080	0.590	0.142
Latest joiners	0.130	-0.316	0.509	0.541	0.078	-0.382	0.470	0.716
Mostly not employed	-0.522	-1.067	0.010	0.059	-0.317	-0.925	0.292	0.294
Labour force participation (50 to 55)								
Employed from age 50 to 55	Ref				Ref			
Moved from full-time to part-time employment	-0.214	-0.755	0.339	0.441	-0.162	-0.681	0.390	0.885
Changed employer	-0.114	-1.641	1.295	0.878	0.106	-1.396	1.454	0.734
Exit before 2008 (age 50) or never joined	**-0.934**	**-1.433**	**-0.409**	**<0.001**	-0.114	-0.774	0.595	0.734
Exit: Unemployed - seeking work	-1.154	-2.455	0.026	0.059	-1.008	-2.286	0.085	0.098
Exit: Temp or perm sick / disabled	**-2.877**	**-4.208**	**-1.543**	**<0.001**	**-2.069**	**-3.430**	**-0.664**	**0.003**
Exit: Looking after home / family	0.163	-1.134	1.446	0.802	0.523	-0.740	1.753	0.403
Exit: Wholly retired / education / training / travel	**0.809**	**0.027**	**1.570**	**0.035**	**0.796**	**0.061**	**1.565**	**0.034**
Joined labour force after 2008 (age 50)	**0.991**	**0.276**	**1.725**	**0.008**	**1.091**	**0.363**	**1.850**	**0.005**
Marital status (age 55)								
Married / civil partnership	Ref				Ref			
Single, never married / civil partnership	0.202	-0.120	0.549	0.239	**0.382**	**0.063**	**0.726**	**0.023**
Separated / divorced	0.128	-0.186	0.456	0.430	0.273	-0.050	0.595	0.094
Widowed	-0.055	-1.381	1.101	0.932	0.034	-1.241	1.180	0.956
Limiting longstanding illness (age 55)								
No	Ref				Ref			
Yes	**-1.135**	**-1.432**	**-0.833**	**<0.001**	**-0.925**	**-1.244**	**-0.622**	**<0.001**
Social class at age 55 (NS-SEC)								
NS-SEC social classes 1 & 2	Ref				Ref			
NS-SEC social classes 3 & 4	0.198	-0.034	0.430	0.096	**0.268**	**0.007**	**0.511**	**0.033**
NS-SEC social classes 5, 6 & 7	-0.113	-0.410	0.196	0.463	-0.074	-0.424	0.282	0.685

Supplementary Table 1. Representativeness of the NCDS analytic sample compared to Labour Force Survey (LFS) estimates

	LFS 2008 (age 50)	NCDS 2008 (age 50)	LFS 2013 (age 55)	NCDS 2013 (age 55)
In employment: Men	83.9%	92.0%	81.0%	86.9%
In employment: Women	77.4%	83.9%	72.4%	77.9%
Unemployed: Men	3.3%	1.5%	3.6%	3.0%
Unemployed: Females	2.5%	2.9%	1.9%	2.2%
Inactive: Men	12.9%	5.2%	15.3%	10.1%
Inactive: Women	20.1%	14.6%	25.7%	19.9%

Supplementary Table 1. Representativeness of the NCDS analytic sample compared to Labour Force Survey (LFS) estimates

	LFS 2008 (age 50)	NCDS 2008 (age 50)	LFS 2013 (age 55)	NCDS 2013 (age 55)
In employment: Men	83.9%	92.0%	81.0%	86.9%
In employment: Women	77.4%	83.9%	72.4%	77.9%

Supplementary Table 2. Model fit criteria for LCGA of employment trajectories

			Women			
Classes	AIC	BIC	ABIC	VLMR-LRT	LMR-ALRT	Entropy
1	151479.6	151492.2	151485.8			
2	128471.6	128502.9	128487.0	<0.0001	<0.0001	0.928
3	121271.0	121321.1	121295.7	<0.0001	0.0001	0.905
4	116991.7	117060.7	117025.7	<0.0001	0.0001	0.902
5	114097.5	114185.2	114140.8	<0.0001	<0.0001	0.895
6	112290.9	112397.4	112343.4	0.0002	0.0002	0.918
7	111068.1	111193.5	111129.9	0.2942	0.3032	0.905
8	109955.6	110099.8	110026.7	0.0167	0.0186	0.904
			Men			
Classes	AIC	BIC	ABIC	VLMR-LRT	LMR-ALRT	Entropy
1	97388.2	97400.6	97394.2			
2	73641.9	73672.7	73656.8	<0.0001	<0.0001	0.965
3	64660.4	64709.7	64684.3	<0.0001	<0.0001	0.959
4	60584.1	60652.0	60617.0	0.0017	0.0021	0.945
5	57424.1	57510.4	57466.0	<0.0001	<0.0001	0.948
6	55730.6	55835.5	55781.5	0.0854	0.0796	0.936
7	54382.6	54505.9	54442.4	0.0003	0.0004	0.936
8	53599.5	53741.3	53668.3	0.0141	0.0162	0.946

Supplementary Table 3. Associations between employment trajectory classes and QoL at age 50 (adjusted for early life exposures and covariates at age 50).

Labour force trajectory classes between 16 and 49	Women				Men			
	Coeff	LCI	UCI	P-value	Coeff	LCI	UCI	P-value
Mostly employed	Ref				Ref			
Early joiners	0.201	-0.120	0.522	0.220	**0.467**	**0.287**	**0.648**	**<0.001**
Later joiners	0.055	-0.312	0.423	0.769	**0.574**	**0.362**	**0.785**	**<0.001**
Latest joiners	-0.188	-0.502	0.126	0.240	**0.410**	**0.161**	**0.659**	**<0.001**
Mostly not employed	**-0.743**	**-1.111**	**-0.376**	**<0.001**	**-0.447**	**-0.768**	**-0.126**	**0.006**
Early leavers	**-1.173**	**-1.606**	**-0.740**	**<0.001**				

Supplementary Table 4. Associations between life course exposures and the change in quality of life for women and men between age 50 and 55.

Variable or measure	Unadjusted model (All)				Fully adjusted model (All)			
	Coeff	LCI	UCI	P-value	Coeff	LCI	UCI	P-value
Sex								
Female								
Male	0.075	-0.065	0.210	0.286	-0.001	-0.154	0.158	0.989
Social class of father's occupation at birth								
Manual	Ref				Ref			
Non manual	0.118	-0.033	0.268	0.124	-0.006	-0.126	0.322	0.941
Childhood disadvantage								
None recorded	Ref				Ref			
At least one item recorded	**-0.278**	**0.272**	**0.293**	**<0.001**	**-0.175**	**-0.337**	**-0.005**	**0.045**
Parental discord at age 7								
No	Ref				Ref			
Yes	-0.303	-0.690	0.104	0.137	-0.185	-0.616	0.265	0.390
Parents divorce, separate or died before age 7								
No	Ref				Ref			
Yes	-0.335	-0.727	0.063	0.084	-0.087	-0.483	0.322	0.669
Employment trajectory classes (16 to 49)								
Mostly employed	Ref				Ref			
Early joiners	**0.284**	**0.107**	**0.478**	**0.002**	0.175	-0.021	0.381	0.084
Later joiners	**0.301**	**0.114**	**0.495**	**0.003**	0.204	-0.006	0.419	0.061
Latest joiners	**0.274**	**0.030**	**0.457**	**0.018**	**0.245**	**0.013**	**0.458**	**0.035**
Mostly not employed	-0.012	-0.273	0.262	0.937	0.088	-0.213	0.370	0.565
Labour force participation (50 to 55)								
Employed from age 50 to 55	Ref				Ref			
Moved from full-time to part-time employment	0.172	0.017	0.890	0.332	0.233	-0.127	0.551	0.188
Changed employer	0.379	-0.136	1.367	0.260	0.517	-0.154	1.188	0.124
Exit before 2008 (age 50) or never joined	**-0.459**	**-0.573**	**0.026**	**<0.001**	0.045	-0.269	0.380	0.786
Exit: Unemployed - seeking work	-0.618	-0.891	1.044	0.131	-0.479	-1.262	0.348	0.253
Exit: Temp or perm sick / disabled	**-2.373**	**-3.119**	**-0.808**	**<0.001**	**-1.652**	**-2.514**	**-0.757**	**<0.001**
Exit: Looking after home / family	-0.171	-0.915	0.339	0.552	0.014	-0.568	0.573	0.960
Exit: Wholly retired / education / training / travel	**0.684**	**-0.099**	**1.122**	**0.007**	**0.722**	**0.201**	**1.230**	**0.005**
Joined labour force after 2008	**0.761**	**-0.112**	**1.151**	**0.002**	**0.880**	**0.388**	**1.350**	**<0.001**
Marital status (age 55)								
Married / civil partnership	Ref				Ref			
Single, never married / civil partnership	-0.034	-0.265	0.015	0.773	0.042	-0.189	0.283	0.722
Separated / divorced	0.081	-0.126	0.282	0.443	0.186	-0.021	0.388	0.073
Widowed	-0.020	-0.595	0.525	0.943	0.107	-0.451	0.637	0.700
Limiting longstanding illness (age 55)								
No	Ref				Ref			
Yes	**-0.965**	**-1.175**	**-0.766**	**<0.001**	**-0.965**	**-1.057**	**-0.651**	**<0.001**
Social class at age 55 (NS-SEC)								
NS-SEC social classes 1 & 2	Ref				Ref			
NS-SEC social classes 3 & 4	0.076	-0.091	0.244	0.373	0.119	-0.052	0.284	0.168
NS-SEC social classes 5, 6 & 7	-0.137	-0.363	0.079	0.236	-0.090	-0.326	0.145	0.447

Supplementary Table 5. Levels of missing data on CASP quality of life data at age 50 and 55.

	CASP data at both 50 and 55		CASP data at age 50 only		Missing CASP data at age 50 and 55	
	N	%	N	%	N	%
All	7422	100	7,581	100	755	100
Female	3,528	47.5	3,600	47.5	458	40.9
Male	3,894	52.4	3,981	52.5	317	59.1
No LLI at age 55	4,983	67.1	5,046	66.5	511	66.0
LLI at age 55	2,419	32.6	2,461	32.5	244	31.5
LLI Missing	20	0.3	74	1.0	20	2.5
NS-SEC social classes 1 & 2	2,687	36.2	2,709	35.7	219	28.3
NS-SEC social classes 3 & 4	2,135	28.8	2,154	28.4	234	30.2
NS-SEC social classes 5, 6 & 7	1,072	14.4	1,095	14.4	129	16.6
NS-SEC Missing	1,528	20.6	1,623	21.4	193	24.9