University of Southampton

Faculty of Medicine

Human Development and Health

How has COVID-19 affected the working lives, finances, mental and physical health, and lifestyle of a cohort of middle-aged men and women in England?

by

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Thesis for the degree of Doctor of Philosophy

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Abstract

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Changes to employment circumstance, health, finances, and lifestyle since the COVID-19 in a cohort of middle-aged people in England

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This thesis explored the impact of the COVID-19 pandemic on employment circumstances, health, lifestyle and finances among middle-aged people participating in the Health and Employment After Fifty (HEAF) study. Furthermore, it explored how health was affected by changes to their employment precipitated by the pandemic.

A range of methodologies were applied, including a systematic review, two cross-sectional on-line surveys, and a qualitative study.

In a systematic review we found conclusive evidence that loss of employment precipitated by the pandemic was associated with increased risk or levels of anxiety, although with moderate effects. However, the direction of effect between working from home in lockdown and anxiety was unclear.

Quantitative analyses of a large cohort of middle-aged people in England showed that employment circumstances, lifestyle, finances and health changed substantially after the onset of the pandemic. Our data showed clear disparities in how the pandemic affected different sectors of the population. Participants in poorer financial position before the pandemic were more likely to experience worsening of their financial circumstances. Those who transitioned to working from home were more likely to report financial improvements, while all other employment changes were associated with worsening financial circumstances. Additionally, poorer health outcomes were more common among individuals in poorer pre-pandemic health. Compared with participants whose job did not change during the pandemic, those who shifted to home working were more likely to perceive a deterioration in their general health, whereas those who decided to retire were more likely to perceive a deterioration in general and mental health and to experience depression in February 2021. It is important to track the mental and physical health of the general population in the long term, with particular attention given to those who experienced the greatest employment disruptions and showed the least resilience.

Finally, interviews with participants who retired since March 2020 showed that, similarly to what was reported pre-pandemic, their decision was influenced by a combination of factors. Certain work-related factors could be targeted to extend working lives and decrease economic inactivity. As postulated by the job demand-control and effort-reward imbalance models, having greater control over work tasks – such as through a flexible job – can mitigate the stress derived from a demanding job and support job retention. Similarly, feeling connected with colleagues and managers and appreciated within the workplace reflects a balance between effort and reward and can contribute to encourage work at older ages.

Table of Contents

Table of Tables

Table of Tables

Table of Figures

Table of Figures

Research Thesis: Declaration of Authorship

Print name: Stefania D'Angelo

Title of thesis: Changes to employment circumstances, health, finances, and lifestyle since the COVID-19 in a cohort of middle-aged people in England

I declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

I confirm that:

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2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
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6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
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Signature:

Date: 14th March 2025

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Definitions and Abbreviations

BAI ..... Beck Anxiety Inventory

CAMB..... Copenhagen Aging and Midlife Biobank

CES-D..... Center for Epidemiologic Studies Depression Scale

CI ..... Confidence Interval

CJRS..... Coronavirus Job Retention Scheme

CMD..... Common mental health disorders

CPRD..... Clinical Practice Data Link

DAG ..... Directed Acyclic Graph

DASS-21 ..... Depression, Anxiety, and Stress Scale-21

DCSQ..... Demand Control Support Questionnaire

DWP..... Department of Work and Pensions

ELSA..... English Longitudinal Study of Ageing

EU ..... European Union

EZ ..... Elena Zaballa

FU ..... Follow-up

GAD-7 ..... Generalised Anxiety Disorder-7

GP..... General Practitioner

HADS ..... Hospital Anxiety and Depression Scale

HEAF ..... Health and Employment After Fifty study

HEAF-COVID-19 study.... Health and Employment After Fifty COVID-19 study

IB..... Ilse Bloom

IFS ..... Institute for Fiscal Studies

JBI..... Joanna Briggs Institute

KWB..... Karen Walker-Bone

MESH..... Medical Subject Headings

NHIS ..... National Health Interview Survey

NHS ..... National Health Service

OECD ..... Organization for Economic Co-operation and Development

ONS ..... Office for National Statistics

OR ..... Odds Ratio

PHEIC ..... Public Health Emergency of International Concern

PHQ-4 ..... Patient Health Questionnaire for Depression and Anxiety

PM ..... Prime Minister

PRISMA ..... Preferred Reporting Items for Systematic Reviews and Meta-analysis

PROSPERO ..... International Prospective Register of Systematic Reviews

PSM ..... Propensity Score Matching

PTSD ..... Post Traumatic Stress Disorder

RR ..... Relative Risk

RRR ..... Relative Risk Ratio

RQ ..... Research Question

SARS-CoV-2 ..... Severe Acute Respiratory Syndrome Coronavirus 2

SD ..... Stefania D'Angelo

SEISS ..... Self-Employment Income Support Scheme

SEP ..... Socio Economic Position

SHARE ..... Survey of Health, Ageing and Retirement in Europe

SIGN ..... Scottish Intercollegiate Guidelines Network

SPA ..... State Pension Age

SRH ..... Self-rated Health

STAI ..... Spielberg State-Trait Anxiety Inventory

STREAM ..... Study on Transitions in Employment, Ability and Motivation

UK ..... United Kingdom

WFH ..... Work from home

WHO ..... World Health Organisation

Chapter 1 Background

1.1 Rationale

This thesis focuses on changes in work circumstances, finances, lifestyle, and health that concerned middle-aged people since the start of the COVID-19 pandemic and the resulting lockdowns. Lockdowns - large-scale physical distancing measures and movement restrictions - were implemented differently across countries and regions to slow down the virus's spread.

The pandemic struck in early 2020 (section 1.2), and in countries like the UK, this occurred alongside an ageing population and government policies aimed at extending working lives (section 1.3). Given the well-established link between good quality work and good health (section 1.7), this thesis examines how employment changes since the onset of the pandemic may have influenced health outcomes. Among health outcomes, anxiety, as one of the most prevalent mental ill health components, was explored in depth through a systematic review of the literature (Chapter 2). Exploration was expanded across other self-reported health outcomes, using quantitative methods from a large English cohort of individuals aged 50+ (Chapter 3). Additionally, qualitative methods were used to investigate the factors that influenced the timing of retirement among people who retired during the pandemic (Chapter 4).

The Health and Employment After Fifty (HEAF) study is a well characterised longitudinal cohort of middle-aged people with multiple points of data collection pre-pandemic. When incepted in 2013-14, the cohort was reasonably representative of the general UK population aged 50-64 years (1). In early 2021 we re-contacted participants of the cohort to gather additional information about their experiences of the pandemic. This enabled us to explore the changes in employment they experienced and their perceived changes in health, lifestyle and financial position since March 2020. The pandemic offered a unique example of a “natural experiment”, exposing everyone to widespread disruptions simultaneously. Thus, it provided an opportunity to explore how individuals with different circumstances, health conditions and employment types were affected.

1.2 The coronavirus pandemic

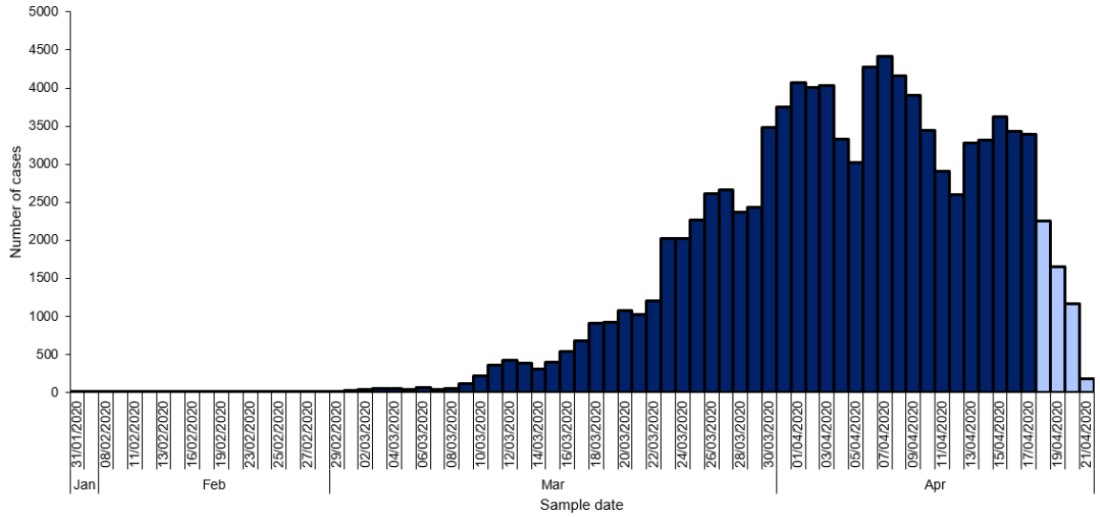
On the 31st of December 2019 a cluster of cases of a new respiratory virus were detected in Wuhan City, Hubei Province of China. A novel coronavirus, SARS-CoV-2, was identified as

the cause of this outbreak and its genetic code was reported in early January 2020. The disease state caused by SARS-CoV-2 was specified as Coronavirus disease 2019 (COVID-19) and, by 30th January 2020, the World Health Organisation (WHO) declared the epidemic a Public Health Emergency of International Concern (PHEIC) (2). In March 2020 the WHO declared COVID-19 to be classified as a global pandemic, making it the first pandemic caused by a coronavirus (3). The most common symptoms of the disease included fever, cough, tiredness, and loss of taste or smell, although clusters of different symptoms have been described alongside the appearance of new variants of the virus. Early findings from mainland China showed that approximately 81% of those affected presented with mild symptoms, 14% with severe symptoms, while 5% developed a critical illness (4). As it was a new virus, there were no diagnostic tests initially and no vaccinations available. With up to 5% critically ill from the infection, there was a large risk of widespread mortality akin to that seen across the world in 1918-19, then caused by Influenza virus: “Spanish Flu”. Over the course of the pandemic, it became apparent that some people developed a ‘Post COVID syndrome’ or ‘Long COVID’. This is characterised by either the persistence of one of more symptoms of acute COVID or the appearance of new symptoms, and research about related risk factors is ongoing (5).

1.2.1 The coronavirus pandemic in the UK

The first official known case of COVID-19 is thought to have entered the UK in mid-January 2020 and the first community transmission was reported on 31st January 2020 (6). Figure 1-1 shows the number of new confirmed cases by date of test in the first months of the pandemic in the UK. It’s worth noting that, in the first months of the pandemic, tests were not widely available and were only being performed among certain occupational groups, such as healthcare workers.

Figure 1-1: Laboratory confirmed COVID-19 cases, by date of sample. Source: Public Health England Weekly Coronavirus Disease 2019 (COVID-19) Surveillance Report



To slow down the transmission of the virus and release pressure on the National Health Service (NHS), on the 23rd of March 2020 the UK Government enforced a national lockdown, ordering people to 'stay at home' except for shopping for basic necessities, medical needs, performing one form of exercise a day (for a maximum of one hour). Everyone was required to work from home unless they were essential workers (defined as people working in the following occupation groups: health and social care, education and childcare, utilities and communication, food and necessary goods, transport, key public services, public safety and national security, national and local governments). To support businesses and self-employed people affected by the pandemic, the UK Government introduced two policies, namely the Coronavirus Job Retention Scheme (CJRS) and the Self-Employment Income Support Scheme (SEISS). The former provided grants to employers so that they could retain and continue to pay staff during coronavirus-related lockdowns and was available from the 1st of March 2020 until the 30th of September 2021. The scheme encouraged employers to furlough workers, rather than make them redundant and subsidised up to 80% of their wages (7). Data show that during the peak of the first lockdown, over 8 million workers were on furlough, while the number was 1.16 million in September 2021 when the scheme ended. The SEISS was introduced slightly later and came into force on the 13th of May 2020. It provided similar support to self-employed individuals who, if eligible, were provided with a grant corresponding to 80% of their average monthly trading profits (8). It is estimated that approximately 2.6 million people received such support until the scheme ended in September 2021 (9). A detailed timeline of the different stages of UK coronavirus lockdowns and what each entailed, up until September 2021, is provided in Appendix A.

At the time of writing this introduction (March 2022), more than 15 million COVID-19 cases and more than 155,000 associated deaths (deaths which occurred within 28 days of a COVID-19 diagnosis) were registered in the UK. These figures are likely to be underestimated as in the early stages of the pandemic, COVID-19 testing was largely confined to hospitalised people and healthcare workers - routine testing for the general population only became available in April 2021.

1.3 Ageing population

High-income countries such as the UK are experiencing a demographic shift towards an ageing population. The percentage of people aged 55 years or more, which accounted for just over one third of the total EU-27 population in 2017, is projected to reach 40.6% by 2050 (10). At the same time, the average number of childbirths per woman has decreased, reaching 1.55 in 2018. This value is below the threshold of 2.1 children per woman needed to keep the population size constant (11). A combination of longer life expectancy and lower birth rates are translating into a change in high-income countries' demographic structures, with an increasing proportion of economically inactive people (not working and not looking for a job).

The ageing phenomenon can be clearly seen by comparing the demographic structure of the UK population in 2020 with that in 1970 (images reproduced from United Nations (12)). The base of the 2020 structure is narrower, reflecting a lower birth rate. Additionally, in 2020, there is a noticeable increase in the middle age groups, when compared with the pyramid of 1970.

Figure 1-2: UK population pyramids in 2020, by age and sex

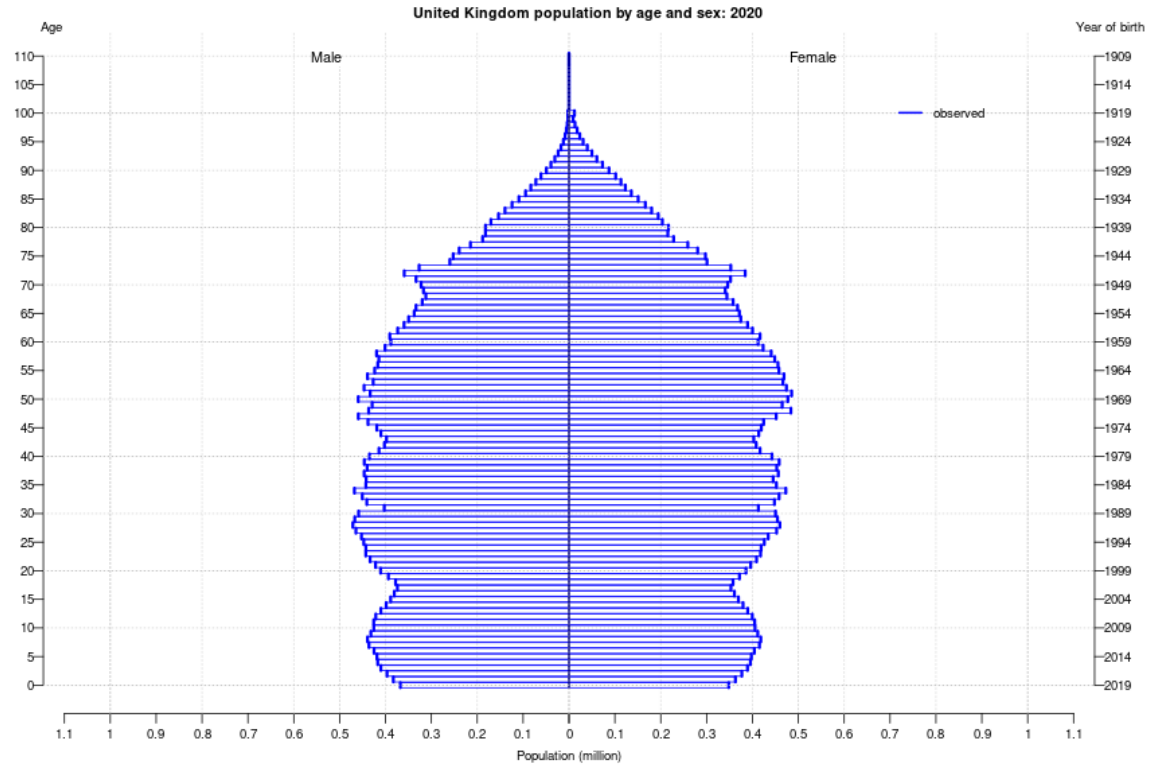
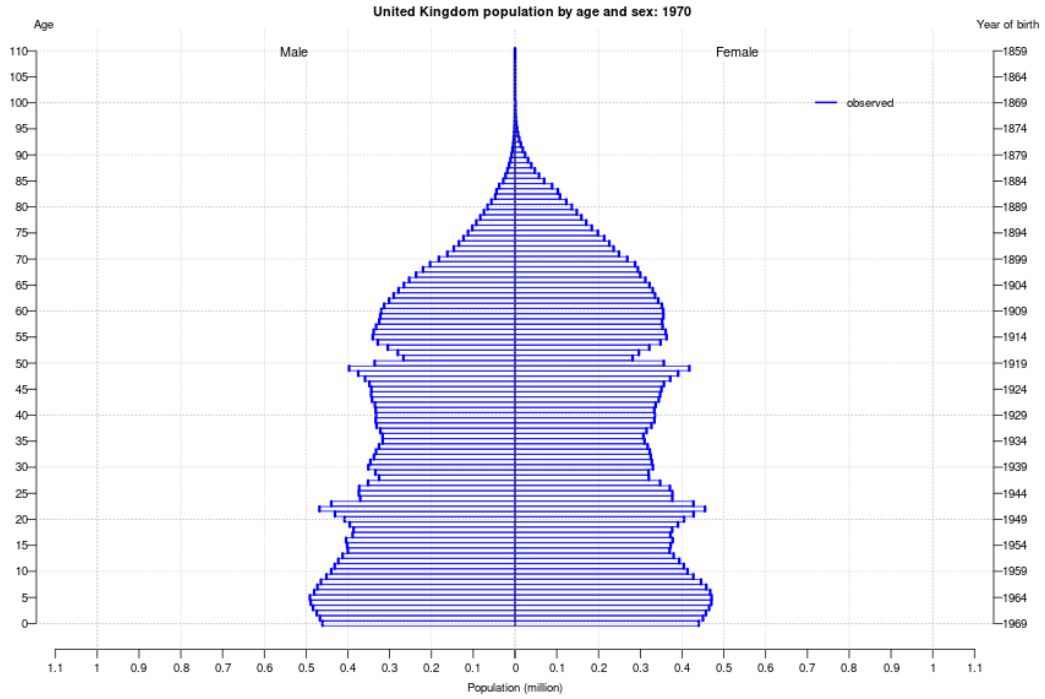


Figure 1-3: UK population pyramids in 1970, by age and sex



Recent UK data published by the Office for National Statistics (ONS) show that the old-age dependency ratio (the number of people of pensionable age for every 1,000 people of working age) is projected to increase from 275 in mid-2022 to 287 in mid-2032 (13). Between 2022 and 2045, while the proportion of men and women of pensionable age (aged 65 and older) is projected to increase by 35.4% and 37.1% respectively, the working age population is expected to increase only by 12.2% and 8.4% (Figure 1-4) (14).

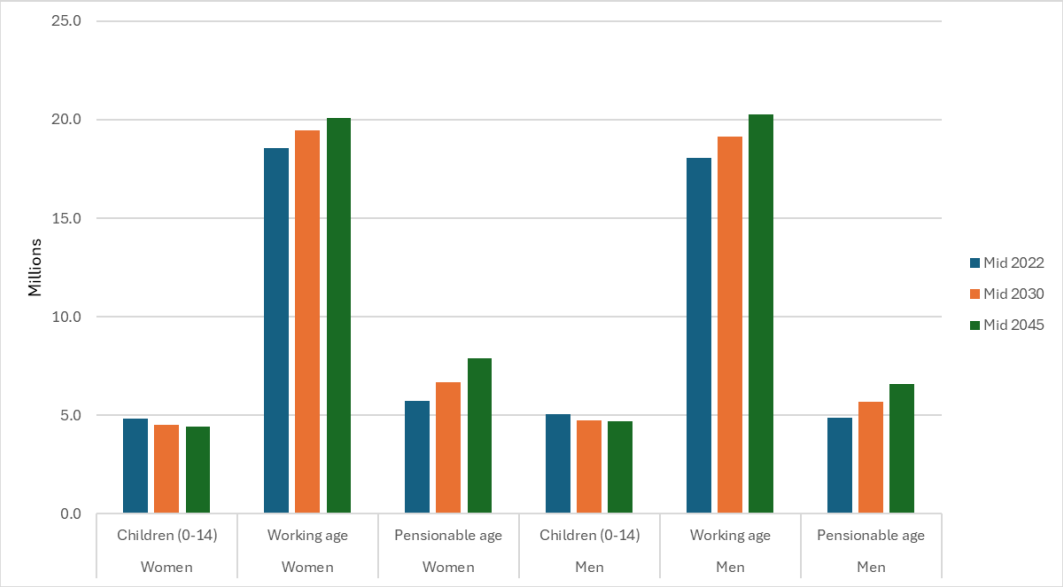


Figure 1-4: UK population projection by life stage (ONS data)

Within the context of an ageing population, several governments, including that of the UK, were implementing policies and legislation to encourage people to work to older ages prior to the COVID-19 pandemic. In the UK the main policy changes were an increase in the age of entitlement to receive state pension, and the abolition of mandatory retirement. Since 2010 the UK state pension age (SPA) was increased gradually so that, at the time of writing, it is 68 years for men and women (increased from aged 65 years in men and aged 60 years in women) (15). Additionally, before 2011, employers used to be able to require workers to retire at the age of 65 years. However, this law was scrapped in April 2011 (16), and since then, employers can no longer force anyone to retire, and they could be brought to a tribunal for age discrimination if they attempted to require an individual to do so. This means that people are now free to make their own decision about when to retire, with decisions likely influenced by multiple factors.

Although there is no formal definition of ‘middle-aged’ individuals, for the purposes of this thesis, I define middle-aged individuals as those aged approximately between 50 and 64 years. Similarly, when addressing work-related aspects, I refer to older workers as those aged 50 and over, as this is the threshold most commonly used in UK government and

international labour statistics (17, 18). In this thesis the two terms are therefore used interchangeably, depending on the context.

1.4 Changes to work participation since the pandemic

Data from the Department for Work and Pensions (DWP) show that the proportion of the UK population aged 50-64 years in paid work steadily increased from 55.8% in 1984 to 72.5% in 2019 (19). Changes in employment rate by 5-year age bands and overall are shown in Figure 1-5. In the 35 years represented, the employment rate increased in all age groups up until 2019 when almost 60% of those aged 60-64 were in paid employment.

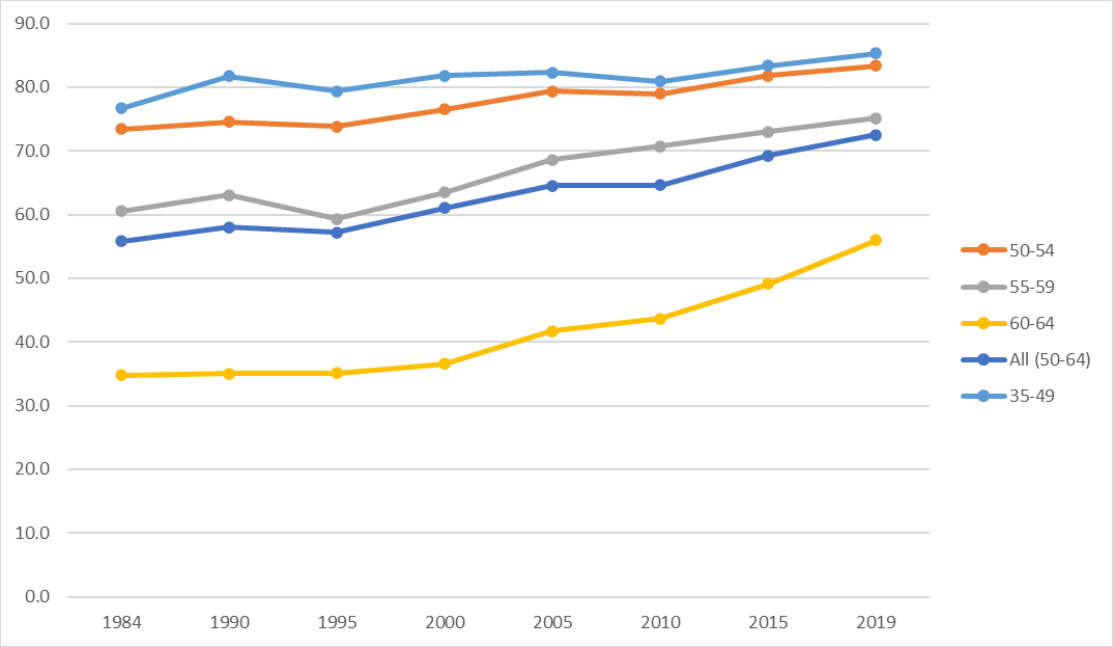


Figure 1-5: UK Employment rates 1984-2019, by age category

When analysing men and women separately, the trend is significantly different. For men, the trends in employment and retirement fall into two distinct periods. Employment rates fell substantially from the mid-1970s to the mid-1990s. This decrease was accompanied by rises in economic inactivity, but not retirement. Employment rates then recovered since the mid-1990s. In 2019 however, these were still around 10 percentage points lower than the employment rates seen in the mid-1970s. The employment rate for women did not see a sharp decline in the mid-1990s, but thereafter, started to increase rapidly up to 2019 (20).

Thus in 2020, two different phenomena coalesced. On one hand, the ageing population and increasing number of people working to older ages, while on the other hand, the COVID-19 pandemic took place, with its far-reaching potential impacts on both work and health.

The worry was that a long-lasting pandemic and multiple lockdowns may affect several aspects of peoples' lives, including work circumstances and labour market participation. The impact of policies which were designed to encourage older workers to remain in paid work to older ages might be considerably restricted if changes caused by the pandemic forced older workers out of the workforce. Research carried out in the UK in the first phase of the pandemic showed that, although the proportion of workers on furlough was highest among individuals aged 25 and under, one in four people aged 50 and older was furloughed, corresponding to 1.3 million working people in this age group (21). According to ONS data, working from home before the pandemic was not very common among older workers, and there was only a modest increase in the percentage of older workers who were working from home during lockdown, but this changed significantly depending on their job type. In January 2021, older workers with higher qualifications and in the managerial and professional socio-economic classification were the most likely to be working from home (17).

Analysis performed by the Institute for Employment Studies using the Labour Force Survey suggested that, for workers aged over 50, nearly half (47%) of those who were not working normally in the second quarter of 2020 were still disrupted in the third quarter (22). Workers aged over 50 years who were away from work or working reduced hours in March 2020 were the least likely to move back into normal working in the third quarter of that year (22). Evidence from previous economic recessions suggested that older workers have been hard hit in the past as they took longer to find employment once unemployed, and experienced steeper wage losses than younger individuals (23) (24). Therefore, a disruption in their work circumstances at older ages would be potentially challenging and could compromise significantly their prospect of working to older ages.

1.4.1 Definition of changes in employment

In this thesis, changes in employment refer to self-reported modification in employment status or work arrangements since the onset of the COVID-19 pandemic. These include job loss, furlough (i.e., remaining employed without performing work), transitioning to working from home, and retirement. In Chapter 2, some of the studies included in the systematic review also considered reduction in working hours as a change in employment. In contrast, this thesis also explored subjective experiences of work-related changes, which refer to individuals' perceptions of how their roles, responsibilities, or workplace dynamics have changed since the pandemic. These, however, were considered exclusively in the qualitative study presented in Chapter 4.

1.5 Why do people retire?

Studies conducted in periods of economic stability suggest that people retire for a combination of reasons including consideration of health, their financial resources, marital status and partner preferences.

Both good and poor health are recognised to be important factors for early retirement or working beyond state pension age. People in poor health are more likely to be forced into early retirement (25-27). However, good health has also been identified as one of the factors for early retirement (27), as people who opt for this pathway might be looking to enjoy life while their health still allows. Studies looking at predictors of working beyond state pension age found that good health (28, 29), and specifically good physical health were important determinants (30). Different measures of financial status such as income or wealth, are not equal in their effect on the decision to retire. The review by Topa and colleagues (31) combined evidence from 151 studies and demonstrated that income was not associated with early retirement, while higher financial security was significantly associated with retiring earlier. Greater individual pension wealth was associated with higher odds of early retirement in the English Longitudinal Study of Ageing (ELSA) (32), while a qualitative study on early retirement among Dutch employees identified financial opportunity (such as pension package) as a key determinant of early retirement (33). Finally, a study of 5,000 individuals participating in the Copenhagen Aging and Midlife Biobank (CAMB) found that the probability of working after retirement increased with higher wealth (measured with household income) (29).

Evidence about the role of marital status is mixed. A Dutch study showed that retirement is a household decision as opposed to a personal one, and this is especially true for married men (34). Other studies failed to show an association between marital status and early retirement (35) or working beyond state pension age (30). The effect of sex on the likelihood of early retirement is less clear. In a study of Danish employees, women were slightly more likely to experience early retirement than men. A possible explanation for this being that women may have more obligations towards people in their personal situations than men do (e.g., an ageing parent) (36). As caregiving disproportionally concerns women, studies have shown that women who are involved in caregiving in their mid-life are more likely to exit the workforce prematurely compared with those who don’t (37). Another study reports that when men are involved in caregiving, their retirement timing reflects the one of women (38). At the same time male sex has been linked with increased likelihood of working beyond the state pension age (29, 30). A possible explanation for the difference in working beyond state

pension between men and women could be that men are perhaps more often employed in industries where it is possible and encouraged to continue working past retirement age (29).

In addition to socio-demographic factors and health, the importance of work-related factors in determining the timing of retirement has been widely researched. A study conducted in the Netherlands among 1,400 employees aged 50-59 years at baseline, examined work-related factors in association with the expressed intention to retire early. The authors found that self-reported experiences of higher job pressure were associated with the intention to retire earlier, while, surprisingly, they did not find evidence that demanding work and irregular working hours had any impact on the intention to retire early (39). Whereas in participants of the STREAM study, a large cohort study of individuals aged 45-64 years at baseline, feeling highly appreciated at work and placing focus on development of skills and knowledge were both associated with decreased likelihood of retiring before the official retirement age (40). Work control appears to play an important role in the decision to retire. For example, a study of non-disabled Finnish public sector employees found that self-reported high work time control was a key predictor of working beyond state pension age (i.e., delaying retirement) (41). Similarly, secondary analysis of a large sample of participants from the Survey of Health, Ageing and Retirement in Europe (SHARE), a multi-country study of individuals aged over 50 when recruited, revealed that favourable psychosocial work conditions such as high work control and a good balance between effort and reward, were important factors for continuing to work beyond state pension age (42). Additionally, being self-employed or working in highly skilled occupations were associated with working past retirement age. In the UK, data from ELSA found that, independent of age, sex, education, occupational class, depression and allostatic load, high effort-reward imbalance (i.e. perception that the individual worker was making high levels of effort that were under-rewarded, under-appreciated or under-recognised) was associated with increased likelihood of exiting the labour market before age 61 years. Conversely, high job control was associated with decreased likelihood of exiting the labour market (43). A survey conducted in the Netherlands among 3,000 employees aged 50 and older reported that employees who experienced more feelings of exhaustion or detachment from work were more likely to express stronger intentions to leave the job before qualifying for state pension compared with employees who did not have such complaints (44). Finally, a study conducted pre-pandemic among recent retirees participating in the HEAF study reported that, when in good health and good financial position, workplace changes were significant contributors to the decision to retire. For many, work-related time-burdens such as excessive working hours, long commutes or being available out of hours, which were easily tolerable early in their careers had suddenly become unacceptable and pushed individuals to retirement (45).

The pandemic not only changed employment circumstances for older workers but might have indirectly influenced their retirement plans.

In the UK, 1 in 8 workers aged 50 years and over mentioned that they had changed their retirement plans because of the pandemic, with 5% saying that they would retire earlier than planned and 8% that they were planning to retire later (17). It is possible that under these special circumstances, different factors may have played a role in determining the decision to retire. In this thesis I explored which factors contributed to the timing of retirement for people who retired since March 2020, with findings presented in Chapter 4.

To better understand the influences of the decision to retire and the specific effects of the pandemic, it is important to examine the health changes triggered by the pandemic. In the next section, I review the evidence about changes in mental health since the beginning of the pandemic.

1.6 Studies on changes in mental health

At the outset of the current project, several papers had already been published, primarily examining the immediate effect of the COVID-19 pandemic and associated lockdowns on mental health. Most studies focused on the adult population, often exploring the effects among middle-aged individuals only as part of sensitivity analyses.

A range of psychological outcomes had been researched, including depression, anxiety, stress and mental well-being. These studies employed different study designs to quantify the short-term effect of the pandemic on mental health outcomes.

Findings from the UCL COVID-19 social study showed that, despite early rises of poor self-reported mental health, the prevalence of depression and anxiety declined shortly after early pandemic stages, suggesting that individuals developed coping strategies relatively quickly after the pandemic started (46). Qiu and colleagues conducted one of the first nationwide surveys on 52,000 responders from around China in February 2020. Their results indicated that 35% of respondents experienced psychological distress, with women showing higher psychological distress compared with men; and individuals older than 60 years more severely affected compared with those below the age of 18 (47).

While numerous studies have explored this area, only a few had availability of pre-pandemic data and therefore had the potential to explore changes attributable to the COVID-19 pandemic. One of those was a study by McGinty et al, who conducted a national survey of the US adult population in April 2020. By comparing the prevalence of serious psychological

distress to that reported in 2018 in the National Health Interview Survey (NHIS), they identified a significant increase in the prevalence of symptoms from 3.9% in 2018 to 13.6% in 2020 (48). Similarly, a study by Pierce et al was one of the first national probability sample studies conducted in the UK adult population (49). The aim of the study was to track the changes in mental health from 2013 up until April 2020. They concluded that there was an overall increase in mental distress since the start of the pandemic. This was however not equally spread among different demographic characteristics. Younger people experienced a substantial rise compared with that expected based on pre-pandemic trends. Similarly, individuals living with children younger than five years were particularly affected. Interestingly, aspects such as being unemployed, living without a partner or having a pre-existing health condition, did not lead to an increase of psychological distress meaning that established pre-pandemic inequalities in mental health were maintained during the pandemic. Kwong and colleagues conducted analyses in two UK cohorts and found that the population experienced a stark increase in anxiety from the start of the pandemic, with a prevalence rate of 24% (95% CI 23–26%) compared with a pre-pandemic level of 13% (95% CI 12–14%). Yet, the prevalence of depression seemed mostly unchanged since the beginning of the pandemic (50). Another UK observational population-based study suggested that, compared with the period 2017–2019, mental health problems measured with GHQ-12 increased markedly by over 50%, from 24.3 to 37.8 percentage points at the end of April 2020 (51). While the prevalence of mental health problems decreased by June 2020, it remained higher that pre-pandemic levels. The most significant increase in poor mental health was found in people below aged 34 years, although participants aged 50-64 years also experienced a 27% increase in the prevalence of mental health problems.

In the early phase of the pandemic, Luo et al conducted a systematic review and meta-analysis of studies exploring COVID-19 in relation to psychological distress, measured with either depression or anxiety, assessed using a variety of validated screening tools (52). The 62 studies included in the review showed that COVID-19 had a substantial impact on the psychological health of the general population with 33% of the sample reporting anxiety and 28% reporting depression. However, most of the studies included in the review were of cross-sectional design which limited the ability to establish a causal relationship between mental health problems and the pandemic itself. A subsequent rapid review and meta-analysis moderated the conclusions of Luo et at (53). This review was limited to studies with a longitudinal design that measured change or difference post-lockdown in at least one outcome related to mental health symptoms. Among the 25 studies included, the review identified a small but significant effect of COVID-19 lockdowns on mental health symptoms among the general population. Despite this, the population seemed relatively resilient to the

challenges posed by lockdown restrictions to mental health. While lockdowns were negatively associated with certain components of mental health such as anxiety and depression, the effects on positive psychological functioning such as satisfaction with life, well-being, and quality of life were not significant. The authors of the review also acknowledged that the impact of lockdowns on mental health might vary across demographic groups and countries. Finally, the meta-analysis by Jin et al revealed that quarantine during lockdown was negatively associated with depression, stress level, and especially anxiety (54). The quarantine examined in their study refers to large-scale self-isolation of most of the population and maintaining social distancing for a certain period of time. Consistent with the authors' hypothesis, the analysis indicated that a longer quarantine duration was associated with a higher effect on mental health outcomes.

These studies collectively suggested that the mental health of the adult population was negatively impacted by the pandemic overall, or at least early on after the pandemic started. Furthermore, the studies suggested that some groups such as women, people with pre-existing mental health issues and younger individuals were particularly vulnerable to the effects of lockdown. Reviewing the literature, it became apparent that only a few studies focussed on middle-aged and older people, while most evidence came from papers investigating adults over the age of 18 years.

1.7 Good work is good for health

There is wide consensus that good quality work is essential to retain good physical and psychological health. Increasing employment and opportunity of employment directly promotes better health and well-being for individuals and communities (55, 56). For most people, work is not only a way to fulfil their material needs, but is a key determinant of social engagement, self-esteem, sense of purpose and achievement. Work affects health directly and indirectly by providing income and a social network. In addition to working in a safe environment, good quality work includes also having a sense of security, autonomy, good line management and good communication within an organisation. There is compelling evidence that working in low quality jobs such as low-paid jobs, with temporary contracts, and where the employees have low autonomy, is associated with poor health outcomes. For instance, employed individuals participating in the Understanding Society UK study were 80% more likely to report less than good health if working with low job security (23.1%) compared with those without low job security (12.7%) (57). Similarly, those with low job satisfaction were more than twice as likely to report less than good health than those without low job satisfaction. High work control, optimal work demand and low level of physically

strenuous work were all significantly associated with maintaining good health functioning over time among public sector employees in Finland (58).

There are several existing frameworks of occupational wellbeing, attempting to explain the way in which work affects health and wellbeing. Two very commonly applied models are the effort-reward imbalance (ERI) model, proposed by Siegrist (59),and the job demand-control (JDC) proposed by Karasek (60). The key principle for the JDC model is that the control and autonomy over the way an individual works can lower the stress derived from a demanding job. Control over work is assessed by combining the answers to a series of questions about whether workers have autonomy over the tasks they perform at work, when they carry them out, and over the choice of their working partners and whether they can take breaks. Whereas the level of work demand is assessed with questions about the speed and intensity of work that is required. The combination of the two components results in four job types, with the worst possible job being characterised by high demand and low control (namely "high strain job"). On the other hand, Siegrist's model assumes that an imbalance between the effort that someone puts in their work and the reward to gain will cause work-related stress. Higher risks of poor health (59) and of incident common mental disorders (61) have been observed among employees who perceive an imbalance between effort and reward. Whereas a meta-analysis of 11 cohort studies reported an increased risk of incident cardiovascular disease for people who perceived effort-reward imbalance (62). High job strain (i.e., low control and high demand) has been linked to a series of poor health outcomes including common mental health disorders (61), and musculoskeletal pain (63). Because of the strong inter-relationship between work and health, it is not surprising that health researchers are interested in studying employment. Examining the consequences of the COVID-19 pandemic on people's work circumstances is essential as unexpected negative changes in people's work could have negatively affected their general health and wellbeing.

1.8 What did we know about impacts of work changes due to the pandemic on health in 2021?

In the early phases of the pandemic, several studies have investigated the impact of changes in employment since the pandemic on health (mainly mental health), with evidence coming from different countries. The studies that specifically focused on anxiety as a health outcome have been described in detail in the systematic review chapter, therefore in this section I have summarised studies which reported on different outcomes, to avoid redundancy of information. Among the employment changes that have been researched, the most common

ones were a shift to home working, and job loss (mainly due to the size of the population they both impacted). There is consensus that job loss negatively affected mental health outcomes examined however, the direction of effect of home working in relation to health outcomes is less clear. Early evidence from a cross-sectional study of 1,500 workers in the US (18% of the sample aged 60+) showed a significant increase in psychological distress among participants with a permanent job loss when compared with those with unchanged job (64). Another cross-sectional US study of adults reported that, those who lost their jobs during the pandemic reported higher symptoms of depression, anxiety, and stress, and lower positive mental health compared to those who either continued working as before or worked from home – the latter group showing similar mental health to those with stable employment (65). In a UK longitudinal study of people aged 18 and older, being made redundant was associated with increased odds of common mental health disorders (CMD) compared with being self-employed and not affected by COVID-19. Adults who worked from home throughout lockdown had the highest odds of CMD, suggesting there may be stressors associated with solitary working (66). A study by Griffiths and colleagues demonstrated that in a cohort of Australians aged 18+ and employed prior to the COVID-19 pandemic, those experiencing work loss were more likely to report psychological distress and poor mental and physical health compared to those whose work was unaffected (67). Similarly, Posel et al (68) found that during South-African lockdown, adults who retained paid employment had significantly lower depression scores than adults who lost employment. However, the employed were not all equally protected against adverse mental health, as being furloughed was not found to be protective against developing depressive symptoms. In a large cohort of Finnish public sector employees, a shift to working from home was associated with a slight increase in psychological distress, and a small deterioration in self-rated health (69). The work of this thesis was able to complement the evidence from existing studies by placing the focus on older workers affected by an employment change to explore its association with poor self-reported mental and physical health outcomes.

To better understand the connection between employment changes and health outcomes, it is also important to consider how the pandemic has affected lifestyle factors.

1.9 Studies on changes in lifestyle

Since the onset of the pandemic, numerous studies have investigated changes that occurred to lifestyle, such as to physical activity or sedentary behaviours, diet quality or food intake, and alcohol consumption. In the following sections I review some of the studies conducted during the early phases of the pandemic, focussing on changes in physical activity, diet and

eating behaviour. These findings will provide some evidence to help shape my research question.

1.9.1 Physical activity

Although the focus of several early pandemic studies, there was little consensus as to whether physical activity levels in the general population changed significantly early in the pandemic. Some studies suggested that physical activity was disrupted. Among those is a systematic review of observational studies which reported a decline in physical activity and an increase in sedentary behaviour during the first COVID-19 pandemic lockdown, regardless of the subpopulation or the methodology used (70). A Spanish cross-sectional study of people aged 42 years on average, conducted in April 2020, found significant decreases in vigorous physical activity and in walking activity since lockdown, especially among men, younger individuals and those previously more physically active (71). Similarly, a cross-sectional study conducted in May 2020 in the Netherlands of participants aged 50-69 years, revealed a mixed picture: approximately half reported no significant change in exercise levels, while the rest were split between increased and decreased exercise (72). A survey of 1,000 Swiss residents conducted during the spring 2020 showed 44% maintained stable activity levels, 35% reported decreased and 21% increased. Individual characteristics and circumstances influenced the direction of the change and working remotely was a risk factor for changing physical activity levels in both directions (73). Likewise, a cross-sectional survey of the German population (aged 14 and older), conducted during a period of enforced social distancing, reported a sharp decline in leisure time physical activity overall (74). Among the 64% of the sample who were physically active in normal times, 49% had reduced their level of physical activity, 42% maintained and only 9% increased their activity, with older individuals more likely to reduce activity. The first ECLB-COVID19 survey showed negative effects on all levels of physical activity and increased in sitting time (75). These findings are important as they originate from a variety of countries from Asia, Africa and Europe, providing a multi-country perspective on the changes. However, it is important to note that they mostly refer to people younger than 60 years.

A small longitudinal study of middle-aged people in the Netherlands reported no significant changes in neither physical activity nor diet quality from February to May 2020 (76). In contrast, a cross-sectional survey in Northern Italy, of predominantly women, reported some positive lifestyle changes, with 32% of physically active individuals maintaining the same level of activity, and 27% who were previously sedentary reporting that they had started exercising (77). Another study conducted in Italy shortly after the implementation of lockdown restrictions found no significant change in the proportion of people involved in any type of

physical activity (78). However, participants physically active, tended to report a higher frequency of training during the emergency when compared to the pre-pandemic period.

1.9.2 Diet and eating behaviour

A number of studies were carried out on diet quality and eating behaviour, measuring a range of outcomes and with somewhat mixed findings. For example, a worldwide systematic review of 95 observational studies found a general improvement in diet quality, with increased fruit and vegetable consumption and decreased red and processed meat intake, but also an increase in unhealthy foods like snacks and sweets (79). In the study by Ammann et al (73), individuals who reported having been able to work remotely during the lockdown were more likely to report an improvement in diet quality (measured as increased consumption of fruit and vegetables) as well as a change in sweet snack consumption in either direction compared to no change. A survey of 1,061 individuals in Qatar found negative lifestyle changes overall, with home workers consuming more fat-rich and sugary foods (80). However, the Qatari study participants were significantly younger than the age group of interest in this project and were likely to differ in terms of personal circumstances including having children at home during lockdown. A multicentre cross-sectional survey suggested that lockdown had a negative impact on eating behaviour, with increased unhealthy food consumption and snacking between meals (75). A survey of 2,000 UK residents conducted in the spring of 2020, examined, among other aspects, the perception of a change in snacking habits since the beginning of lockdown (81). Their findings were mixed, with 56% reporting snacking more frequently and 23% reporting snacking less frequently, compared to before lockdown. Participants who reported an increase in snacking frequency were more likely to have a higher BMI compared with the rest of the sample.

1.10 The Health and Employment After Fifty (HEAF) study

This thesis uses data already collected as part of the HEAF study. HEAF is an observational cohort study set up in 2013-14 by the MRC-LEC, with the intent to explore the health benefits and risks of work at older ages and conversely the impact of health on employment outcomes.

1.10.1 Participants and recruitment process

Participants were recruited from people registered with general practices contributing to the Clinical Practice Data Link (CPRD). The CPRD advertised the study to contributing practices, and those which volunteered to take part in the study were identified to the HEAF research

team who contacted their practice managers. In all, 24 general practices finally contributed to the HEAF sampling frame during the period January 2013 to June 2014 (1). All patients born between 1948 and 1962 (target age 50-64 years) who were registered with the participating practices were eligible to be recruited and were contacted initially by their practices (unless their GPs thought they should not be approached because of terminal illness or recent bereavement). Contact details of participants were not revealed to the research team until they had decided to take part in the study and included them when returning a baseline questionnaire and written consent form. Of the 39,359 people who were approached to participate, 8,134 (20.7%) returned a valid questionnaire, were in the target age range and consented to be followed up.

1.10.2 Questionnaires

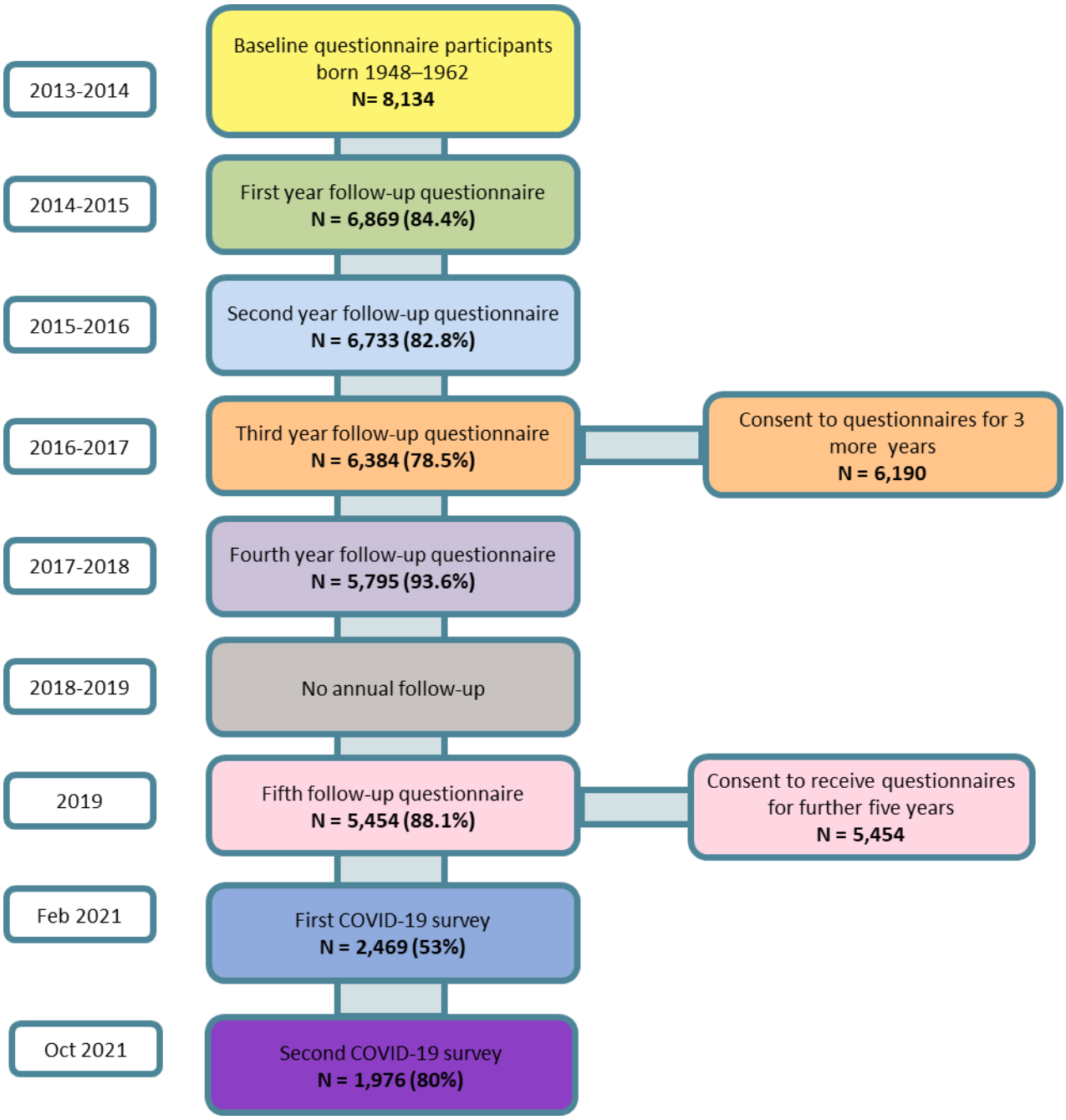
The baseline questionnaire covered the following main domains: demographic and anthropometric characteristics; current work status; content and characteristics of paid work (if in a paid job); physical and psychosocial demands of work; feelings about work, financial status and retirement expectations and plans; and selected items on health. As shown in Figure 1-6, after the initial baseline questionnaire, people were contacted approximately annually to complete follow-up questionnaires. Among other things, at each follow-up, participants were asked whether their employment position had changed compared with the previous time point, as well as questions about their current health and wellbeing. While the initial response rate was relatively low, the recruited sample, although somewhat older, better educated, and wealthier than 50–64 year-olds in the population at large, was reasonably representative, especially in terms of employment status and marital status, and included participants from most regions of England and most deciles of neighbourhood material affluence or deprivation (1). Nevertheless, the cohort was predominantly composed of participants of White Caucasian ethnicity.

The retention rate at subsequent follow-ups was very good. The latest point of contact before the COVID-19 pandemic was in May-June 2019 when participants were sent a sixth questionnaire (FU5). A total of 5,454 participants returned a usable questionnaire at that time and their main characteristics are shown in the table below. There was a slight sex imbalance with men making up 44% of the sample. However, this had been the case from the start of the study. The average age was 64.3 years (SD 4.4 years). As the HEAF cohort aged, the proportion of people in paid work (either employed or self-employed) decreased from 68% at baseline to 42% in 2019.

Table 1-1: Characteristics of participants at FU5

Characteristics at FU5	
Men, N (%)	2,399 (44.0%)
Age (years), mean (SD)	64.3 (4.4)
In work, N (%)	2,271 (41.6%)
Depressed (CESD score≥16), N (%)	1,300 (23.8%)
Fair/poor SRH, N (%)	1,129 (20.7%)

Figure 1-6: HEAF flow chart



[1]

[1] Numbers in brackets are the unconditional response rates at each wave, computed as number responded at wave *i* divided by number eligible at wave *i*. For the first three follow-ups, those eligible were the people who consented to follow-up at baseline. For the fourth and fifth follow-ups, participants were counted as eligible if they had consented to further follow-up at the third follow-up. The response rate for the first COVID-19 survey is computed as the ratio between number of responders and number who could be contacted via an email address

1.11 HEAF COVID-19 surveys

In this section I describe variables that were collected when the pandemic had started.

Appendix A outlines the phases of the COVID-19 pandemic in the UK and provides a detailed account of the restrictions imposed during each phase. In February and October 2021, we invited HEAF participants to complete two online surveys and report on the changes that had occurred to their lives, including changes to their employment, finances, health, and lifestyle, since the beginning of the COVID-19 pandemic. These surveys were limited to participants who completed FU5, and for whom we had an email address (N=4,665).

The aim of the first COVID-19 online survey was to assess the short-term changes to several aspects of people's lives as a consequence of the pandemic. The survey included 67 questions and was administered with the online platform Qualtrics (Provo, UT) (https://www.qualtrics.com). Topics covered included: personal experiences of COVID-19 and shielding; healthcare utilisation other than for COVID-19; employment circumstances before and after March 2020; personal finances; mental and physical health; social isolation; and aspects of lifestyle and changes to people's lives since the pandemic started. Before filling in the survey, participants were asked to confirm their consent in taking part in this sub-study of the main HEAF investigation and were informed they could withdraw their consent at any time. Full details of the survey questions are available in Appendix I.

A protocol for the COVID-19 HEAF study was submitted for ethical approval on 29th May 2020, as a substantial amendment to the existing project, together with a proposed questionnaire, information sheet and invite email. Health Research Authority (HRA) approval was granted on 8th September 2020 (Appendix G).

A few months before the launch of the survey, since our participants were accustomed to receiving postal questionnaires, we sent them all a newsletter by post to notify them of the upcoming online survey focused on COVID-19. This was an opportunity for them to make sure we had their current email address.

In February 2021, 4,665 HEAF participants with a known email address were sent an email with a link to complete the online survey. Data collection lasted until the end of May 2021.

(n=4,665). For the second COVID-19 survey, the denominator for the response rate is 2,469 who complete the first COVID-19 survey.

Later in the year, in October 2021, we recontacted participants who had responded to the first online survey, with a second online survey. This covered the period after the end of the first lockdown and the aim was to explore longer-term changes brought by the pandemic. The type of questions that were asked in the two surveys were almost identical, although in the second survey we added several questions about experiences of home working due to interest in exploring sustainability of longer-term work changes. In the next chapter, I refer to data collected in the first survey unless specified otherwise.

1.12 Results and comparison with larger cohort

A total of 2,872 participants returned the first online survey. However, only 2,481 replied to initial questions about informed consent and entered a valid ID number. An additional 12 participants stopped after the first 7 questions and were therefore excluded. This left 2,469 participants (1,088 men and 1,381 women) in the sample, which corresponded to a 53% response rate (calculated out of 4,665 individuals invited). The average age at completion of the survey was 65.6 (SD=4.3) years.

When we compared earlier data on participants who responded to the first survey (n=2,469) and the remaining consenting participants who did not respond (n=2,985), we found that the responders were more likely to be financially comfortable, to have a higher level of educational qualification and to self-report better health. This differential response will be considered in the interpretation of findings.

Table 1-2: Comparison of responders and non-responders to the first online survey

	Responded to the first survey (n=2,469) N (%)	Did not respond (n=2,985)
Sex, male	1088 (44.1)	1311 (43.9)
Financial position - baseline		
Comfortably	1031 (41.8)	941 (31.5)
Doing alright	896 (36.3)	1112 (37.3)
Just about/struggling	504 (20.4)	885 (29.7)
Missing	38 (1.5)	47 (1.6)
Level of qualification		
No qualification/school only	615 (24.9)	1130 (37.9)
Vocational training certificate	614 (24.9)	996 (33.4)
University degree/higher	1240 (50.2)	859 (28.9)

	Responded to the first survey (n=2,469) N (%)	Did not respond (n=2,985)
Fair/poor SRH	335 (13.6)	647 (21.7)

1.13 Aims of this project

The aims of this project were:

1) To explore the impact that changes in employment status and circumstances attributable to the pandemic had on anxiety of the adult population worldwide.
2) To explore the effect that changes in employment status and circumstances attributable to the pandemic had on the health of middle-aged people in England.
3) To explore the reasons that influenced retirement timing for people aged 50 and older who retired since the first lockdown in England.

Having an established well-characterised cohort incepted pre-pandemic facilitated the collection of additional pandemic-specific data. Furthermore, the HEAF study was shown to be reasonably representative of the general population aged 50-64 years (1), increasing the generalisability of findings. This thesis focused on middle-aged people, a demographic of particular interest. Individuals aged 50 and older differs from younger workers in terms of the employment aspects (outlined in paragraph 1.4) and are also more likely to live with multi-morbidities, making them an important group to study. For example, reports indicate that just under half of 50-64-year-olds live with one long term condition, while 23% live with 3 or more (82). The COVID-19 pandemic could have important negative health consequences for this group, potentially increasing the prevalence of co-morbidities per person.

1.14 Structure of the project

These aims were addressed as follows:

1) Firstly, I conducted a systematic review of published literature that explored the association between changes in employment since the onset of the first lockdown and anxiety in the adult population.
2) I invited HEAF participants to complete two online surveys, and after combining the collected information with that from previous follow-ups of the cohort, I quantitatively analysed data to explore changes in employment circumstances, health, lifestyle and finances precipitated by the pandemic.

3) I conducted semi-structured telephone interviews with a sample of HEAF participants who have retired since March 2020.

Part 1: Systematic review

A systematic review of the literature was conducted to review the published evidence on consequences of changes in employment since lockdown on anxiety. Papers were included if they investigated the associations between a change in work (either becoming unemployed, furloughed, working from home during lockdown, or a change in working hours) since the pandemic and its subsequent impact on anxiety. Studies were included if they examined the general adult population (aged 18+) as long as the age group 50+ was represented. Studies that focussed on specific occupational groups or on participants with specific health conditions were excluded as their findings could not be generalised to the general population. There were no exclusions based on the study location or based on study design, and studies were included if published in either English or Italian. The protocol of the systematic review was submitted to PROSPERO (Ref: CRD42021260499) and is available in the supplementary material Appendix B. The systematic review is reported in Chapter 2 of this document. As reported in Appendix F, a paper with these findings in currently under review.

Part 2: Quantitative component

To address aim 2 of this project, I designed two online surveys that were sent to HEAF participants who provided us with a valid email address. These were used in combination with data the HEAF participants had already provided us with in earlier follow-ups. The first online survey was sent in February 2021 and aimed to assess the changes brought by the first lockdown in England. The second survey sent in October 2021 aimed to evaluate the longer-term changes brought by the pandemic. Only participants who replied to the first survey were contacted the second time. After a descriptive section that outlines the main findings of the surveys, I have focussed on the association between changes in employment since the beginning of pandemic and self-reported poor health outcomes. I have explored whether those associations were attenuated once adjusted for a selection of covariates measured prior to and during the pandemic. Self-reported health outcomes were collected in the first and second online surveys. Those from the first survey provided a measure of short-term outcomes, while those from the second survey of longer-term health outcomes.

Part 3: Qualitative telephone interviews

To answer aim 3 of the thesis, I conducted telephone interviews with a sample of HEAF participants who had returned both online COVID-19 surveys, were still in paid employment in

February 2020, and reported that they retired either in the first or the second online survey. The aim of the interviews was to unpick what influenced the retirement timing and to describe their lives as retirees during a pandemic. The interviews were semi-structured and analysed using reflexive thematic analysis. Results of these analyses feature in Chapter 4 of this document and have been published (83).

Chapter 2 Changes in employment circumstances since lockdown and anxiety: a systematic review

2.1 Introduction

As described in paragraph 1.3, the UK is undergoing a demographic change. Although the proportion of older workers in paid employment had been increasing over the previous decade, following policies that have encouraged employment at older ages, the COVID-19 pandemic and the enforced lockdowns put a halt to this. Changes in employment status (e.g., becoming unemployed, relocation to home working, and being furloughed, among others) were common over the course of the pandemic and often accompanied by other challenges such as financial worries, forced isolation and fear of infection.

Previous studies conducted in periods of general economic stability have shown that being unemployed (84) as well as transitioning from paid employment to unemployment (85) may impact negatively on mental health. This has been found in the general population as well as amongst older workers (86), for whom job loss is particularly problematic due to their difficulty of finding new employment once out of work (87). The mechanisms behind this association were addressed in the latent deprivation model proposed by Jahoda (88), in which the lack of five latent functions of employment (time structure, social contact, collective purpose, status, and activity) impacted negatively on mental health. One might therefore hypothesise that people who lost their job during the pandemic would have experienced a worsening in their mental health.

Another common change in employment circumstances during the pandemic was a shift to working from home. Evidence on the effect of home working on mental health is mixed: a rapid review of studies conducted pre-pandemic and mostly of cross-sectional design, revealed mixed and inconclusive findings on working from home and mental health (89). Some of the studies included in the review found home working to be associated with increased stress (90, 91), fatigue (92), depression (93) or mental exhaustion (94), while others highlighted positive impacts of home working such as better quality of life (95, 96), and improved wellbeing (97, 98). The authors of the review suggest that the support received from the manager, and from the work environment more generally, are key factors for the

experience of home working to be successful (89). Another systematic review included 14 studies all conducted pre-pandemic and aimed at exploring the effect of home working on health outcomes. All studies included were rated of poor quality and the authors' conclusion was that evidence on the relationship between telework and health was scarce and more studies were needed (99). Moreover, the body of available evidence refers to a pre-pandemic period and may not be completely informative of consequences of home working imposed during the pandemic.

The direction of effect between being furloughed and mental health is also unclear. Some studies have reported that being furloughed was as harmful to depression as job loss (68) or that the odds of poor mental health were comparable between those who lost a job and those who were temporarily off work (vs employment unaffected) (67); while others have suggested that retaining a job although in furlough, had a positive impact on mental health (66).

Previous studies, including a systematic review of longitudinal studies (100), have shown that early stress responses to a traumatic event such as the COVID-19 pandemic, can lead to adverse mental health outcomes such as depression and anxiety. The literature reviewed above suggests that changes in employment because of the pandemic may add to the anxiety generated by a pandemic and exacerbate these effects.

We therefore conducted a systematic review to evaluate how changes in employment that occurred during the COVID-19 pandemic impacted on anxiety in the adult population. If we were to find a significant negative association between certain categories of changes in employment and anxiety, our research could inform targeted effort to reach that segment of the population for additional mental health support.

We could find no previous systematic review had been conducted on this topic.

The systematic review protocol was registered in June 2021 in the International Prospective Register of Systematic Reviews database (PROSPERO) (CRD42021260499) and amended in September 2022. This can be found in Appendix B.

2.2 Methods

2.2.1 Population

The population of interest was older working adults as this was the age group of interest for the whole project. However, restricting the target population to older workers would not have identified enough papers. Therefore, we decided to target working age adults (aged 18+), as long as the study sample included the age group 50+. In addition to what was published, we contacted all corresponding authors of the included papers to enquire about any additional analyses they could provide based on the age group 50+, in line with recommendations in the Cochrane handbook (101).

2.2.2 Exposure/Intervention

This comprised any change of employment status that occurred after the start of the pandemic. It included having lost a job, reduced working hours and/or pay, working from home in lockdown, or being furloughed. The reference category could be either not having experienced such changes in employment (i.e., job loss vs no job loss) or having an unchanged employment status compared to the pre-pandemic period.

2.2.3 Outcome

The outcome of interest was anxiety, regardless of the tools used for the assessment.

2.2.4 Inclusion/exclusion criteria

Our inclusion criteria for the systematic review were:

- Sample including age group 50+.
- Sample recruited from the general population.
- Change/s in employment since the onset of COVID-19 pandemic reported as exposure.
- Any type of observational study design.
- Quantitative evidence.
- Peer reviewed evidence in either English or Italian.

We excluded papers whose sample did not include the age group 50+, as this age group is the demographic of interest of this thesis. Also, we excluded papers which did not explore changes in employment that occurred with the COVID 19 pandemic as an exposure. Manuscripts presenting only descriptive statistics and not associations were included, provided they compared anxiety across categories or levels of changes in employment. These studies are labelled “descriptive studies” as opposed to “analytical studies” which reported associations between variables. Papers exploring the research question of interest on a specific occupational group/s or on a sample with a specific health condition were excluded as their findings would not be generalisable. Finally, we excluded evidence from qualitative studies.

2.2.5 Search strategy

The study followed The Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines 2020. The search strategy was designed and trialled initially in MEDLINE (Ovid platform) and was revised and discussed with an experienced Research Engagement Librarian, from the University of Southampton. The search terms were in three groups: one about changes in employment, a second about COVID-19 and a third that described the outcome (anxiety). These three groups were combined with an ‘AND’. The first group included terms like ‘unemployment’, ‘furlough’, and ‘job loss’. For the second section about COVID-19 we used search blocks designed by other researchers and publicly available online, to make sure we would include all possible terms to indicate the coronavirus pandemic. The third section included anxiety or anxiety disorders. The search strategy made use of Medical Subject Headings (MESH) terms as well as free text to include all synonyms of the main components. We also used proximity searching to search for two or more words that occurred within a certain number of words from each other, and wildcards to make sure that words with a similar stem would be picked up. The finalised search strategy was then tailored to each of the following databases to account for differences in the syntax and terminology used in each of them:

- EMBASE (Ovid)
- MEDLINE (Ovid)
- PsycInfo (EBSCO)
- CINAHL (EBSCO)

The search strategies designed for MEDLINE (Ovid) and CINAHL (EBSCO) are available in Appendix C. The final searches were run on 22/07/2023.

2.2.6 Data extraction

A data extraction form was created with all fields relevant to the review. A draft version was trialled by me (SD) and Karen Walker-Bone (KWB) on a sample of studies. Two reviewers, SD, and Elena Zaballa (EZ) extracted information from all papers independently and compared forms afterwards. Data extracted were author and year, country, data collection period, study design, description of the sample included, definition and prevalence of the exposure/s, definition and prevalence of the outcome, whether it was entirely a descriptive study or examined associations between variables, statistical methods used, risk estimates when available, confounders considered and estimates available for the age group 50+. A copy of the data extraction form is available in Appendix E.

2.2.7 Quality assessment

A risk of bias tool was developed based on a combination of the Scottish Intercollegiate Guidelines Network (SIGN) template for cohort studies (102) and the Joanna Briggs Institute (JBI) checklist for cross-sectional studies (103). Wording of some questions was slightly adapted to fit better with this specific review. In the form, items with an asterisk (*) were applicable only to cohort studies and not to cross-sectional studies, while some items were not applicable to purely descriptive studies. The final tool comprised 13 items with an additional summary measure of quality (Q14). The risk of bias tool was developed and trialled by KWB and SD and is available in Appendix D. The risk of bias check was carried out independently by SD and KWB and possible outcomes for each study were: “unacceptable”, “acceptable”, “medium quality”, “high quality”. Results were compared, and any discrepancy discussed to reach an agreement.

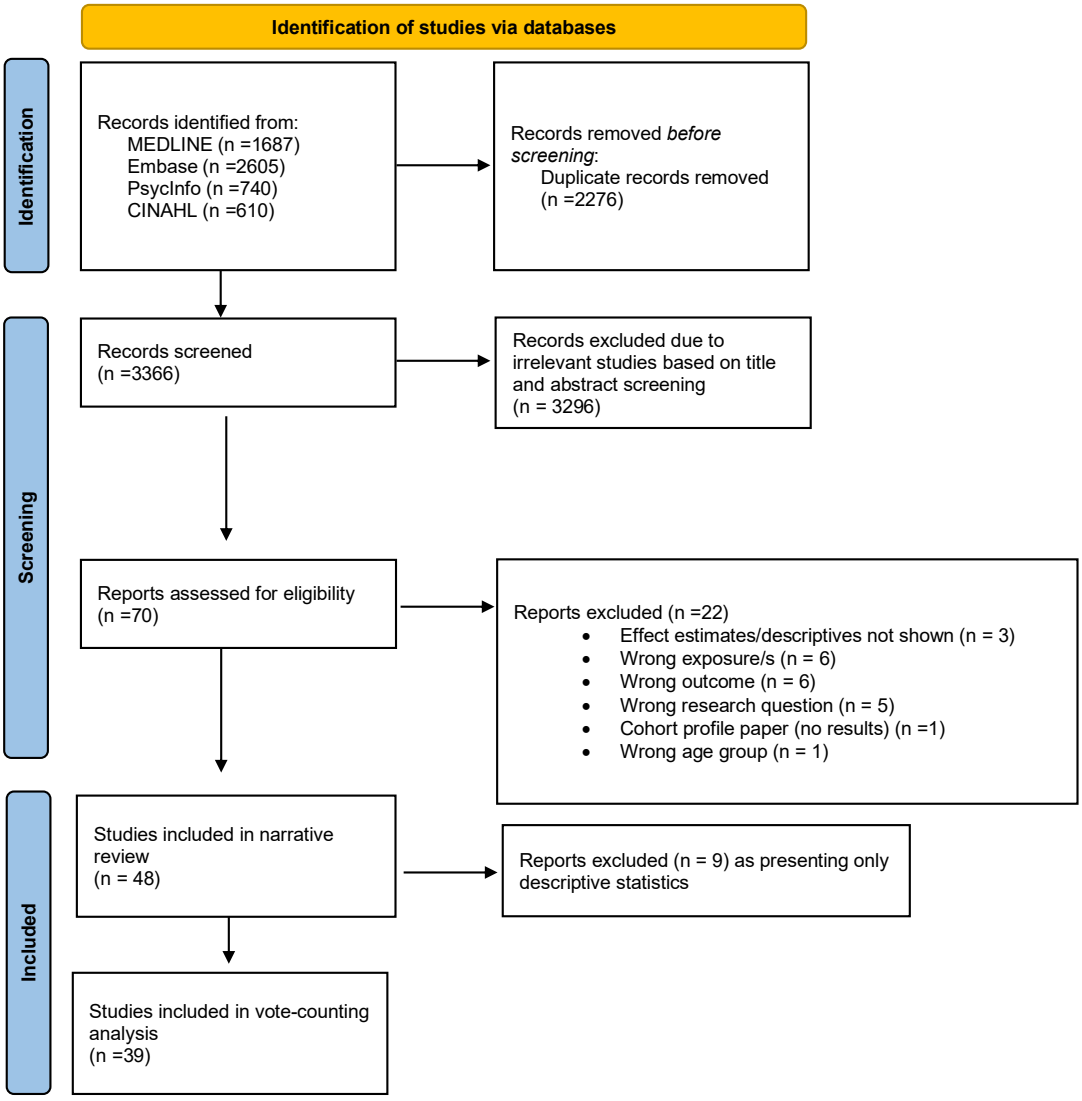
2.2.8 Data synthesis

As a first step, a narrative review was undertaken, with findings described according to the type of exposure and study design. To provide a quantitative summary of the available evidence, we synthesised findings using a “vote-counting” technique, based on the direction of effect between exposure and anxiety. We followed the methodology detailed by the Cochrane handbook (104) which recommends the use of this method where a meta-analysis

is not feasible. Vote-counting can answer the question “is there evidence of an effect?”. It does not give importance to whether the effect is significant or to the sample size. In essence, it compares the number of studies showing benefits to the number showing harm for a particular outcome. To undertake vote-counting, we first categorised each effect estimate as either showing benefit or harm to health. In our case, the outcome was anxiety, therefore a beneficial effect on health meant a decrease in anxiety. A sign test was then performed to test the null hypothesis of an equal number of positive and negative results. To perform the sign test, we counted the number of effects showing benefit and those showing harm for each exposure. Inconclusive results were excluded from the calculation. Neither statistical significance nor the size of the effect was considered in the categorisation. An effect direction plot was then created for each exposure of interest. This plot uses arrows to display visually the direction of effect of the association within each study (105). The process was conducted separately by study design. The vote-counting was only applicable to analytical studies.

2.3 Results

Figure 2-1: PRISMA flow-chart of studies included in the systematic review



A total of 5,642 references were retrieved with the search strategy carried out in MEDLINE, EMBASE, PsycInfo, and CINAHL databases. After having imported such references to EndNote, I used the duplicates function to identify duplicated entries. 2,276 references were duplicates and were removed. This left a total of 3,366 references to screen. Once duplicates had been removed, remaining papers were exported to Rayyan, a free online platform that facilitates work in collaboration with others (106). I screened titles and abstracts for eligibility, and classified them as “include”, “exclude”, or “uncertain”. A second reviewer (EZ) screened all those that were “uncertain”, all those classified as “include”, and an additional 10% of

those classified as “exclude”, and agreement was reached to include 70 entries based on their title and abstract only.

A further independent full screening of articles was carried out in the same way by SD and EZ, resulting in the exclusion of a further 22 papers. Reasons for exclusion were detailed in the flow-chart Figure 2-1. These were: effect estimates/descriptives not reported (n=3); wrong exposure (n=6); wrong outcome (n=6); wrong research question (n=5); cohort profile paper (n=1); wrong age group (n=1). Thus, we ended up with 48 papers that were eligible for inclusion in the systematic review. In August 2023 I carried out a snowball search using the Web of Science database. This entailed screening the bibliography of the main manuscripts and searching for later papers that have referenced them. This did not identify any additional paper meeting the review criteria, so the final number of papers included in the review remained 48.

A summary of the main characteristics of the 48 included papers is presented in Table 2-2 (cross-sectional studies) and Table 2-3 (longitudinal studies). The majority of studies had a cross-sectional design (n=39) while the other 9 used a longitudinal design. Studies’ locations varied widely, although the majority were conducted in the USA, followed by Australia. Data were collected at different phases of lockdown, with the majority referring to the initial phases of lockdown although some studies also collected data at later phases. The number of study participants ranged from 186 (107) to a maximum of 1,576,770 (108). The breakdown of participants by age was not always reported, with 34 of the 48 studies reporting on the proportion of middle-aged participants included in the sample (threshold to define middle aged varied from 50 to 55 depending on the study). In most studies women outnumbered men. A total of 9 of the 48 studies were purely descriptive while the remaining 39 were analytical and reported at least one association between the exposure of interest and anxiety. The quality of the cross-sectional studies was rated as follows: n=21 studies were rated “acceptable”, n=17 “medium quality” and 1 “unacceptable”. Longitudinal studies were of slightly better quality and 3 were rated “acceptable”, 3 of “medium quality” and 3 of “high quality”. The main reasons for scoring poorly on quality assessment were that recruitment of participants was mainly performed with snowball techniques which did not ensure representativeness of the sample; and failure to adjust for important confounders in the analyses such as a measure of socio-economic status and a measure of health. Additionally, the cross-sectional design of most studies may have introduced bias in the estimates due to exposure and outcome being assessed at the same time. Details of the quality assessment scoring of each paper are available in Table 2-1.

Table 2-1: Quality assessment for studies included in the systematic review.

Author and Year	Clear question	Inclusion criteria	Description of subjects	Similar groups	% Dropout *	Comparison*	Outcome defined	Outcome measured	Exposure measured	Confounders**	CIs**	Clear association**	Generalisable	Quality
Abdalla *et al*, 2021 **(109)**	Y	Y	Y	Y	N/A	N/A	Y	Y	Y	N/A	N/A	N/A	Y	+
Abrams *et al*, 2021 **(110)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	Y	Y	N	Y	++
Alsaif *et al*, 2022 **(111)**	Y	N	Y	U	N/A	N/A	Y	Y	Y	Y	Y	Y	N	+
Amer *et al*, 2022 **(112)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	N/A	N/A	N/A	N	+
Batterham *et al*, 2021 **(113)**	Y	Y	Y	U	Y	N	Y	Y	Y	U	Y	N	Y	++
Blomqvist *et al*, 2023 **(114)**	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	+++
Blomqvist *et al*, 2023 **(115)**	Y	Y	Y	Y	N	N	Y	Y	Y	N	Y	N	Y	++
Burhamah *et al*, 2020 **(116)**	Y	Y	Y	U	N/A	N/A	Y	N	N	U	Y	N	U	+
Burstyn *et al*, 2021 **(117)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	Y	Y	N	Y	++
Dawel *et al*, 2020 **(118)**	Y	Y	Y	Y	N/A	N/A	Y	Y	Y	Y	N	N	Y	++
De Miquel *et al*, 2022 **(119)**	Y	Y	Y	Y	N/A	N/A	Y	Y	N	N	Y	N	U	+

Author and Year	Clear question	Inclusion criteria	Description of subjects	Similar groups	% Dropout *	Comparison*	Outcome defined	Outcome measured	Exposure measured	Confounders**	CIs**	Clear association**	Generalisable	Quality
Dragano *et al*, 2022 **(120)**	Y	Y	Y	Y	N	N	Y	Y	Y	N	Y	Y	Y	+++
Elezi *et al*, 2020 **(121)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	N/A	N/A	N/A	N	+
Fiorenzato *et al*, 2021 **(122)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	N/A	N/A	N/A	Y	+
Fisher *et al*, 2020 **(123)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	N	Y	Y	Y	++
Fisher *et al*, 2022 **(124)**	Y	Y	Y	U	N/A	N/A	Y	U	Y	N/A	N/A	N/A	N	+
Guerin *et al*, 2021 **(125)**	Y	Y	N	Y	N/A	N/A	Y	Y	Y	N	Y	Y	Y	++
Hagen *et al*, 2022 **(126)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	U	N	N	N	+
Hammarberg *et al*, 2020 **(127)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	N	Y	Y	Y	++
Haynes *et al*, 2021 **(128)**	Y	N	Y	U	N/A	N/A	Y	U	Y	N/A	N/A	N/A	N	0
Hoffmann *et al*, 2023 **(129)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	N	Y	N	N	+
Hwang *et al*, 2023 **(130)**	Y	Y	Y	Y	N	N	Y	U	Y	N	Y	Y	N	+

Author and Year	Clear question	Inclusion criteria	Description of subjects	Similar groups	% Dropout *	Comparison*	Outcome defined	Outcome measured	Exposure measured	Confounders**	CIs**	Clear association**	Generalisable	Quality
Jewell *et al*, 2020 **(131)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	N	N	N	N	+
Killgore *et al*, 2021 **(132)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	N/A	N/A	N/A	Y	+
Mani *et al*, 2023 **(133)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	N	N	Y	N	+
Matsubayashi *et al*, 2022 **(134)**	Y	N	Y	Y	N	N	Y	Y	N	N	Y	Y	U	+
McDowell *et al*, 2021 **(65)**	Y	Y	N	U	N/A	N/A	Y	Y	Y	Y	Y	Y	N	++
Mojtahedi *et al*, 2021 **(135)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	N	N	U	U	+
Monnig *et al*, 2023 **(136)**	Y	Y	Y	U	N/A	N/A	Y	Y	N	N	Y	N	N	+
Nelson *et al*, 2020 **(137)**	Y	Y	Y	U	N/A	N/A	Y	Y	U	N	Y	N	N	+
Okafor *et al*, 2021 **(138)**	Y	Y	Y	U	N/A	N/A	Y	U	N	Y	Y	Y	Y	++
Pieh *et al*, 2020 **(139)**	Y	Y	N	Y	N/A	N/A	Y	Y	Y	N/A	N/A	N/A	Y	+
Prata Ribeiro *et al*, 2021 **(140)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	Y	Y	Y	N	++

Author and Year	Clear question	Inclusion criteria	Description of subjects	Similar groups	% Dropout *	Comparison*	Outcome defined	Outcome measured	Exposure measured	Confounders**	CIs**	Clear association**	Generalisable	Quality
Ruengorn *et al*, 2021 **(141)**	Y	Y	Y	U	N/A	N/A	Y	N	Y	Y	Y	U	N	+
Savolainen *et al*, 2021 **(142)**	Y	U	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	+++
Settels *et al*, 2023 **(143)**	Y	Y	Y	Y	N/A	N/A	Y	N	Y	Y	Y	Y	Y	++
Shahaj *et al*, 2023 **(144)**	Y	Y	Y	Y	N/A	N/A	Y	N	Y	Y	Y	Y	Y	++
Shalaby *et al*, 2022 **(107)**	Y	N	Y	U	N/A	N/A	Y	Y	Y	N	Y	N	U	+
Smith *et al*, 2020 **(145)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	Y	Y	Y	Y	++
Solomou *et al*, 2020 **(146)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	N/A	N/A	N/A	N	+
Umucu *et al*, 2021 **(147)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	Y	Y	Y	U	++
Warren *et al*, 2021 **(148)**	Y	Y	Y	Y	N/A	N/A	Y	Y	Y	Y	Y	Y	Y	++
Wright *et al*, 2021 **(149)**	Y	Y	Y	U	Y	N	Y	Y	Y	U	Y	N	Y	++
Yao *et al*, 2021 **(108)**	Y	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	U	+

Author and Year	Clear question	Inclusion criteria	Description of subjects	Similar groups	% Dropout *	Comparison*	Outcome defined	Outcome measured	Exposure measured	Confounders**	CIs**	Clear association**	Generalisable	Quality
Zamanzadeh *et al*, 2023 **(150)**	Y	N	Y	U	N/A	N/A	Y	U	Y	N	Y	Y	Y	+
Zhang *et al*, 2022 **(151)**	Y	Y	Y	Y	N/A	N/A	Y	U	Y	Y	Y	N	Y	++
Zhao *et al*, 2021 **(152)**	Y	Y	Y	U	N/A	N/A	Y	Y	Y	Y	Y	Y	Y	++
Zhou *et al*, 2020 **(153)**	Y	U	Y	U	Y	Y	Y	Y	Y	Y	Y	N	Y	++

* Only applicable to longitudinal studies; ** Only applicable to analytical studies; Y = yes; N = no; U = unclear; N/A = not applicable. Quality: 0=Unacceptable; +=Acceptable; ++=Medium Quality; +++=High quality

2.3.1 Exposure assessment, by study design

Table 2-4 shows the definition of exposure and outcome used by each descriptive study included in the review. Five studies measured anxiety in people who had lost employment since lockdown. Three of those used a dummy variable and compared anxiety level for people who had experienced job loss with those who did not have such experience (124, 132, 154), while two studies compared those who lost their job with those whose position remained unchanged (112, 139). The second type of exposure was working from home in lockdown. An important distinction was whether the experience of home working was new or whether homeworking was already in place, but most papers did not differentiate between the two. Only one of the descriptive studies shown in Table 2-4 reported on anxiety levels for people shifting to home working after COVID-19 restrictions (128) while in the other four papers it was not possible to discern whether home working was already in place (121, 122, 139, 146). No other exposure was analysed in these descriptive papers. Table 2-5 shows an equivalent description for the analytical studies. Most studies explored the effect of loss of employment as a risk factor for anxiety, but the assessment of that exposure varied widely across studies. Sixteen studies used dummy variables and compared participants who experienced a job loss/became unemployed with those who did not have such experience (107, 111, 113, 118, 123, 125-127, 130, 141-144, 149, 150, 155); while eight studies compared those with job loss/who became unemployed to those whose job or work location remained unchanged (65, 110, 114, 117, 120, 145, 148); among these was the study by Yao (108) in which the category “involuntarily not working” included loss of employment as well as many other reasons such as being off work with coronavirus, caring for someone, or being furloughed. In a sensitivity analysis, the authors explored the effect of each reason for “involuntarily not working” (therefore including loss of employment) and compared it with people “voluntarily not working” (i.e., retired). Differently, Jewell and colleagues (131) used the group working remotely before and during lockdown as a reference, Mojtahedi et al (135) used those working from home during lockdown as reference, and Zhou et al (153) those unemployed before COVID-19 as reference and combined being laid off, furloughed, or otherwise unemployed due to COVID-19 in a single exposure variable.

Some studies adopted different definition of job loss: a Spanish study combined those who became unemployed with those temporarily laid off (i.e., furloughed) and compared them with participants without such experience (119), another study combined stopped working with stopped studying as one exposure (116), while a third study classified as “experiencing

an adverse change" any of job loss, layoff, or significant reduction in working hours in the previous three months, and compared them with those without adverse changes (134). Monnig and colleagues (136) asked participants about any job loss that involved them or their household more widely, while in a sample of Swedish employees, having been dismissed or having received notice were analysed together (115). It was unclear whether the exposure reported by Mani et al (133) in a sample from India, referred to job loss or being furloughed as the authors refer to "temporary unemployment". Okafor and colleagues reported on loss of job or wages (138), while Zhao and colleagues (152) explored the effect of becoming unemployed by asking participants economically active pre-pandemic whether they had experienced a reduction in income since the outbreak (no change, small reduction, reduction by half, larger reduction, or unemployed). In the paper by Nelson (137) the definition of exposure included not only job loss as such, but a change in working hours as well.

The second most common exposure analysed in these papers was working from home, which was reported in eleven of the analytical studies. Four studies used remote worker during lockdown as a dummy variable (therefore using the category not remote worker as a reference) (113, 118, 120, 142), while five studies compared the effect of being a remote worker in lockdown with that of remaining in the same position as before lockdown (110, 140, 145, 148, 151). Finally, one paper compared remote working initiated since the pandemic with performing remote working already before the pandemic (131) and one study used as reference the group of people unemployed during lockdown (129).

Other less common exposures reported in this review were being furloughed, featuring in four papers (110, 114, 115, 135) and a decrease in working hours which featured in two papers (110, 125).

2.3.2 Outcome assessment

The most common tool to assess anxiety was the Generalised Anxiety Disorder (GAD-7), a 7-item scale designed to detect cases of generalised anxiety disorders and to assess severity of symptoms. The scale works by assessing the frequency of each symptom, and ranges from 0 to 21, with scores of ≥5, ≥10, and ≥15 representing mild, moderate, and severe anxiety symptom levels, respectively (156). Most of the descriptive papers used this scale to specify a continuous (112, 121, 146) or categorical (109, 132, 139) outcome measure. The Hospital Anxiety and Depression Scale (HADS) was used to assess presence

of anxiety in a cross sectional study of adults living in Italy during lockdown (122) while a survey conducted in Johannesburg used a bespoke measure and assessed the frequency of feeling anxious or stressed (124).

In the analytical papers, the GAD-7 scale was used either as a continuous variable (113, 118, 126, 148, 149) or as a binary measure. Thirteen of the papers that dichotomised the score used the threshold of 10, recommended by Spitzer et al (156) to identify moderate or severe anxiety disorders, while Burhamah et al (116) used a threshold of 8. Ruengorn et al (141) adopted a Thai version of the score with 5 as the cut-off. A shorter version of GAD-7, namely GAD-2 was used in five papers (108, 125, 137, 145, 152). This consists of the first 2 questions of GAD-7, and a cut-off score ≥3 is recommended. Two papers (65, 110) used the 21-item Beck Anxiety Inventory (BAI) (157), a self-reported questionnaire measuring 21 common somatic and cognitive symptoms of anxiety, and a third paper used a Portuguese version of the same scale (140). One paper (147) used the short form of the Patient Health Questionnaire for Depression and Anxiety (PHQ-4) (158), two papers (135, 142) the Spielberg State-Trait Anxiety Inventory (STAI) and three papers (129) (135, 153) the Depression, Anxiety, and Stress Scale [DASS21] (159) or a modified version of it (111). A paper by Burstyn et al (117) used HADS to measure anxiety. Finally, some papers used bespoke measures to assess anxiety. Two manuscripts which used data from SHARE asked participants whether in the previous month they had felt nervous, anxious or on edge (143, 151). Another paper on the same European sample aged 50+ collected information regarding a worsening of nervousness in the 4 weeks preceding the survey (144). Hwang asked participants to rate how much anxiety due to the COVID-19 pandemic they experienced, with higher scores being indicative of more negative feelings. A cross-sectional survey conducted in the USA (138), opted for a bespoke measure of anxiety where the participants were asked to report their agreement with the following: “Since the outbreak I feel negative and/or anxious about the future”. Finally, a six-country survey asked participants to report whether they experienced any anxiety due to the pandemic (150).

2.3.3 Main findings of descriptive studies

Table 2-4 shows the main findings of the descriptive studies which were excluded from the “vote-counting” process. These were all cross-sectional in design. All descriptive studies were rated poorly, with eight out of nine rated “acceptable” and one rated “unacceptable” (128). Five of the eight descriptive studies described anxiety amongst those who experienced job loss. The studies by Abdalla (109) and Killgore (132) reported that the

prevalence of anxiety was significantly higher among participants who lost their jobs since the start of the pandemic as compared with those who did not. In a sensitivity analysis conducted by Killgore et al based on 16% of their sample aged 50+, the authors found comparable results to those reported in the whole sample. Amer et al (112) surveyed 859 adults living in Saudi Arabia, and reported that anxiety score was higher for participants with work suspension, as opposed to those working as before, and similar findings were reported by Pieh in the UK (139). In contrast, a study conducted in a deprived neighbourhood of Johannesburg (South Africa), found no differences in the rate of anxiety between those who lost their jobs and those who did not (124).

Six of these studies reported on the prevalence of anxiety among those who were working remotely since lockdown. In most of these studies, participants working from home since lockdown were not dissimilar regarding their prevalence of anxiety to those whose employment had remained unchanged. This was reported in studies from Italy (122), the UK (139), the USA (128) and Cyprus (146). On the other hand, Amer et al (112) and Elezi et al (121) both reported that participants working from home in lockdown had a higher mean level of anxiety compared with those who remained working as before.

2.3.4 Main findings from the analytical studies

Similarly, Table 2-5 (cross-sectional) and Table 2-6 (longitudinal) describe the main findings from the 39 analytical studies, separately by study design. All nine longitudinal studies presented in Table 2-6 explored the prospective association between job loss and anxiety. A study performed in a cohort of 1,269 adults in Australia, found no association between loss of employment and clinically significant anxiety (113). The study by Matsubayashi et al (134) collected data on 9,000 residents in Japan who completed a series of online surveys, and found that experiencing an adverse job change of any kind (including but not limited to job loss) was associated with increased odds of anxiety (OR: 1.84 95%CI 1.50-2.17). The study by Savolainen and colleagues (142) collected data in 2019 and 2020 on a representative sample of 1,044 Finnish workers and found no increase in anxiety over time for those who became unemployed (unstandardised β: 1.05 SE: 1.05 p-value: 0.360) since lockdown. Yao and colleagues (108) showed that participants involuntarily not working (vs those still in work) were 20% more likely to report anxiety, and that any reason for involuntarily not working (being laid off, employer's business closure due to COVID-19, employer went out of business) was associated with significantly increased odds of anxiety compared to people voluntarily not working (i.e. retirees). Zhou et al (153) recruited 1,021 residents in the US who

completed two surveys one month apart. Participants either laid-off, furloughed or otherwise unemployed due to COVID-19 did not display different levels of anxiety compared with a control group of participants already unemployed prior to the pandemic. Blomqvist et al published two papers which feature in this review. They analysed participants of an existing cohort of working age Swedes (The Swedish Longitudinal Occupational Survey of Health) to investigate the prospective association between job loss (as opposed to a stable work situation) and anxiety (114) and between having been dismissed or received notice and anxiety (115). In both studies, they found no significant associations after full adjustment. In a large population-based German cohort, although only less than 1% of the sample reported unemployment due to coronavirus, the authors showed that having such experience led to an increase in anxiety (as opposed to no change in employment position) (OR: 1.30 95%CI 1.11-1.51) (120). Finally, a study in South Korea, where 15% of the cohort experienced job loss, showed a convincing negative association between job loss and anxiety (130). The remaining studies to explore such association were of cross-sectional design and are presented in Table 2-5. Several of them compared the loss of employment with not having had such experience and can be divided into those suggesting significant negative effects of job loss on anxiety (107, 111, 118, 123, 125, 126, 137, 150, 155) and those finding no significant relationships between the two (119, 136, 141, 149).

The remaining cross-sectional studies used “no change in employment” (i.e., attending work as before) as the reference category. These all found a positive significant association between job loss and anxiety. Participants recruited by Iowa University, who had been working pre-pandemic and then experienced job loss, reported worse anxiety score than those whose job was unchanged (Hedges’ g: -0.212 95%CI: -0.363 to -0.061) (65). Warren and colleagues (148) recruited a mixed sample of healthcare workers (40%), non-healthcare essential workers (30%) and general population (30%) and found that being unemployed because of COVID-19 (vs. working from normal location) was associated with higher anxiety (β: 2.49; 95%CI: 1.53 to 3.44, with the score ranging from 0 to 21) and higher odds of clinically significant anxiety (OR: 2.78; 95%CI: 1.86 to 4.16). In their study looking at the relationship between income reduction and mental health symptoms, Zhao et al (152) reported that participants who became unemployed were five times more likely to report anxiety compared with participants whose income remained unchanged. The fully adjusted model included sex, age, education, self-rated health, chronic disease, smoking, alcohol, protective equipment, and social distancing measures. A cross-sectional survey conducted in Philadelphia (USA), showed a significant association between job loss and anxiety only among men (117). While a survey of the Indian adult population revealed that those who

were temporarily unemployed since lockdown were twice as likely to score positively for anxiety, as compared with people still employed (133). Smith et al compared the proportion of participants with anxiety among those no longer working as opposed to those working at their physical workplace. They found that after adjustment for relevant factors, participants no longer employed had a similar prevalence of anxiety compared with participants still working at their physical workplace (145).

Three studies used people who were working from home during lockdown as reference category. The first recruited online just over 4,000 participants aged 18+, resident in Kuwait and reported that no longer working or studying was associated with slightly increased odds of anxiety (OR: 1.39 95%CI: 1.04 to 1.86) (116). A smaller study with data collected in multiple countries reported that losing job or a business during lockdown was associated with higher anxiety score (β: 0.13 $p<0.001$, no 95% CI reported) (135). Finally, results from the Mental Health and Wellbeing Survey during COVID-19 Pandemic performed in the US found that no longer working due to COVID-19 was not associated with anxiety after full adjustment for confounders (131).

Three longitudinal studies explored the association between remote working and anxiety. The study by Batterham et al (113) found that being able to work from home (vs not) was associated with a greater decline in anxiety over the course of the follow-up time (3 months) (unstandardised β -0.371, SE: 0.188, p-value: 0.049). A cohort of Finnish workers (142) found no increase in anxiety between 2019 and 2020 for those who became remote workers (unstandardised β: 0.41, SE: 0.65, p-value: 0.535) since lockdown. However, they found that working remotely in 2020 (vs not) was cross-sectionally associated with elevated anxiety. Finally, a study by Dragano et al (120) reported that working from home in lockdown (vs not) was associated with increased anxiety compared with the pre-pandemic period. The remaining studies exploring the effect of remote working on anxiety were cross-sectional. All but two studies found no significant association between remote working (either shift to remote working or remote working in lockdown) and anxiety (118, 129, 131, 148). In the study conducted by Smith and colleagues (145), however, participants working remotely reported significantly lower adjusted prevalence rate of anxiety compared with participants working at their physical workplace (prevalence rate: 35.3%; 95%CI 27.1 to 43.5 among home workers and proportion: 43.5; 95%CI 35.4 to 51.6 among site-based workers). Prata Ribeiro and colleagues found that working from home in lockdown was associated with lower anxiety than working at the usual workplace (140).

2.3.5 Findings among middle-aged people

The focus of our review was middle-aged people and, although they were represented in each of the 48 studies of this systematic review (according to protocol), only some studies reported on associations separately for this age group. Some of these findings were shown in the published manuscripts while others were obtained by contacting the corresponding authors.

Hammarberg et al (127) conducted a short online survey in Australia and found that women aged 50+ who lost a job because of COVID-19 restrictions were 50% more likely to report clinically significant symptoms of anxiety than those who did not. Differences for men were not significant. The study by Abrams (110) included only Americans aged 55+, but failed to find a significant association of anxiety with job loss or being furloughed, or working from home (vs job unchanged).

Settels, Shahaj and Zhang all conducted secondary analyses of SHARE which included adults aged 50+ from 27 European countries. 21% of the sample by Zhang said they had felt more anxious or nervous than the previous month, however the authors did not find a significant association between working from home (vs working in the usual place) and anxiety (151). Shahaj used the same outcome and reported that participants who lost their job were twice as likely to have experienced increased anxiety in the previous month (144). Settels found that those who had lost their employment or their business because of the pandemic were 70% more likely to have felt nervous, anxious or on edge in the previous month, compared with those who did not (143).

Most studies were underpowered for this stratified analysis and did not find significant associations between exposures and anxiety among people aged 50+ (114, 115, 118, 119, 125, 142). However, loss of employment was significantly associated with greater anxiety amongst people age 50+ in a series of studies (108, 120, 134, 136) and the prevalence of clinically significant anxiety was higher amongst people with job loss vs those without (132). Finally, remote working was linked to higher anxiety amongst people aged 50+ in the study by Dragano (120), while the association was not significant in a study of Finnish workers (142).

Table 2-2 Characteristics of included studies - cross-sectional design

Author and Year	Country	Data collection period	Number of participants	Gender breakdown, N (%)	Participants aged 50+, N (%)	Overall quality
Abdalla *et al,* 2021 **(109)**	USA	31st March-13th April 2020	1,450	Men = 725 (48.2%) Women = 725 (51.8%)	Age 60+ = 366 (29.9%)	Acceptable (+)
Abrams *et al,* 2021 **(110)**	USA	2nd April-31st May 2020	6,264	Not reported	All aged 55+	Medium quality (++)
Alsaif *et al,* 2022 **(111)**	Saudi Arabia	Not specified	754	Men = 408 (54.1%) Women = 346 (45.9%)	Age 56-65 = 27 (3.6%)	Acceptable (+)
Amer *et al,* 2022 **(112)**	Saudi Arabia	May 2020-June 2020	858	Men = 368 (42.9%) Women = 489 (57.1%)	Age 50-65 = 105 (12.3%) Age 65+=3 (0.4%)	Acceptable (+)
Burhamah *et al,* 2020 **(116)**	Kuwait	25th-30th May 2020	4,132	Men = 1268 (30.7%) Women = 2864 (69.3%)	Age 51+ = 1241 (30.0%)	Acceptable (+)
Burstyn *et al,* 2021 **(117)**	Philadelphia, USA	17th April-3rd July 2020	911	Not reported	Men Age 55+ = 81 (34.6%) Women Age 55+ = 197 (29.7%)	Medium quality (++)

Author and Year	Country	Data collection period	Number of participants	Gender breakdown, N (%)	Participants aged 50+, N (%)	Overall quality
Dawel *et al,* 2020 **(118)**	Australia	28th-31st March 2020	1,296	Men = 645 (49.8%) Women = 649 (50.2%) 2 missing values	Age 50+ = 549 (42.4%)	Medium quality (++)
De Miquel *et al,* 2022 **(119)**	Spain	June 2020	2,381	Prevalence (95%CI) Men = 47.48% (45.39-49.58%) Women = 52.53% (50.42-54.61%)	Not reported	Acceptable (+)
Elezi *et al,* 2020 **(121)**	Albania	4th April-29th April 2020	1,678	Men = 449 (26.8%) Women = 1,229 (73.2%)	Age 46-55 = 68 (4.1%)	Acceptable (+)
Fiorenzato *et al,* 2021 **(122)**	Italy	29th April-17th May 2020	1,215	Men = 351 (28.9%) Women = 864 (71.1%)	Age 45-65 = 429 (35.3%)	Acceptable (+)
Fisher *et al,* 2020± **(123)**	Australia	3rd April-3rd May 2020	13,829	Men = 3328 (24.1%)	Age 50+ = 7344 (53.1%)	Medium quality (++)

Author and Year	Country	Data collection period	Number of participants	Gender breakdown, N (%)	Participants aged 50+, N (%)	Overall quality
				Women = 10434 (75.5%) Other = 67 (0.5%)		
Fisher *et al,* 2022 **(124)**	South Africa	11th May-22nd May 2020	353	Men = 187 (53%) Women = 165 (46.7%) Other = 1 (0.3%)	Not reported	Acceptable (+)
Guerin *et al,* 2021 **(125)**	USA	10th June-25th June 2020	2,565	Men = 1,386 (54.0%) Women = 1,179 (46.0%)	Age 50+= 1,198 (46.7%)	Medium quality (++)
Hagen *et al,* 2022 **(126)**	Norway	1st April-2nd June 2020	19,372	Men = 4,648 (24.0%) Women = 14,601 (75.4%) Other = 119 (0.6%)	Not reported	Acceptable (+)
Hammarberg *et al,* 2020 ± **(127)**	Australia	3rd April-2nd May 2020	13,762	Men = 3328 (24.2%) Women = 10434 (25.8%)	Age 50+ = 7322 (53.2%)	Medium quality (++)

Author and Year	Country	Data collection period	Number of participants	Gender breakdown, N (%)	Participants aged 50+, N (%)	Overall quality
Haynes *et al,* 2021 **(128)**	USA	8th May-6th June 2020	276	Men = 55 (20%) Women = 221 (80%)	Age 45-64 = 49% Age 65+ = 14%	Unacceptable (0)
Hoffmann *et al,* 2023 **(129)**	Poland	1st June-31st Dec 2021	1,306	Men = 290 (22.21%) Women = 1016 (77.79%)	Not reported	Acceptable (+)
Jewell *et al,* 2020 **(131)**	USA	7th April-1st June 2020	1,083	Men = 189 (17.6%) Women = 884 (82.4%)	Age 45+ = 536 (50%) Age 60+ = 223 (20.7%)	Acceptable (+)
Killgore *et al,* 2021 **(132)**	USA	28-hour period between 9th and 10th April 2020	1,013	Men = 446 (43.6%) Women = 567 (56.4%)	Age 50+=160 (15.8%)	Acceptable (+)
Mani *et al,* 2023 **(133)**	India	25th April-10th May 2020	2,640	Men = 1609 (61%) Women = 1031 (39%)	Age 51+ = 389 (14.5%)	Acceptable (+)
McDowell *et al,* 2021 **(65)**	USA	3rd April-7th April 2020	2,301	Men = 784 (44%) Women = 1519 (66%)	Not reported	Medium quality (++)

Author and Year	Country	Data collection period	Number of participants	Gender breakdown, N (%)	Participants aged 50+, N (%)	Overall quality
Mojtahedi *et al,* 2021 **(135)**	UK, North America, India, Brazil, and others	Data collection performed on: 23rd April -21st May in UK and Ireland And 18th -25th May 2020	723	Men = 315 (43.6%) Women = 407 (56.3%) Other = 1 (0.1%)	Not reported	Acceptable (+)
Monnig *et al,* 2023 **(136)**	USA	18th June-19th July 2020	1,079	Men = 536 (49.7%) Women = 536 (49.7%) Missing = 7 (0.6%)	Age 50+=304 (28.2%)	Acceptable (+)
Nelson *et al,* 2020 **(137)**	US, Canada, Europe	19th March-10th April 2020	2,065	Men = 636 (30.8%) Women = 1429 (69.2%)	Not reported	Acceptable (+)
Okafor *et al,* 2021 **(138)**	USA	15th August-15th September 2020	446	Men = 170 (38.1%) Women = 270 (60.5%) Other = 6 (1.3%)	Not reported	Medium quality (++)
Pieh *et al,* 2020 **(139)**	UK	21st April-1st May 2020	1,006	Men = 462 (45.9%)	Age 55-64 = 173 (17.2%)	Acceptable (+)

Author and Year	Country	Data collection period	Number of participants	Gender breakdown, N (%)	Participants aged 50+, N (%)	Overall quality
				Women = 544 (54.1%)	Age 65+ = 148 (14.7%)	
Prata Ribeiro *et al,* 2021 **(140)**	Portugal	18th March-18th April 2020	1,626	Men = 397 (24.4%) Women = 1,229 (75.6%)	Not reported	Medium quality (++)
Ruengorn *et al,* 2021 **(141)**	Thailand	21st April-4th May 2020	2,303	Men = 851 (37.0%) Women = 1384 (60.0%) Other = 68 (3.0%)	Age 51+ = 222 (9.6%)	Acceptable (+)
Settels *et al,* 2023 † **(143)**	27 European countries	June to August 2020	11,231	Men = 5,161 (45.95%) Women = 6,070 (54.06%)	All aged 50+	Medium quality (++)
Shahaj *et al,* 2023 † **(144)**	27 European countries	June to August 2020	44,841	Men = 18,596 (41.5%) Women = 26,245 (58.5%)	All aged 50+	Medium quality (++)
Shalaby *et al,* 2022 **(107)**	Canada	24th April-2nd June 2021	186	Men = 27 (14.5%) Women = 159 (85.5%)	Not reported	Acceptable (+)

Author and Year	Country	Data collection period	Number of participants	Gender breakdown, N (%)	Participants aged 50+, N (%)	Overall quality
Smith *et al,* 2020 **(145)**	Canada	26th April – 6th June 2020	3,305	Men = 1,195 (36.2%) Women = 2,022 (61.2%) Missing = 88 (2.7%)	Age 55+ = 1,000 (30.3%)	Medium quality (++)
Solomou *et al,* 2020 **(146)**	Cyprus	3rd April – 9th April 2020	1,642	Men = 466 (28.4%) Women = 1,176 (71.6%)	Age 50+ = 271 (16.5%)	Acceptable (+)
Umucu *et al,* 2021 **(155)**	USA	May-June 2020	5,791	Men = 2,399 (25.9%) Women = 3,367 (63.1%)	Not reported	Medium quality (++)
Warren *et al,* 2021 **(148)**	USA	22nd June-5th July 2020	5,022	Men = 2,042 (40.7%) Women = 2,960 (58.9%)	Age 55+ = 2,195 (43.7%)	Medium quality (++)
Wright *et al,* 2021 **(149)**	UK	1st April-12th May 2020	41,909	Not reported	Not reported	Medium quality (++)
Zamanzadeh *et al,* 2023 **(150)**	China, Italy, Japan, South Korea, the UK, the US	15th April-23rd April 2020	6,089	Men = 2,951 (48.0%) Women = 3,138 (52%)	Age 56-65 = 948 (16%) Age 66+ = 1035 (17%)	Acceptable (+)

Author and Year	Country	Data collection period	Number of participants	Gender breakdown, N (%)	Participants aged 50+, N (%)	Overall quality
Zhang *et al,* 2022 † **(151)**	27 European countries	June to August 2020	11,197	Men = 5,088 (53%) Women = 6,109 (47%)	All aged 50+	Medium quality (++)
Zhao *et al,* 2021 **(152)**	Hong Kong	9th-23rd April 2020	1,501	Men = 672 (44.8%) Women = 829 (55.2%)	Age 50+ = 748 (49.8%)	Medium quality (++)

Table 2-3: Characteristics of included studies – longitudinal design

Author and Year	Country	Data collection period	Number of participants	Gender breakdown, N (%)	Participants aged 50+, N (%)	Overall quality
Batterham *et al,* 2021 **(113)**	Australia	Baseline data collected from 28th to 31st March 2020, and 7 follow-up online surveys up to June 2020	1,296	Men = 647 (49.9%) Women = 649 (50.1%)	Age 55+ = 435 (33.6%)	Medium quality (++)
Blomqvist *et al,* 2023* **(114)**	Sweden	The first questionnaire between January/February 2021; follow-up between January/February 2022	1,558	Men = 628 (40%) Women = 930 (60%)	Not reported	High quality (+++)
Blomqvist *et al,* 2023* **(115)**	Sweden	The first questionnaire between January/February 2021; follow-up between January/February 2022	1,231	Men = 531 (43.1%) Women = 700 (56.9%)	Not reported	Medium quality (++)
Dragano *et al,* 2022 **(120)**	Germany	30th April-15th May 2020	161,787	Men = 77,773 (48.1%)	Age 50+ = 103,184 (63.8%)	High quality (+++)

				Women = 84,014 (51.9%)		
Hwang *et al,* 2023 **(130)**	South Korea	3 surveys sent in: June, September, and December 2020	3,000	Men = 1,711 (57.0%) Women = 1,289 (43.0%)	Age 50+ = 17.1%	Acceptable (+)
Matsubayashi *et al,* 2022 **(134)**	Japan	June 2020-February 2021	9,000	Men = 4464 (49.6%) Women = 4536 (50.4%)	40-64 years: Men - 1629 (36.49%), Women - 1620 (35.71%), Total - 3249 (36.1%)	Acceptable (+)
Savolainen *et al,* 2021 **(142)**	Finland	Baseline data collected in September-October 2019. Follow-up data in September-October 2020	1,044	Men = 572 (54.79%) Women = 472 (45.21%)	Age 50-66 = 405 (38.79%)	High quality (+++)
Yao *et al,* 2021 **(108)**	USA	Baseline survey on 23rd April 2020, followed by follow-up surveys for up to 17 weeks	1,576,770	Men = 762,684 (48.37%) Women = 814,086 (51.63%)	Age 50+=735,411 (46.6%)	Acceptable (+)
Zhou *et al,* 2020 **(153)**	USA	Wave 1: 20th April 2020 Wave 2: 4th- 8th May Wave 3: 18th - 22nd May	1,021	Men = 483 (47.31%) Women = 534 (52.30%) Non-binary = 4 (0.39%)	Age 50+ = 414 (40.5%)	Medium quality (++)

Table 2-4: Main findings of descriptive studies – all cross-sectional

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome/mean (SD)	Main findings	Main findings age 50+
Abdalla *et al* **(109)**	Job loss	Not mentioned	GAD-7 with a cut off 15.	Prevalence 10.9% (95% CI 9.1% to 13.2%)	Prevalence of probable anxiety significantly higher among participants who lost their jobs because of COVID-19 (24%) compared with those who did not (9%) ($p<0.05$)	
Amer *et al* **(112)**	Working remotely, decreased working hours, work suspension or working as before the pandemic.	Working as before= 381 (44.5%) Working remotely=199 (23.2%) Decreased working hours=191 (22.3%) Work suspension = 86 (10.0%)	GAD-7 analysed as continuous.	Breakdown by anxiety categories No anxiety: 260(30.2); Mild: 355 (41.2); Moderate: 162 (18.8); Severe: 84 (9.8) Mean GAD-7=4.01; SD=4.9; median=2, range (0-21)	Anxiety score was higher for participants working remotely or with work suspension, as opposed to those working as before. Median (mean and SD) Working as before: 2(3.9 SD=4.9) Working remotely: 3(4.5 SD=4.9) Work suspension: 3(4.8 SD=5.5)	
Elezi *et al* **(121)**	In work but employment interrupted by the pandemic, work from home after the pandemic, continue to go to work like before.	In work but employment interrupted by the pandemic: 262 (15.6%) Work from home after the pandemic: 309 (18.4%) Continue to go to work like before pandemic: 338 (20.1%)	GAD-7 analysed as continuous.	Not specified	Mean (SD) GAD-7. In work but employment interrupted by the pandemic: mean 5.74 (5.098) Work from home after the pandemic: mean 5.06 (4.364) Continue to go to work like before pandemic: mean 4.74 (4.423).	

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome/mean (SD)	Main findings	Main findings age 50+
					Those who kept working as before had the lowest anxiety score	
Fiorenzato *et al* **(122)**	Working condition under lockdown as follows: Working outside home, working from home, underemployed.	Working outside home = 297 (24.4) Working from home = 535 (44.0) Underemployed = 383 (31.5)	Hospital Anxiety and Depression Scale - Anxiety (HADS-A) used to assess the presence of anxiety. Cut off score of 8 used to identify clinically significant disturbances.	Total N (%) HADS-A>8 = 434 (35.72%) Mean (SD) HADS-A = 6.51 (4.03)	Mean difference in anxiety between underemployed and WFH = 0.73 (95%CI 0.22 to 1.24, p<0.005). The same comparison WFH vs outside was not significant and not reported.	
Fisher *et al* **(123)**	Job loss. Those not in work before lockdown were excluded.	Prevalence of job loss = 70.1% (95%CI = 64.1, 76.1)	Participants were asked how often in the past week they felt anxious or stressed. Answers were: never/some of the time/most of the time/all of the time and dichotomised as yes/no.	Prevalence anxiety overall = 82.0 (78.0, 86.0) Women = 83.5 (77.8, 89.2) Men = 80.6 (74.9, 86.3) Age ≥50 years = 66.0 (53.2, 78.8)	Similar proportion reported anxiety among those who lost a job (83.1 (77.2, 89.0)) vs those who did not (83.1 (74.0, 92.2)). No significant differences found between the groups (p=0.99)	
Haynes *et al* **(128)**	Not employed outside home prior to COVID-19, switched to home working, continued working outside the home. Those who lost their job were excluded.	Not employed outside home prior to COVID-19 = 59(21.4%); Switched to home working = 111(40.2%) Continued working outside the home= 89 (32.2%)	Unclear how anxiety was assessed.	Prevalence of anxiety = 52%	Those continuing work outside home reported elevated levels of anxiety (52%), as well as those who switched to remote working (54%). Those who did not work outside home prior to lockdown reported slightly lower anxiety (49%). P-value not reported.	
Killgore *et al* **(132)**	Job loss since COVID-19	Total job loss = 176 (17.4%), Men = 66	Anxiety defined as GAD-7>8, Zung Self-rated Anxiety Scale (SRAS) >	Total with anxiety based on GAD-7 N (%) = 321 (32.7);	Mean anxiety significantly higher in the group with COVID-19 job loss vs the	The proportion of participants with clinically meaningful anxiety is

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome/mean (SD)	Main findings	Main findings age 50+
		(14.8%), Women = 110 (19.4%)	36; the state and trait portions of the Spielberg State-Trait Anxiety Inventory (STAI) > 46.	Zung SRAS=462 (45.8); STAI-state=302 (29.8); STAI-trait=402 (39.7). Mean (SD) of GAD-7=6.0 (5.8); Zung SRAS = 36.2 (9.4); STAI-state = 40.3 (11.0); STAI-trait = 41.7 (13.1)	group without job loss. Also, the proportion of participant who reach a clinically meaningful anxiety is significantly higher amongst those with job loss.	higher among those with job loss vs no job loss.
Pieh *et al* **(139)**	Not working now and did not work before, not working now but was working before lockdown, home office, working in the usual place, reduced working hours, retired.	Not reported.	GAD-7 with a cut off 10.	Total N (%) = 392 (39.0), Men = 144 (31.2), Women = 248 (45.6), Aged 55-64 = 52 (30.1), Aged 65+ = 18 (12.2)	Prevalence of anxiety is 46% among those who lost their job vs 40.6% among those with unchanged work vs 36.9% among those working remotely. Chi-squared test across all categories of work status is significant with p<0.001	
Solomou *et al* **(146)**	I am working from home, I sometimes work from home and sometimes at my workplace, I'm still working at my workplace, I'm out of work and will be paid 60% of my salary, other. Those not in employment excluded.	I am working from home = 480 (29.2%) I am still working at my workplace = 178 (10.8%) I'm out of work and will be paid 60% of my salary = 49 (3.0%)	GAD-7 and analysed as continuous	Normal = 589 (35.9%) Mild = 673 (41%) Moderate = 230 (14%) Severe = 150 (9.1%) Mean GAD-7 overall = 6.79 (SD=4.74) Mean GAD-7 Men = 5.21 (SD=4.18) Mean GAD-7 Women = 7.42 (SD=4.80)	No significant difference in the GAD-7 score across categories of work status according to the Kruskal-Wallis test. Working from home = mean GAD-7 6.11 (SD=4.34) Working at the workplace = mean GAD-7 6.57 (SD=5.11) Out of work and paid 60% = mean GAD-7 6.77 (SD=4.64)	

*GAD-7: Generalised anxiety disorder assessment; WFH: work from home.

Table 2-5: Main findings of analytical studies – cross-sectional design [2]

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
Abrams *et al* **(110)**	Job transition since the pandemic: lost employment, furloughed, reduced hours or income, and work-from-home.	Work unchanged: 509 (8.12%) Not working, unchanged: 4303 (68.7%) Lost job: 116 (1.85%) Furloughed: 359 (5.73%) Reduced hours or income: 447 (7.13%) Work from home: 531 (8.47%)	Anxiety symptoms assessed with the 5-item Beck Anxiety Inventory (BAI)	Mean (SD) anxiety symptoms: 1.67 (SD = 0.60)	Gender, age, race/ethnicity, educational attainment, occupation, medical condition, use of mobility aid, smoking, living alone, household membership, relationship status, US Census division, prior diagnosis of anxiety		All participants aged 55+ Reference: work unchanged Job loss β(95%CI) 0.23(-0.02,0.49) Furloughed β(95%CI) 0.07 (-0.10,0.25) Reduced hours or income β(95%CI) 0.06 (-0.09,0.22) Work from home β(95%CI) 0.14 (-0.00,0.28)
Alsaif *et al* **(111)**	Job loss	Total job loss = 51 (6.8%)	Arabic version of the Depression	Total with anxiety of any	Sex, age, nationality,	Job loss vs not	

[±] The studies by Fisher and Hammarberg use a common sample (online survey available on the Monash University website); * The studies by Blomqvist use a common sample (SLOSH). [†] Zhang, Settels and Shahaj all conduct secondary analyses of SHARE, however their sample is unlikely to overlap.

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
			Anxiety Stress Scale (DASS-21).	severity = 34.8%	educational level, marital status, chronic health issues, diagnosed with COVID-19	AOR (95%CI) 2.02 (1.10, 3.74) p<0.05	
Burhamah *et al* **(116)**	Working or studying from home, work suspended, attending work as usual, retired prior to lockdown, unemployed prior to lockdown.	Stopped working/studying = 1620 (39.2%)	GAD-7 with a cut-off score of 8.	GAD-7≥8 = 1086 (26.3%)	Gender, age, working health sector, risk of getting virus at work, past psychiatric history, home quarantine, rating of the government protocol, time on social media, time following COVID-19 news	Stopped working or studying vs Working or studying from home: OR (95%CI) p-value 1.39 (1.04-1.86) 0.026	
Burstyn *et al* **(117)**	Job loss, working hours remained the same, increased or decreased since the pandemic.	Lost job=67(7.4), Men=14, Women=53	Hospital Anxiety and Depression Scale (HADS) to measure anxiety with score ranging from 0 to 21. HAD-A analysed as continuous. HAD-A≥11 indicates anxiety	HAD-A≥11: Men = 15(19%); Women = 78 (40%)	Age, education, income, children living at home, phase of stay-at-home order, general health	Lost job vs same working hours MEN RR (95%CI) 1.56 (1.12, 2.19) Lost job vs same working hours WOMEN RR (95%CI) 0.94 (0.78, 1.13)	
Dawel *et al* **(118)**	Job loss because of COVID-19; Working from	Total job loss = 117 (9.0%)	GAD-7 used as continuous score	Mean GAD-7	Age, gender, education, has partner, lives alone, child at	Job loss (vs not) (multivariate) β p-value 0.51 0.665	Job loss (vs not) (multivariate) β (95%CI)

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
	home due to COVID-19	Men job loss = 50 (7.8%) Women job loss = 67 (10.3%) Total WFH = 173 (13.4%) Total WFH Men= 78 (12.1%) Total WFH Women = 95 (14.6%)		Overall 4.4 (SD=5.2) Men 3.7 (SD=4.9) Women 5.1 (SD=5.4) GAD-7≥ 10 =212 (16.4%)	home, any chronic disease, any neurological disorder, any current MH disorder, bushfire exposure to smoke, fire, other adverse life event, COVID-19 exposure, financial distress, work and social adjustment scale (all factors significant in univariate analyses)	WFH (vs not) (univariate) β (SE) p-value 0.18 (0.42) 0.665	p-value 0.608 (-1.053, 2.269) 0.473 WFH (vs not) (multivariate) β (95%CI) p-value 0.193 (-1.099, 1.485) 0.769
De Miquel *et al* **(119)**	Unemployed or temporarily laid-off (furlough) due to the coronavirus pandemic.	Unemployed or temporarily laid-off: n=64, 26.93% (25.10–28.83%)	GAD-7 with a cut off score of 10.	GAD-7≥10= 272 (11.4%)	Gender, age, education level, and marital status	Unemployed or temporarily laid-off (vs not) AOR (95%CI) 0.93 (0.69-1.26)	Unemployed or temporarily laid- off (vs not) AOR (95%CI) 1.47 (0.82-2.63)
Fisher[±] *et al* **(123)**	Job loss because of restrictions	Job loss: 1251(9.0%)	GAD-7 with a cut off score of 10.	GAD-7≥10 = 3661, 21.0% (95%CI 19.6-22.4%)	Any COVID experience, worried about COVID, great impact of restrictions, and state, remoteness and socio-	Job loss (vs not) AOR (95% CI) 1.22 (1.06-1.41)	

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
					economic quintile of residence, sex, age, living situation, place of birth, and employment status.		
Guerin *et al* **(125)**	Job loss, temporarily laid off or furloughed, working hours reduced, No change in position	Job loss = 108 (4.2%) Temporarily laid off or furloughed = 317 (12.4%) No change = 1502 (58.6%)	GAD-2 used as continuous variable.	Not reported	Age, sex, race, education, marital status, social support, household income, interaction between job loss and income.	Job loss (vs not) β (SE) p-value 1.08 (0.43). 0.013 Hours reduced (vs not) β (SE) p-value 0.88 (0.30) 0.003	Job loss (vs not) β (SE) p-value 0.49 (0.79). 0.53
Hagen *et al* **(126)**	Job loss	Job loss = 411 (2.1%)	GAD-7 used as continuous variable.	Minimal 44.2%; Mild 32.1%; Moderate 15.0%; Severe 8.7% Mean GAD-7 = 6.28 (SD=5.07)	Infection self/family, sex, student, mental health problems, increased use of alcohol, or tobacco, less exercise, economic impact, lower education.	Job loss (vs not) Standardised β p-value 0.03 <0.001	
Hammarberg[±] *et al* **(127)**	Job loss because of COVID-19 restrictions	Job loss Men=277 (8.3%) Women=964 (9.2%)	GAD-7 with a cut off score of 10.	GAD-7≥10: Men = 472(14.2%) Women = 275(21.8%)	Deprivation quintile, living situation, caring for children, caring for relatives, worried about contracting COVID-19, high		Job loss (vs not) Women age 50+ OR (95%CI) 1.56 (1.20-2.02)

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
					adverse impact of restrictions		Job loss (vs not) Men age 50+ OR (95%CI) 1.38 (0.83-2.29)
Hoffmann *et al* **(129)**	Place of work during the COVID-19 pandemic: hybrid, in the workplace, or remotely at home.	Hybrid = 211 (28.63) In the workplace = 377 (51.15) Remotely at home = 149 (20.22)	DASS-21	Mean (SD) DASS-21=7.25 (6.53)	Only univariate associations reported	Remotely at home vs unemployed β (95%CI); p-value -0.30 (-1.64, 1.03) 0.655	
Jewell *et al* **(131)**	Working remote before and after COVID-19 Unemployed prior to COVID-19 Work outside home No longer working due to COVID-19 Working remotely due to COVID-19	Working remotely before and after COVID-19: 104 (9.9%) no longer working due to COVID-19: 107 (10.2%) working remotely due to COVID-19: 552 (11.4%)	GAD-7 with a cut off score of 10.	GAD-7≥10 = 342 (34.0%)	Age, race, ethnicity, insurance, gender, household size, 5 measures of concern (financial, food access, economy, illness, death)	No longer working due to COVID-19 (vs working remotely before and after COVID-19) OR p-value 1.32; p 0.45 WFH (vs working remotely before and after COVID-19) OR p-value 0.70; p 0.22	
Mani *et al* **(133)**	Temporary unemployed, forced to work from home	Temporary unemployed = 499 (22%)	GAD-7 with a cut off score of 10.	Mean GAD-7 = 2.71 (SD=4.33).	Sex, age, lack of salaried jobs, work stress, being a	Temporary unemployed (vs still employed) AOR p-value 2.02;	

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
		Forced to work from home = 975 (37%)		Moderate anxiety = 114 (19%); severe anxiety = 87 (14%). Men = 324 (20.1%); Women=284 (27.6%); Age 50+ = 66 (17%)	healthcare worker, media reports.	p<0.001 Prevalence of anxiety lower among those WFH (22.6%) vs. away from home (28.4%)	
McDowell *et al* **(65)**	No change in work, working from home, when I was not before, and lost employment in relation to pandemic.	No changes: 34% Started working from home: 54% Lost job: 12%	21-item Beck Anxiety Inventory (BAI) and analysed as continuous.	Mean ± SD BAI: 7.96 ± 8.38	Age, sex, race, BMI, smoking, screen time, physical activity, marital status, chronic conditions, public health restrictions.	Hedges' g (95%CI) Job loss (vs no change in work) Hedges' g (95%CI) p-value- 0.212 (-0.363 to -0.061) 0.008	
Mojtahedi *et al* **(135)**	Unemployed before the pandemic, I lost my job/business during the pandemic, furloughed, I still have my job/business and travel to work, I still have my job/business and	Total job loss = 64(9.1%); sample A: 14(3.9%) sample B: 50 (14.4%) Furloughed = 106(15.1%); sample A: 75 (21%) sample B: 31 (8.9%)	DASS21 and STAI used as continuous.	Participants with moderate/severe anxiety: 117(31%) in sample A; 221 (63.7%) in sample B	Challenge, commitment, control, and confidence	Job loss (vs WFH) DASS21 β with p-value 0.13 p<0.001 Furlough (vs WFH) DASS21 β -0.03 Working travelling (vs WFH)	

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
	working from home.	Previously unemployed = 109(15.5%); sample A: 63(17.6%) sample B: 46(13.3%) Working (travelling) = 146(20.7%); sample A: 80(22.4%) sample B: 66(19%) Still in work and working (home) = 279(36.9%); sample A: 125(35%) sample B: 154(44%)				DASS21 β with p-value 0.07 p<0.05 Job loss (vs WFH) STAI β with p-value 0.009 p<0.001 Furlough (vs WFH) STAI β -0.001 Working travelling (vs WFH) STAI β 0.02	
Monnig *et al* **(136)**	"Have you, or has anyone in your household experienced a loss of employment since March 13, 2020"?	Personal/household loss of employment = 447 (41.4%)	GAD-7 with a cut off score of 10.	Mean (SD) of GAD-7 = 7.0 (5.6). GAD-7≥10 = 34.8%	Age, household income, living alone, education, race, ethnicity, gender, know someone hospitalised, worried about covid, essential worker status, children in the household, covid testing history, loneliness,	Loss of employment (vs not) AOR (95%CI) 1.36 (0.93, 2.05)	Loss of employment (vs not) OR (95%CI) 3.007 (1.533, 6.917)

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
					barriers to environmental rewards, food insecurity.		
Nelson *et al* **(137)**	Not clearly defined. "Measure of COVID-associated financial strain included questions associated with lost or change in job, income, and financial comfort"	Job loss = 280 (13.56%)	GAD-2 with a cut off 3.	Mean GAD-2 score = 3.31 (SD=1.97)	Gender, age, and date completion questionnaire	Job loss (vs not) β (95%CI) p-value 0.227 (-0.023,0.476) p=0.076	
Okafor *et al* **(138)**	Lost job or wages because of COVID-19	Lost job or wages = 113 (26.0)	"Since the outbreak I feel negative and/or anxious about the future". Responses ranging from "strongly agree" to "strongly disagree". Binary variable: agree vs disagree	284 (65.0%)	Age, sex, education, marital status, health insurance, overall health, family member has covid, financial difficulties, smoking, smoked more (vs not), drank more (vs not).	Lost job or wages (vs employed during the outbreak) OR (95% CI) p-value 3.92 (2.07,7.44)	
Prata Ribeiro *et al* **(140)**	working from home, working at workplace, not working in lockdown	Working from home = 922 (56.7%)	Portuguese version of the Beck Anxiety Inventory (BAI)	N (%) with at least mild symptoms = 864 (53.1%)	Age, gender, occupation, days in isolation, contact with COVID-19, under	WFH (vs in the workplace)	

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
		Working at workplace = 262 (16.1%)	and analysed as continuous.	Mean BAI = 10.2 (SD=8.2).	psychiatric care, receiving psychiatric medication	β (95%CI) p-value -1.66 (-2.86, -0.46) 0.007	
Ruengorn *et al* **(141)**	Job loss since the covid pandemic	Job loss Total = 262 (11.4%) Men = 77 (9.0%) Women = 178 (12.9%) Age ≥51 years = 12 (5.4%)	Thai version of the Generalised Anxiety Disorder Scale—7-items (GAD-7). A cut-off of 5 was used to identify those with anxiety symptoms	GAD-7≥5 = 944 (41.0%)	Age, sex, marital status, education, religion, region, living status, reimbursement scheme, history mental illness, history NCD, debt, exposure during outbreak, confirmed cases in community, quarantine status, resilient coping	Job loss (vs not) OR (95%CI) p-value 1.39 (0.89-2.18) 0.146	
Settels † *et al* **(143)**	"Due to the Corona crisis have you become unemployed, laid off or had to close your business?" Those not in employment immediately before the pandemic were excluded.	Lost employment = 2079 (18.51%)	"In the last month, have you felt nervous, anxious or on edge?" (yes/no)	Anxiety symptoms = 2999 (26.7%)	Gender, age, self-rated health before the COVID-19 era, education, country, loneliness, household making ends meet, face-to-face contact with non-relatives.		Lost employment (vs not) AOR (95%CI) p-value 1.567 (1.169, 2.099) <0.001

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
Shahaj ł *et al* **(144)**	Job loss due to COVID-19	Job loss = 1726 (3.8%)	Participants were asked if in the preceding 4 weeks they felt nervous. If they answered yes, they were asked whether symptoms had worsened. Outcome is a binary variable with a value of 1 if "more nervous", a value of 0 if "remained the same or improved"	More nervous = 9725 (70.7%) Analyses on this outcome are based on a smaller sample of N=13755	Sex, age, education, having a partner, living alone, multimorbidity, worsening health, someone hospitalised with Covid, someone died from covid, frequency of social contact, country-level variables (Covid-19 deaths, stringency index, GDP, GINI)		Job loss (vs not) AOR (95%CI) p-value 2.06 (1.49, 2.85) <0.001
Shalaby *et al* **(107)**	Job loss due to COVID-19	Job loss=21 (12.1%)	GAD-7 with a cut off score of 10.	GAD-7≥10 = 71 (42.5%)	Not employed, depression diagnosis, mental health counselling, would like mental health counselling, medication for mental health concerns, no support from family, no support from Government, no support from employer	Job loss (vs not) AOR (95%CI) p-value 4.401 (1.007-19.241) p 0.049	

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
Smith *et al* **(145)**	Working remotely, working at workplace, no longer employed	Working remotely: 1376 (41.6%) site-based workers: 1693 (51.2%) no longer employed: 236 (7.1%)	GAD-2 with a cut off score of 3.	GAD-2≥3=1399 (42.3%)	Age group, sex, visible minority status, disability, population density, province of residence, supervisory status, job tenure, co-workers with COVID-19, experiencing symptoms of COVID-19, being exposed to someone with COVID-19, workplace size, date of survey	Adjusted proportion (95% CI) Working remotely =35.3 (27.1-43.5) Site-based workers =43.5 (35.4-51.6) No longer employed=43.8 (34.0-53.7) Site based with 100% PPE =33.9 (25.0-42.7) Site-based workers with 100% ICP =29.8 (20.5-39.0)	Age group 55+, adjusted proportion (95% CI) Working remotely = 26.2(20.2-32.2) No longer employed = 28.1 (17.8-38.5) Site-based = 34.5 (28.5-40.5) Site-based with 100% ICP = 20.6 (12.1-29.1) Site-based with 100% PPE = 23.6 (15.9-31.3)
Umucu *et al* **(147)**	Job loss in the past month	Job loss=598 (9.0%)	Probable anxiety (yes/no) measured with Patient Health Questionnaire (PHQ-4)	Participants with probable anxiety 2116 (30.0%)	Adjustment for age, sex, race, education, government response to COVID-19, viewing COVID-19 as a threat to Americans, probable depression	Job loss (vs not) OR (95%CI) p-value 1.48 (1.21-1.81) p<0.01	

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
Warren *et al* **(148)**	Working from normal location, working from home, not working right now due to COVID19, unemployed right now due to COVID-19, not working for other reasons" (e.g., as a student) unrelated to COVID-19.	Working from normal location = 2539 (50.5%) Working from home = 1256 (25.0%) unemployed due to COVID-19 = 227 (4.5%)	GAD-7 used as continuous and as categorical (with a cut off score of 10).	GAD-7≥10 = 716 (14.3%)	Age, sex, race, marital status, education, current psychological diagnosis, log COVID-19 case and death count per 100k county population.	Work from home (vs normal location) β (95%CI) p-value 0.36 (-0.03,0.75) 0.096 Unemployed due to covid (vs normal location) β (95%CI) p-value 2.49 (1.53,3.44) <0.001 Work from home (vs normal location) OR (95%CI) p-value 1.16 (0.93,1.45) 0.262 Unemployed due to covid (vs normal location) OR (95%CI) p-value 2.78 (1.86,4.16) <0.001	
Wright *et al* **(149)**	Job loss or been unable to do paid work	Total mean lost work = 0.10 (SD=0.30)	GAD-7 used as continuous.	Total average GAD-7 score = 4.67 (SD=5.24)	Worries about employment, day of the week, days since lockdown began + other time constant variables (these	Standardised β (95%CI) Employment adversities experiences (vs	

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
					are supposedly socio-economic, personality and other variables that do not vary over time). Unclear which ones were included	not)/predicted change over time in anxiety = 0.034 (-0.012, 0.079)	
Zamanzadeh *et al* **(150)**	"Have you lost your job or has your activity (as self-employed) been stopped as a consequence of the COVID-19 pandemic?"	Job loss or activity stopped = 1835 (30.0%)	"Have you experienced any anxiety due to the COVID-19 pandemic?	Total N (%) = 2780 (46%)	Mortgage, gender, age, income, living area, religious services.	Marginal effect job loss Probability (SD) p-value 0.055 (0.015); p<0.001	
Zhang † *et al* **(151)**	Since lockdown, worked at home only/ worked at the usual place/worked from home and at the usual place/ none of these. Participants retired, unemployed or who were laid off were excluded.	proportion and 95%CI Worked at the usual place = 5809 (52.1 (49.8, 54.5)) Worked from home only = 1848 (14.3 (12.8, 15.9))	"In the last month, have you felt nervous, anxious, or on edge?"	Total, N (proportion and 95%CI) More nervous than before = 2306 (21.1 (19.1, 23.2))	Age, gender, education level, live alone, contact less often or never, household income, change working hours, difficulty with daily activities, chronic disease, vaccination, close to suspected or confirmed COVID-19 cases		WFH (vs usual place) AOR (95%CI); p-value 1.40 (0.87, 2.27); 0.1656

Author	Exposure definition	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
Zhao *et al* **(152)**	Reduction in income since the outbreak (no change, small reduction, reduction by half, larger reduction, or unemployed). Students, retirees, and homemakers excluded.	Became unemployed = 70 (6.7%)	GAD-2 with a cut off score of 3.	GAD-2≥3 = 218 (14.5%)	Sex, age, and education, PPE, social distancing measures	Unemployed (vs no change in income) OR (95%CI) p-value 5.38 (2.64-10.96) p<0.001	

GAD-7: Generalised anxiety disorder assessment – 7 items; GAD-2: Generalised anxiety disorder assessment – 2 items; DASS-21: Depression, Anxiety, Stress Scale – 21;

STAI: State-Trait Anxiety Inventory; BAI: Beck Anxiety Inventory; AOR: adjusted Odds Ratio; RR: Relative Risk; WFH: Working from home

Table 2-6: Main findings of analytical studies – longitudinal design [3]

Author	Exposure definition	Study duration	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
Batterham *et al* **(113)**	Lost job; work from home	Baseline: 28th-31st March 2020 7 FUP surveys up to June 2020	Lost job = 117(9.0) Work from home = 173(13.3)	GAD-7 with a cut off score of 10 and used as continuous.	GAD-7≥10 at each data point 212(16.4%) 164 (16.9%) 163 (17.2%) 137 (15.1%) 112 (12.9%) 104 (12.8%) 102 (13.5%)	Unclear	Lost job (vs not)/baseline anxiety β (SE) p-value 0.025 (0.423) 0.92 Lost job (vs not)/linear change anxiety β (SE) p-value 0.243 (0.246) 0.32 Lost job (vs not)/quadratic change anxiety β (SE) p-value -0.029 (0.039) 0.45	

± The studies by Fisher and Hammarberg use a common sample (online survey available on the Monash University website); * The studies by Blomqvist use a common sample (SLOSH). ! Zhang, Settels and Shahaj all conduct secondary analyses of SHARE, however their sample is unlikely to overlap.

Author	Exposure definition	Study duration	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
							WFH (vs not)/baseline anxiety β (SE) p-value 0.293 (0.631) 0.42 WFH (vs not)/linear change anxiety β (SE) p-value -0.371 (0.188) 0.049 WFH (vs not) /quadratic change anxiety β (SE) p-value 0.056 (0.029) 0.05	
Blomqvist* et al **(114)**	Stable work situation,	Baseline: January-	Stable work situation: 1171(75%);	GAD-7 with a cut off score of 10.	GAD-7≥10 = 191 (14%)	Sex, age, education, country of birth,	Job loss (vs stable work) AOR (95%CI) 1.18 (0.36, 3.83)	Job loss (vs stable work) AOR (95%CI) 0.57 (0.13, 2.55)

Author	Exposure definition	Study duration	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
	furloughed, job loss.	February 2021 FUP: January-February 2022	furloughed: 140(9%); job loss: 98(6%)		Mean score = 75, SD=5	socio-economic classification, civil status, prior mental health problems	Furloughed (vs stable work) AOR (95%CI) 0.66 (0.23, 1.91)	Furloughed (vs stable work) AOR (95%CI) 0.88 (0.20, 3.92)
Blomqvist* et al **(115)**	Dismissed or received notice, furloughed, became unemployed since the outbreak	Baseline: January-February 2021 FUP: January-February 2022	Dismissed or received notice=45 (3.7%); furloughed=151 (12.6%)	GAD-7 with a cut off score of 10.	GAD-7≥10 = 69 (5.6%)	Job security, sex, age, mental health at baseline	Dismissal or notice (vs not) AOR (95%CI) 0.73 (0.13, 4.00) Furloughed (vs not) AOR (95%CI) 0.68 (0.17, 2.77)	Dismissal or notice (vs not) AOR (95%CI) 3.84 (0.56, 26.35) Furloughed (vs not) AOR (95%CI) 0.66 (0.10, 4.22)

Author	Exposure definition	Study duration	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
Dragano *et al* ***(120)***	No pandemic-related changes, unemployed due to corona, working from home since the pandemic at least some days	Baseline: 2014-2019 FUP: April-May 2020	no pandemic-related change = 68,765 (42.5%) Unemployed due to corona = 828 (0.5%) Working from home since the pandemic at least some days =44,174 (27.3%)	GAD-7 with a cut off score of 10.	GAD-7≥10= 10161 (6.3%) Mean score (SD) = 3.40 (3.54)	Age, gender, type of household, high-risk contact with infected person, own covid infection, self-reported health	Unemployed due to corona (vs no change) β (95%CI) p-value 0.66 (0.44,0.88) <0.001 WFH (vs not) β (95%CI) p-value 0.28 (0.25, 0.32) <0.001 Unemployed due to corona (vs no change) RR (95%CI) p-value 1.30 (1.11, 1.51) <0.001 WFH (vs not) RR (95%CI) p-value 1.05 (1.00, 1.09) <0.05	Unemployed due to corona (vs no change) β (95%CI) p-value 0.59 (0.23,0.94) <0.001 WFH (vs not) β (95%CI) p-value 0.25 (0.19, 0.30) 0.001 Unemployed due to corona (vs no change) OR (95%CI) 1.58 (1.02, 2.44) WFH (vs not) OR (95%CI) 1.03 (0.94, 1.14)

Author	Exposure definition	Study duration	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
Hwang *et al* ***(130)***	Job loss	Baseline: June 2020 FUPS: September and December 2020	Total = 15.1%; Women = 17.9%; Men = 12.9%	Participants were asked: "how much anxiety do you feel due to the COVID-19 pandemic?". Analysed as continuous.	Mean (SD) anxiety. Total= 2.509 (0.740) Men=2.451 (0.735) Women=2.586 (0.741)	Sex, age, education, job type, firm size, occupational characteristics, time of survey.	Job loss (vs not) β (SE); p-value -0.168 (0.045) p<0.01	
Matsubayashi *et al* ***(134)***	Any of job loss, layoff, or reduction in working hours (=Adverse change)	Baseline: June 2020 FUP: February 2021	Any adverse change Total = 1116 (12.4%) Men = 547 (12.25%) Women=569 (12.54%)	GAD-7 with a cut off score of 10.	Not reported	Sex (in the analysis including the whole sample), age, survey rounds, log	Adverse change (vs not) overall AOR (95%CI) 1.838 (1.502-2.174) Men AOR (95%CI) 1.828 (1.354-2.301) Women AOR (95%CI) 1.857 (1.378-2.36)	Adverse change (vs not) overall AOR (95%CI) 1.886 (1.246-2.527) Men AOR (95%CI) 2.421 (1.331-3.512)

Author	Exposure definition	Study duration	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
						number of monthly total COVID-19 infections and deaths in the prefectures		Women AOR (95%CI) 1.406 (0.660-2.152)
Savolainen *et al* ***(142)***	Change in employment was measured between 2019 and 2020. Became unemployed since the beginning of the pandemic. Became remote worker since the	Baseline: September-October 2019 FUP: September-October 2020	Became unemployed = 3.35% Became remote worker = 12.25% Total remote worker in 2020 = 391 (37.45%)	COVID-19 anxiety assessed with the Spielberger State–Trait Anxiety Inventory STAI-6.	Participants reporting at least some anxiety = 531 (50.86%)	Model 0 = age and gender Full Model = loneliness, distress, technostress, work exhaustion, openness, consciousness, extroversion,	Cross sectional Remote worker (vs not) (full model) β (95%CI) p-value 0.01 (0.46) 0.98 Became unemployed (vs not) (model 0) β (95%CI) p-value 1.05 (1.14) 0.360 Became remote worker (vs not) (model 0) β (95%CI) p-value 0.41 (0.65) p-value 0.535	Became unemployed (vs not) (model 0) β (95%CI) p-value 3.17 (1.85) 0.09 Became remote worker (vs not) (model 0) β (95%CI) p-value 1.04 (1.05) 0.325

Author	Exposure definition	Study duration	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
	beginning of the pandemic.					agreeableness, neuroticism, social media information bubble, social support from work, remote work, lives alone, sex, age, income, educational level, occupational area		

Author	Exposure definition	Study duration	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
Yao *et al* ***(108)***	Employed, voluntarily not working (i.e., retired), Involuntarily not working which included laid off, Employer's business closed temporarily due to covid, Employer went out of business.	Baseline: 23rd April 2020 FUPS: data collected every two weeks for up to 17 weeks	Working = 930,472 (59.01%) Voluntarily not working = 307,179 (19.48%) Involuntarily not working = 339,119 (21.51%)	GAD-2 with a cut off score of 3.	GAD-2≥3 = 503,147(31.91%)	Economic status, health, access to medical care, interview weeks, age, sex, race, education, marital status, number of children	Involuntarily not working (vs in work) OR p-value 1.203 <0.001 Laid off (vs voluntarily not working) OR p-value 1.538 <0.001 Employer's business closed temporarily due to covid (vs voluntarily not working) OR p-value 1.302 <0.001 Employer went out of business (vs voluntarily not working) OR p-value 1.703 <0.001	Involuntarily not working (vs in work) OR p-value 1.169 <0.001 Laid off (vs voluntarily not working) OR p-value 1.504 <0.001 Employer's business closed temporarily due to covid (vs voluntarily not working) OR p-value 1.277 <0.001 Employer went out of business (vs voluntarily not working) OR p-value 1.617 <0.001

Author	Exposure definition	Study duration	N (%) with exposure	Outcome definition	N (%) with outcome or Mean (SD)	Confounding factors	Estimates (95%CI)	Estimates (95%CI) age 50+
Zhou *et al* ***(153)***	Laid off, furloughed, or otherwise unemployed due to COVID-19, unemployed prior to COVID-19	Baseline: 20th April 2020 FUP: 4th-8th May 2020; 18th-22nd May 2020	Laid off, furloughed, or otherwise unemployed due to COVID-19 = 103 (10.34%) at wave 1 45(7.15%) at wave 2 37(8.39%) at wave 3	DASS-21 with a cut off 15	Moderate anxiety at wave 1: 10.38%, wave 2: 9.16%, wave 3: 9.05% Severe anxiety at wave 1: 8.03%; wave 2: 5.85%; wave 3: 3.39%. Extremely severe anxiety at wave 1: 26.34%; wave 2: 23.06%; wave 3: 21.27%	Sex, age, race, ethnicity, region, party identification, health condition, COVID-19 symptoms, COVID-19 testing	Laid off (vs unemployed prior to COVID-19) (wave 1) β (95%CI) 0.03 (-0.05,0.12) Laid off (vs unemployed prior to COVID-19) (wave 2) β (95%CI) 0.004 (-0.08,0.08) Laid off (vs unemployed prior to COVID-19) (wave 3) β (95%CI) 0.004 (-0.08,0.09)	

GAD-7: Generalised anxiety disorder assessment – 7 items; GAD-2: Generalised anxiety disorder assessment – 2 items; DASS-21: Depression, Anxiety, Stress Scale – 21; STAI: State-Trait Anxiety Inventory; BAI: Beck Anxiety Inventory; AOR: adjusted Odds Ratio; RR: Relative Risk; WFH: Working from home; FUP: follow-up

Table 2-7: Effect direction plot of the 39 analytical studies [4]

Author, year	Study Design	Country	Job loss	Working from home	Furloughed	Any of job loss, reduction working hours	Decrease working hours	Study quality
Dawel **(118)**, 2020	CS	Australia	▼	▼				++
Fisher **(123)**, 2020	CS	Australia	▼					++
Hammarberg **(127)**, 2020	CS	Australia	▼[2]					++
Smith **(145)**, 2020	CS	Canada	▼	▲				++
Abrams **(110)**, 2021	CS	USA	▼	▼	▼		▼	++
Burstyn **(117)**, 2021	CS	USA	◄►[2]					++
Guerin **(125)**, 2021	CS	USA	▼				▲	++

[4] LEGEND

Study desing: CS: cross sectional; L: longitudinal

Effect direction: upward arrow ▲= positive health impact, downward arrow ▼= negative health impact, sideways arrow ◄►= no change/mixed effects/conflicting findings

Sample size: Final sample size Large arrow ▲ >300; medium arrow ▲ 50-300; small arrow ▲ <50

Study quality: denoted by row colour: green = high quality; yellow = medium quality; orange = acceptable

Number of outcomes analysed is 1 unless indicated otherwise by the superscript number next to the effect direction

Author, year	Study Design	Country	Job loss	Working from home	Furloughed	Any of job loss, reduction working hours	Decrease working hours	Study quality
McDowell **(65)**, 2021	CS	USA	▼					++
Okafor **(138)**, 2021	CS	USA	▼					++
Prata Ribeiro **(140)**, 2021	CS	Portugal		▲				++
Umucu **(147)**, 2021	CS	USA	▼					++
Warren **(148)**, 2021	CS	USA	▼[2]	▼[2]				++
Zhao **(152)**, 2021	CS	Hong Kong	▼					++
Zhang **(151)**, 2022	CS	27 European Countries		▼				++
Settels **(143)**, 2023	CS	27 European Countries	▼					++
Shahaj **(144)**, 2023	CS	27 European Countries	▼					++
Burhamah **(116)**, 2020	CS	Kuwait	▼					+
Jewell **(131)**, 2020	CS	USA	▼	▲				+
Nelson **(137)**, 2020	CS	USA, Canada, Europe	▼					+
Mojtahedi **(135)**, 2021	CS	UK, Ireland, North America, India, Brazil	▼[2]		▲[2]			+

Author, year	Study Design	Country	Job loss	Working from home	Furloughed	Any of job loss, reduction working hours	Decrease working hours	Study quality
Ruengorn **(141)**, 2021	CS	Thailand	▼					+
Alsaif **(111)**, 2022	CS	Saudi Arabia	▼					+
De Miquel **(119)**, 2022	CS	Spain	▲					+
Hagen **(126)**, 2022	CS	Norway	▼					+
Shalaby **(107)**, 2022	CS	Canada	▼					+
Hoffmann **(129)**, 2023	CS	Poland		▲				+
Mani **(133)**, 2023	CS	India	▼					+
Monnig **(136)**, 2023	CS	USA	▼					+
Zamanzadeh **(150)**, 2023	CS	China, Italy, Japan, South Korea, UK, USA	▼					+
Savolainen **(142)**, 2021	L	Finland	▼	▼				+++
Dragano **(120)**, 2022	L	Germany	▼	▼				+++
Blomqvist **(114)**, 2023	L	Sweden	▼		▲			+++
Batterham **(113)**, 2021	L	Australia	▼	▼				++
Wright **(149)**, 2021	L	UK	▼					++

Author, year	Study Design	Country	Job loss	Working from home	Furloughed	Any of job loss, reduction working hours	Decrease working hours	Study quality
Blomqvist **(115)**, 2023	L	Sweden	▲		▲			++
Yao **(108)**, 2021	L	USA	▼					+
Matsubayashi **(134)**, 2022	L	Japan				▼		+
Hwang **(130)**, 2023	L	South Korea	▼				▲	+

2.3.6 Key findings of the vote-counting method

In the previous paragraphs I have synthesised findings with a narrative review. In this section I summarise findings from analytical studies using the "vote-counting" method. Table 2-7 shows the effect direction plot for all analytical studies included in the review, arranged by study design. The health outcome shown in the table is anxiety. Of the 29 cross-sectional studies presented in the table, 26 explored the association between job loss and anxiety, with 24 of those reporting a negative association between the two (i.e., job loss harmful to anxiety). Only one study reported inconsistent findings and one study reported job loss to be beneficial to anxiety. The two-tailed sign test p-value is <0.001, meaning that there is strong evidence of a negative association between job loss and anxiety. Eight of the nine longitudinal studies explored job loss as exposure, seven of which found it to be harmful to anxiety while one indicated the opposite. The two-tailed sign test p-value is 0.04, showing that there is evidence of a negative association between job loss and anxiety also amongst the longitudinal studies.

A total of eight cross-sectional studies reported on the association between working from home in lockdown and anxiety: half studies showed a negative association and the rest reported a positive association between working from home and anxiety. The two-tailed sign test was not significant (p=0.40) meaning that there is not enough evidence to support an association between working from home and anxiety in either direction. Three of the nine longitudinal studies explored the effect of working from home on anxiety and all found that working from home was associated with higher anxiety.

Only two cross-sectional studies evaluated the effect of being furloughed on anxiety with findings in opposite directions, while the two longitudinal studies reporting on this association suggested that being furloughed may have been beneficial to anxiety. However, data were too sparse for this association to be statistically significant. Finally, only three studies included in this review looked at reduced working hours necessitated by the pandemic as an exposure. The two that were cross-sectional reported associations in opposite directions and the only longitudinal study suggested that a decrease in working hours following lockdown reduced levels of anxiety. One study had a composite exposure defined as any of: job loss or reduction in working hours and found this exposure increased the odds of anxiety.

2.4 Discussion

In this systematic review we sought to combine evidence on the association between changes in employment that occurred following the onset of the COVID-19 pandemic and anxiety amongst adults aged 18 and older, with a particular focus on people aged over 50. Despite the high volume of studies initially identified by the search, a screening of titles and abstracts reduced the number substantially. We identified 48 studies which met the inclusion criteria specified in the protocol, the majority of which had a cross-sectional design. We found strong evidence that job loss following lockdown was associated with increased levels/risk of anxiety, in both cross-sectional and longitudinal studies. The association between working from home and anxiety was less often explored, and its direction was inconclusive. Similarly, data on the effect of being furloughed on anxiety were too sparce for meaningful conclusions.

The review had a particular focus on older workers, but, although all papers included people aged 50 and older, less than half presented results specifically for that age group. Five studies reported a significantly increased likelihood of anxiety in people who had lost their employment in this age group (108, 120, 134, 136, 143), and one among women but not men (127), while another identified job loss as a risk factor for deterioration of anxiety compared to its level in the preceding four weeks (144). Only one study found a significant association between working remotely and higher anxiety amongsts adults aged 50+ (120). Particular attention should be given to the age group 50+ as, while governments of western countries are implementing policies to encourage longer working lives, unexpected disruption to their employment as a consequence of the pandemic could result in a permanent departure from paid work. In addition, people above the age of 50 are more likely than younger people to have chronic morbidities. Data from the UK show that almost 50% of people aged 50-64 live with one long term condition and 23% live with as many as three or more comorbidities (82). An increase in anxiety among middle-aged people would add to this burden of impaired health.

This review shows evidence that the disruption of normal work functioning has had some impact on the mental health of the adult population and on people aged 50+. This is not a novel finding and confirms that unemployment and job loss are associated with poorer mental health (84, 85). However, the findings are of great importance, given the scale of job loss in this particular period of economic and social instability. Unfortunately, changes in employment coincided with other sources of stress such as financial worries, worries about

infection, and mandatory isolation. This overlap makes it challenging to disentangle the effect of employment changes from those of other stressors, in their impact on anxiety. However, we have no reason to believe that these stressors may confound the association of interest. For example, financial worries are likely a consequence of job loss, while worries about infection would apply equally to those experiencing a job change and those who did not – and, if anything, might affect more strongly the reference group. Finally, mandatory isolation could be considered as a stressor affecting both groups and could be seen as a consequence of a job change and not a confounder of the association.

It is unlikely that combining the estimates in a meta-analysis would contribute added value due to the diversity of ways in which exposures and outcomes were assessed. However, in order to have an impression of the magnitude of the associations, we have pooled evidence from eight studies, all exploring job loss (assessed in a variety of ways) in relation to a dichotomous anxiety outcome among middle-aged people. We found an overall OR: 1.67 (95% CI: 1.39 to 1.93) which suggests a significant but small increased risk of anxiety for middle-aged people who have lost their job since the pandemic. Most studies included in this review referred to the immediate period after the beginning of the pandemic. It is crucial to monitor whether the observed associations are sustained long-term as this would help determine whether older individuals who lost their job as a consequence of the pandemic require additional mental health support. Most research about interventions to reduce mental health problems (mostly PTSD) is conducted among veterans. Self-management techniques such as formal relaxation and exercise, for instance, have proven effective to reduce anxiety and stress, among veterans unwilling to seek mental health treatment (160). Alternatively, mindfulness-based interventions have also proven to be effective in the treatment of PTSD amongst veterans (161).

Our findings on the relationship between remote working and anxiety are inconclusive. It is unclear whether working from home in lockdown led to a decrease or increase in anxiety. This result is possibly due to the heterogeneity of the group that remote workers have been compared with. Additionally, there is evidence that it is not remote working per se which might act as a stressor, but rather an abrupt shift to remote working. Additional studies are therefore needed to investigate this further.

These findings may have important implications as in the post-pandemic era, work practices have shifted, and remote (or at least hybrid) working has become more common than before the pandemic. Data from the European Union (EU) (162) show that working from home was

not common before the pandemic, with less than one in twenty employees reporting working from home regularly in 2018 and less than one in ten doing so occasionally. Before the pandemic, home working was usually restricted to certain types of work, and mostly done on an occasional basis in order to reduce commuting times and to improve work-life balance. With COVID-19 and lockdowns there was an abrupt shift to home-working and this was no longer a choice of the employee. Mechanisms linking home working and mental health in a pre-pandemic scenario might no longer hold when the element of 'choice' is removed and home working becomes an imposition. Data show that 48% of employees in the EU reported working from home at least some of the time in July 2020 (163). Similarly, the percentage of UK employees exclusively working from home rose from approximately 3% in January/February 2020 to over 30% in March/April 2020, during the peak of the first national lockdown (164). It would be important to capture whether workers were home-working before the pandemic or whether there was a shift to home working since lockdown. However, only four papers in this systematic review were able to analyse the effect of a shift to remote working as opposed to simply working remotely in lockdown (65, 118, 131, 142).

Among the main limitations of studies included in the review is the sampling strategy they adopted. Most studies were set up immediately after the beginning of lockdown and researchers recruited convenience samples via social media platforms, using snowball techniques, therefore increasing the potential for bias in their findings. Bias is of course a problem in any type of survey, but those which collect data on mental health are particularly problematic as recruitment by snowballing may tend to exclude people who suffer from mental illness (165). It has been shown that samples recruited via social media and using monetary incentives to participation, are likely to be younger, poorer, and more concerned about their mental health than the general population (166). Another potential bias that may have occurred is response bias and it is likely that individuals that decided to take part in surveys differed systematically from those who decided not to take part. The method of recruitment is one of the reasons for assigning a poor rating to papers' quality. Only three studies were rated as of "high quality" (117, 120, 142), meaning that better quality evidence is needed in this area. Most of the studies included in this review tended to overrepresent women and under-represent people with mental illness, limiting the ability to generalise findings to the broader population. Despite this limitation, there is no indication that this method of recruitment introduced bias in the strength and direction of association between employment changes and anxiety. Only a minority of studies used data from established cohorts recruited pre-pandemic (114, 115, 120, 142-144, 151) These studies may offer

benefits in terms of generalisability due to their more representative samples and longitudinal designs.

The main exposure of interest was self-reported and assessed in a variety of ways. Although some papers assessed job loss by asking participants whether they lost their job since the beginning of lockdown, others used different definitions or combined categories of exposure, making comparisons across studies challenging. Such heterogeneity made a meta-analysis unfeasible. For example, some papers combined losing the job with being temporarily unemployed (i.e., being furloughed). This might not be appropriate as there are indicators that the effects of job loss and furlough on anxiety differ (110, 114, 115). Due to such heterogeneity of exposure definitions, the prevalence of job loss varied widely across studies. Although in most studies it was around 8 to 15%, it reached 41% when it included personal or household job loss (136), and 39% when the authors combined having stopped working with having stopped studying (116). In a descriptive study set in a deprived neighbourhood of Johannesburg, 70% of the study sample reported having lost their job since the start of COVID-19 pandemic (124). Anxiety was also self-reported and assessed with a variety of diagnostic tools, some validated and others bespoke. Most studies that used the GAD-7 tool adopted the recommended cut-off score 10, but in the study by Ruengorn et al (141) a cut-off score of 5 was used to represent clinically significant cases of anxiety while the study by Burhamah et al used 8 as cut-off score (116). Possibly due to the choice of different cut-off scores, prevalence of anxiety varied even across studies using the same diagnostic tool, and it was especially high in the paper by Ruengorn (41% of the sample scored positive for anxiety). The highest prevalence of anxiety was reported by Okafor (138) where 65% of the sample agreed with the sentence: “Since the outbreak I feel negative and/or anxious about the future” and were therefore classified as anxious. Although there is a variety of ways in which researchers have measured anxiety, this does not appear to affect the association between employment changes and anxiety in the current review.

The tools to measure anxiety used in all surveys are screening tools and not diagnostic tools. They are designed as quick and easy tools to be completed independently by the individual and not within a healthcare setting. A study looking at mental health and wellbeing of healthcare workers during the pandemic in the UK showed that the prevalence of common mental health disorders was higher when using a screening tool compared to that obtained when using a diagnostic tool (167). This needs to be considered in our review too as it is plausible that levels of anxiety in the population may be, although worrying, not as high as detected with the screening tools. Publication bias may have also played a role. This is the

tendency to selectively report and publish positive results, while discarding those that are either not significant or not in agreement with the initial hypothesis. We were unable to include grey literature in this review due to the large number of published papers obtained. Publication bias in this review may be reduced by the fact that in some papers the association of interest was considered only in secondary analyses.

A strength of our review is its adherence to PRISMA guidelines. In addition, two reviewers independently conducted data extraction and quality assessment for each of the included studies to ensure consistency and rigour. We searched four databases from a diverse range of disciplines, helping to ensure that we identified all relevant peer-reviewed evidence to answer our research question. We additionally performed a snowball search for other reports by looking at the reference list of the included papers. Some limitations need to be acknowledged such as limiting the search to peer-reviewed evidence and not including grey literature. This of course could have resulted in the exclusion of potentially relevant reports or working papers. The search was also limited to literature published in either English or Italian. Although we might have missed potentially relevant material by adopting these filters, that is unlikely as most high-quality research is published in English. We were unable to conduct a meta-analysis due to extreme heterogeneity, but we complemented a narrative review with a vote-counting technique which has a quantitative component. Papers featuring in the systematic review came from a variety of countries which implemented lockdown restrictions very differently. Therefore, the prevalence of job loss and working from home varied widely across the different papers. Nonetheless, the findings show consistency across countries.

Anxiety is only one aspect of mental health, but when in the early stages of the review I ran a search including both anxiety and depression, that yielded approximately 12,000 hits (as opposed to the 5,000 returned from the current search). We therefore had to take the pragmatic decision to focus only on one measure of mental health for the workload to be appropriate for a PhD thesis. Further research is required to explore the effect of changes in employment circumstances on other mental health outcomes.

2.5 Conclusions

To the best of my knowledge, this systematic review is the first to examine the impact of changes in employment circumstances enforced by the COVID-19 pandemic on anxiety of the adult population and amongst older workers. The disruption of normal work functioning

during the pandemic and related lockdowns has had some impact on anxiety levels in the adult population and amongst older workers. This review found convincing evidence of a negative association between job loss and anxiety, but the effect size did not appear strong enough to justify significant concern. Nevertheless, if the association between job loss and anxiety identified in this review was to persist long-term, older workers who lost their job since the pandemic may deserve additional support. Considering the inevitability of future epidemics (168), Governments should ensure that the mental health of the general population is adequately supported.

Chapter 3 Changes in employment since the onset of the pandemic and their impact on health

3.1 Introduction and rationale

The second aim of the thesis was to explore the effect that changes in employment status and circumstances attributable to the pandemic had on the health of middle-aged people in England. Furthermore, if such effect existed, I planned to further investigate whether estimates were different depending on pre-pandemic financial position and perception of employment changes.

An understanding of the impact of the COVID-19 pandemic on employment, finances, lifestyle and health within the HEAF cohort could shed useful light on how middle-aged people in the UK more generally were affected by the pandemic, and how their experiences compared with those of other age groups and other countries. Most importantly, it might help to inform strategies for managing persisting negative consequences of the pandemic. Among the changes in employment that occurred, a switch to home working merits special attention because of its high prevalence during lockdowns and its lasting impact on work arrangements, with hybrid work now being a common practice where feasible.

This chapter begins with introducing the methodology used to describe and quantify changes that occurred during the first UK lockdown from March 2020 to August 2020 in the cohort of middle-aged people taking part in the HEAF study, details of which have been given in section 1.10. The chapter carries on by presenting the results of these analyses.

I formulated the following research questions to address this aim:

-RQ1: What changes in employment, personal finances, lifestyle, and health occurred during the first lockdown?

-RQ2: Did changes in employment during the first lockdown affect health independently of important confounders?

-RQ3: Did the relationships explored in RQ2 differ according to pre-pandemic financial position? Did they differ according to how participants perceived their employment changes as compared with before the pandemic?

There is substantial evidence that the pandemic's effects were not evenly distributed across different segments of the population (169). The proportion of workers affected by job changes and sector closure was highly dependent on their socio-economic group and level of earnings, with people on low incomes more likely to have lost their job, or suffered a reduction in earnings (170). Large socioeconomic disparities have been documented between people whose work was amenable to home working and those who were obliged to remain in their usual workplace during the acute phase of the pandemic, mostly working in low paid, manual jobs in the caring, retail, and service sectors (171) (172). Furthermore, being able to work from home protected individuals from a risk of subsequent job loss and loss of earnings (170).

Not only did the employment effects of the pandemic differ according to socioeconomic position, but so did vulnerability to the virus and risk that the infection would be fatal. UK data show that those in the bottom three deciles of household income distribution were approximately 50% more likely to have a health condition that increased their risk of poorer outcomes if they were to catch COVID-19 (171).

I therefore hypothesised that the negative impact of job loss on poor health might be more severe for people in poorer socio-economic position, as they often lack economic resources needed to cope with emergencies. Furthermore, it is possible that people's perception of whether their employment changed for the better or the worst might importantly modify any observed association between changes in employment and health (RQ3). To answer RQ3, I therefore treated pre-pandemic financial position and perception of changes in employment as potential modifiers of the association between changes in employment and health outcomes.

3.2 Statistical analyses

3.2.1 Outcomes

Among the health outcomes explored in RQ1, fair/poor self-rated health (SRH) was assessed through a single question with five options for answers ranging from "excellent" to "poor". Responses were dichotomised as "at least good" vs "fair/poor" to increase statistical power. Poor sleep was defined as report of at least one severe symptom from difficulty falling asleep; difficulty staying asleep; waking up too early; and waking not feeling refreshed in the morning. Depression and anxiety were self-reported by participants in answer to questions of the form: "Do you have depression/anxiety?". If an individual answered that they had a condition, they were also asked whether they were treated for it (medicated condition) and

whether the condition limited their ability to perform daily activities (disabling condition). Depressive symptoms were also assessed through the 20-item Center for Epidemiologic Studies Depression Scale (CES-D), which measures frequency of symptoms of depression over the past 7 days on a four-point ordinal scale. A score of 16 or more is indicative of mild or significant depression (173).

Disabling musculoskeletal pain was assessed by asking participants whether they experienced pain in any of the back, neck, legs or arms that had lasted for at least a month and made it difficult to perform daily chores.

To address RQ2, I defined six health outcomes, five of which were directly reported by the participants during the survey, while a sixth was derived from their answer at two time points. Worsening of SRH was computed as the difference between their SRH before and during the first lockdown (both of which were ascertained in the first survey). To define worsening of each of mental and physical health, I used information from two bespoke questions. I asked participants to rate whether they felt that their mental or physical health had worsened since the beginning of lockdown on 5-item Likert scales with answers ranging from “strongly agree” to “strongly disagree”. If the participants ticked the option “strongly agree” or “agree” I classified them as “mental/physical health worsened”. Therefore, the category “not worsened” included people whose health had remained the same or had improved. In the first set of analyses, these outcomes were evaluated in the short-term, using answers from the first survey. Therefore, “short-term outcomes” are either changes in health between the beginning of the pandemic and February 2021 or self-reported health outcomes in February 2021. Subsequent analyses explored RQ2 using longer-term health outcomes (section 3.3.9). Thus “longer-term health outcomes” are either changes in health that occurred up to October 2021 or prevalence rates in October 2021.

3.2.2 Exposure

With the information provided by participants in the first survey, I classified them into six categories according to whether their employment position had changed since the start of the first lockdown and the type of change. The main exposure in all analyses was “changes in employment” assessed in the first online survey with the following categories: working in the same place (taken as reference category), shifted to working from home, furloughed, decided to retire, any other change. Participants who were already retired pre-lockdown (N=1,240) were not eligible to experience a change in job. They have therefore been included in descriptive analyses (section 3.3.1), but did not feature in the main analyses exploring the effect of changes in employment on health. Table 3-1 explains further how I specified

exposure categories. When describing exposures, I delved more into the category of home working.

Table 3-1 Changes to employment status during the first lockdown in the sample overall and amongst participants working in February 2020.

Change in employment	Items within each category	Whole sample (n=2469)	Working in February 2020 (n=962)
		N (%)	
Already retired pre-lockdown	Retired pre-lockdown & out of work during lockdown	1240 (50.2)	-
No employment change = Working in the same place (used as reference category in regression analyses)	Remained in the same employment; have taken paid or unpaid leave; have been re-deployed by the same employer & no mention of home working	370 (15.0)	330 (34.3)
Employment change = Working from home	Remained in the same employment & mentioned home working; have taken paid or unpaid leave & mentioned home working; have been re-deployed by the same employer & mentioned home working; whose employer cut their working hours & mentioned home working; reported an unspecified job change & mentioned home working	385 (15.6)	336 (34.9)
Employment change = Furloughed	Furloughed	173 (7.0)	146 (15.2)
Employment change = Decided to retire	Decided to retire	61 (2.5)	44 (4.6)
Employment change = Any other job change	Made redundant; employer cut their working hours, and they did not work from home; change in work for unknown reasons and not accompanied by home working; remained in the same employment but performed no work in lockdown; taken annual leave and performed no work in lockdown.	136 (5.5)	98 (10.2)
Missing	55 unemployed before lockdown and not working in lockdown, and for the remaining 49 it was not possible to determine what happened	104 (4.2)	8 (0.8)

3.2.3 Covariates

Variables treated as covariates were defined from information collected either before or during the pandemic.

As a measure of financial position, I used participants' perception of how they were managing financially in 2019. This was determined from a single question with possible answers: "living comfortably", "doing alright", "just about getting by", "finding it difficult to make ends meet", and "finding it very difficult to make ends meet". I re-categorised the variable for these analyses as "Managing comfortably", "Doing alright", "Just about/struggling" to increase statistical power. Pre-pandemic SRH was assessed in 2019 through a single question with five options for answer ranging from "excellent" to "poor". Responses were dichotomised as "at least good" or "fair/poor" as detailed in section 3.2.1. Pre-pandemic number of comorbidities was derived from a list of 20 health conditions that participants self-reported. The total number of comorbidities was re-coded as 0, 1, 2+. Pre-pandemic job type was categorised using the Karasek's demand control support questionnaire (DCSQ) classification (60) introduced in section 1.7 as: low demand and high control (low strain), high demand and high control (active job), low demand and low control (passive job), or high demand and low control (high strain). An additional category was added to accommodate participants not in work in 2019.

Other covariates were assessed from the first online survey. Age was derived using date of birth and date of completion of the first online survey and was treated as a continuous variable. Participants were asked whether they were advised to shield (i.e., avoid any contact with other people because of being clinically extremely vulnerable). Social isolation during the first lockdown was assessed following the procedure by Gale et al (174). Participants reported whether they were living alone, and the frequency of contact (either face to face or virtual) with children, other members of the family, friends, and with evening classes/social groups. I created a score by assigning one point for each of: living alone, having less than monthly contact with children, other members of the family, friends, and evening classes/social groups. Scores ranged from 0 to 5 with higher scores indicating more social isolation. Participants were asked whether either family members or friends had been affected by COVID-19, and this was treated as a dichotomous variable (yes vs no). Living alone in lockdown was assessed with a single question (yes vs no). Combining answers from the first and the second online survey, I derived a dichotomous variable indicating whether an employment change that occurred in March 2020 still applied in October 2021 or had been only short-term. To ascertain changes in financial position I used two bespoke questions. I asked people whether they agreed with the statements: "My household finances

have improved" and "My household finances have worsened", with options for answer on a 5-item Likert scale ranging from "strongly agree" to "strongly disagree". Answers to these questions were combined and a new variable was generated and labelled "Changes to financial position due to lockdown" with possible values: "I am worse off"; "I am the same"; "I am better off". In case of inconsistencies in the way people responded to these two questions, the new variable was set to missing.

Four lifestyle variables were measured in the first online survey and used in these analyses. They indicated participants' perceptions of whether, since the beginning of the pandemic, there had been a change in 1) their alcohol consumption (among drinkers), 2) their physical activity, 3) their food intake, and 4) the healthiness of their diet. Each covariate was classified into three mutually exclusive categories: same level, decrease, increase.

3.2.4 Possible approaches to confounding

As in any epidemiological study of causation, confounding is a concern. A confounder is a variable that is associated with, but not a consequence of, the exposure and is associated with the outcome independently of the exposure. In an observational study such as HEAF, one attempts to measure the true causal association between an exposure and an outcome while accounting for the effect of potential confounders. There are several strategies to deal with confounders at either the design stage or at the analysis stage of a study. At the analysis stage, one approach is to stratify analyses by levels of the potential confounder. For example, conducting analyses separately for men and women would eliminate the potential for the confounding effect of sex on the association under investigation. However, this approach becomes problematic if there is a need to control simultaneously for multiple confounders as it can divide the original sample into subsets, in some of which statistical power is severely limited.

A second approach is the use of propensity score methods (PS), which mimic the scenario of a randomised trial within an observational study design. In observational studies often subjects that are exposed to the factor of interest differ systematically from those who are not. The propensity score is usually estimated using a logistic regression model, in which the exposure is regressed on observed baseline characteristics. The estimated propensity score is the predicted probability of being exposed to the factor of interest derived from the fitted regression model. Conditional on the propensity score, the distribution of observed baseline covariates will be similar between exposed and unexposed subjects thereby reducing confounding (175).

Four common propensity score methods are available to remove the effect of confounding: propensity score matching, stratification on the propensity score, inverse probability of treatment weighting (IPTW) and covariate adjustment using the propensity score. Propensity score matching, entails forming matched sets of treated (exposed) and untreated (not exposed) subjects, who share similar values of the propensity score. This ensures that both groups are comparable in terms of baseline characteristics. Stratification on the propensity score involves stratifying individuals into mutually exclusive subsets based on their estimated propensity score. The treatment effect is then estimated within each subset and combined across all strata, helping to balance covariates across treatment groups. The IPTW assigns each participant a weight equal to the inverse probability of receiving the treatment they actually received. This creates a pseudo population where the distribution of measured baseline characteristics is independent of treatment assignment. Finally, the method of covariate adjustment using the propensity score works by regressing the outcome variable on an indicator denoting treatment status and the estimated propensity score. This approach adjusts for confounding by controlling for a single summary measure of all observed covariates, rather than including each one individually (175).

A third approach, which is the one I used in this thesis, relies on controlling for confounders within the statistical model. Multivariable regression techniques allow simultaneous control for confounders (of any nature) by adding each to the model. The choice of confounders to add to the model is important and over-adjustment should be avoided. Two alternative approaches are commonly followed: data driven or evidence driven.

3.2.4.1 Data driven approach

A data driven approach entails deriving the list of confounders for which to adjust for, from patterns in the data rather than from theoretical knowledge. Such a method usually begins by running exploratory analyses to quantify the association between each potential confounder, the exposure and the outcome. These will help identify variables that potentially meet the confounder definition. There are several ways to select confounders with a data driven approach, the most common ones being forward selection, backward elimination and stepwise regression. A forward selection model building process starts with an empty model and gradually adds confounders. Confounders showing statistically significant associations (at 5% level) with both the exposure and outcome are considered. Variables are added one at a time, assessing their significance and the change in effect size of the main exposure on the outcome. If the effect size changes by more than 10%, the variable is retained as a confounder. This process continues until all potential confounders are evaluated.

A backward elimination method starts with all candidate confounders in the model. These are gradually eliminated starting from the least significant ones, until the model only includes meaningful variables.

A stepwise regression combines the two previous methods and adds and removes variables based on the significance level of the associations.

3.2.4.2 Directed Acyclic Graphs (DAG)

As opposed to a data-driven approach, an evidence-based approach is more subjective and does not consider associations in the dataset under analysis. This approach helps with identifying confounders that should be adjusted for in the analysis. It identifies confounders based on existing evidence of the association between variables. Directed Acyclic Graphs (DAGs) are graphical representations of causal associations between variables, which are derived from prior research and the researcher's perception on the causal association between variables (176). To explore the association between changes in employment and health outcomes (RQ2 and RQ3) I employed an evidence-based approach.

With the aid of the software DAGitty (177), and informed by the background literature, I drew possible causal relationships between variables relating to the association between changes in employment (exposure) and health (outcome). The process started by evaluating each covariate in turn and its potential causal association with any of the exposure, outcome or other covariates already added. An arrow was drawn between variables only if the association between them was deemed potentially causal. The process ended when all variables had been evaluated.

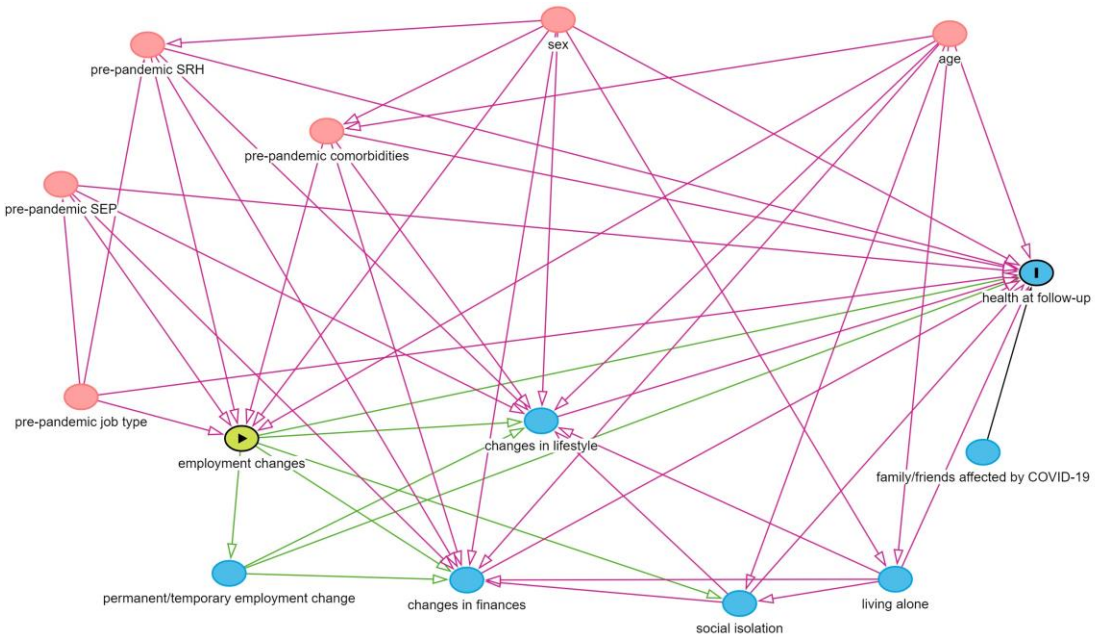
Variables that I considered adding were:

- Employment change (permanent vs temporary),
- Social isolation during lockdown,
- Family/friends affected by COVID-19,
- Living alone in lockdown,
- Changes in finances assessed in the first survey,
- Changes in lifestyle assessed in the first survey,
- Age,
- Sex,
- Pre-pandemic financial position,
- Pre-pandemic SRH,
- Pre-pandemic comorbidities,

- Pre-pandemic job type.

The DAG is presented in Figure 3-1. Variables identified by a red circle are those that should be treated as confounders, whereas those in blue were evaluated but deemed not to require inclusion in the model. The minimal sufficient adjustment necessary to estimate the total effect of employment changes on health included adjustment for age, sex, pre-pandemic financial position, pre-pandemic SRH, pre-pandemic comorbidities and pre-pandemic job type.

Figure 3-1: DAG showing adjustment factors to address RQ2.



3.2.5 Effect modification

Effect modification exists when the association between an exposure and an outcome differs according to different levels or categories of a third variable (i.e., the effect modifier). To answer RQ3, I treated pre-pandemic financial position and perception of changes in employment as potential effect modifiers of the association between changes in employment and health outcomes.

3.2.6 Data analyses

I used different statistical approaches, depending on the nature of the outcome.

To address RQ1, I performed descriptive analysis to explore changes in employment, in finances, in lifestyle and in health. N (%) were used to describe categorical variables, mean (SD) in case of normally distributed continuous variables while median (IQR) for not-normally distributed variables. Descriptive findings for the whole cohort are presented in the main text while those with stratification by sex are presented in Appendix J.

To address RQ2, I built a multivariate Poisson regression model with robust standard errors, to explore the effect of changes in employment on health outcomes. Associations were summarised by relative risks (RR) with 95%CIs. Estimates are presented first with adjustment for sex and age only; then adjusted for age, sex, pre-pandemic SRH, pre-pandemic comorbidities, pre-pandemic financial position, pre-pandemic job type (Model 1), as advised by the DAG.

Finally, to address RQ3, I tested for an interaction between changes in employment and 1) pre-pandemic financial position; and 2) perception of change in employment position, when looking at associations with health outcomes. I report associations between changes in employment and health outcomes, stratified by the levels of the effect modifiers.

3.2.7 Sensitivity analyses

The full study sample included participants who reported that they were “retired with some work” in February 2020. These are people who may have retired from their main job but still held a ‘bridge’ employment. They could therefore have experienced a job change after lockdown, although they were already retired pre-lockdown. A first sensitivity analysis involved repeating analyses with exclusion of participants who in February 2020 were “retired with some work”. My expectation was that associations would become stronger with this restriction.

In an additional sensitivity analysis, I repeated the main analysis with restriction to participants for whom data were available on all confounders included in the fully adjusted model, as opposed to having full data on sex, and age only (minimally adjusted model). This meant that any change in associations between models with different adjustments could confidently be attributed to the confounders and not to a difference in which participants were included in the models.

3.2.8 Approaches to missing data

Missing data is a common problem in epidemiological studies. For this chapter I employed a complete case analysis approach. This meant that only participants with full data on the exposure, outcome and covariates were included in my sample. To increase the sample size, each analysis was based on the greatest possible sample size for that particular outcome. When there are missing data, it is important to check the type of missingness in deciding on the best approach to deal with them. If the probability that data are missing is completely independent of the observed data and of missing data, then the scenario is Missing Completely at Random (MCAR). A second scenario is Missing at Random (MAR), in which the probability of missing data is dependent on observed data but does not depend on the values of the missing data. Finally, a third scenario is Missing not at Random (MNAR). In this case, the probability of missing data depends also on the value of the missing data. It is normally not possible to distinguish whether observations are MAR or MNAR, but it is possible to test whether data follow MCAR, and I tested for that below.

Table 3-2 shows the level of missingness in the dataset for exposure and outcomes. This varied from 2.2% to 6.9%. When looking at patterns of missingness, 87% of the sample had data on all variables, while 3% had missing data on changes in employment, and 2% on mental health worsening and on changes in finances. Other combinations of missing data occurred in 1% or less of the sample. When looking at predictors of missingness for the outcomes, it was apparent that the data did not follow the MCAR assumption for some outcomes, as missingness was dependent on observed characteristics like sex and age. For example, older women were more likely to have missing data on worsening of mental health. Although there is no definitive threshold of missing data that is acceptable, there seems to be consensus that a missing rate of less than 5% is generally of low concern (178, 179).

Table 3-2: Level of missing data

Proportion with missing data	%
Change in employment	4.2%
Change in finances	6.9%
Change in alcohol	2.2%
Change in physical activity	2.2%
Change in food intake	2.1%

Change in diet quality	2.2%
Worsening of SRH	2.3%
Worsening of mental health	5.8%
Worsening of physical health	3.2%
Anxiety	2.8%
Depression	3.2%

Several approaches have been suggested to deal with missing data, including mean imputation and regression imputation. However, the method that is most often recommended is multiple imputation with chained equations (MICE), which produces unbiased estimates under MAR assumption (180). The method works as follows: first, multiple datasets are created by replacing missing values with estimates generated from imputation models based on the observed data. Each dataset represents a plausible version of the complete data. In the second step, estimates from each dataset are combined using Rubin's rule which accounts for the variability introduced with the multiple imputation process (181). In this project I used complete case analysis however multiple imputation could be considered in future work.

3.3 Results

3.3.1 Changes in employment

A total of 962 (39%) participants were in paid work just before the COVID-19 pandemic (February 2020). Most were employees, while 205 (21%) were self-employed. A further 1,246 (50.5%) were retired and not doing any paid work, while 191 (7.7%) were retired from their main job but still working. Of the remainder, 57 were unemployed (either seeking or not seeking work) and 13 people omitted completing this section of the survey.

Table 3-3: Employment status before lockdown (February 2020).

Employment status	N (%)
Employed	750 (30.4)
Employed off sick	7 (0.3)
Self employed	205 (8.3)
Unemployed and seeking work	12 (0.5)
Unemployed and not seeking work	45 (1.8)
Retired, doing some paid job	191 (7.7)
Retired, not doing any paid work	1246 (50.5)
Missing	13 (0.5)

A total of 379 (15.4%) participants self-identified as “key workers”, individuals whose jobs were considered essential for the economy. This proportion did not change when I excluded from the analyses people who said they were “retired with some work” in February 2020.

Figure 3-2 is a Sankey plot that shows visually which pre-pandemic employment categories (represented on the left) feature in each category of changes in employment, among individuals in paid employment in February 2020 and with non-missing data in the variable changes in employment (N=954). It appears that both participants who were employed and those self-employed in February 2020 contributed to all categories of changes in employment.

Figure 3-3 is restricted to participants in paid work in February 2020 and describes changes in their employment since the beginning of the pandemic depending on certain characteristics such as: their employment status, age, sex, and on whether they were advised to shield. The aim is to describe variations in patterns of employment change across different demographic and occupational subgroups. An almost identical proportion of

employed and self-employed workers pre-pandemic experienced no change in employment during the pandemic, but a higher proportion of employed individuals started to work from home or were furloughed. In total, 27% of self-employed individuals experienced a job change of another kind (this was only 5.7% among employed individuals). Working from home was more common among younger people, while the proportion of those who decided to retire after the beginning of the pandemic, was highest among older people (aged 66+ years). There were no major differences across the sexes, but women were slightly more likely to have shifted to home working compared with men. Finally, the proportion working from home was similar among those who were advised to shield and those who were not, while the proportion of the sample still required to attend the usual place of work was higher among participants not advised to shield. Nevertheless, approximately 15% of those who were advised to shield continued to work from their normal workplace (Figure 3-3).

Figure 3-2: Changes in employment during the pandemic (on the right) according to employment status pre-pandemic in February 2020 (on the left)

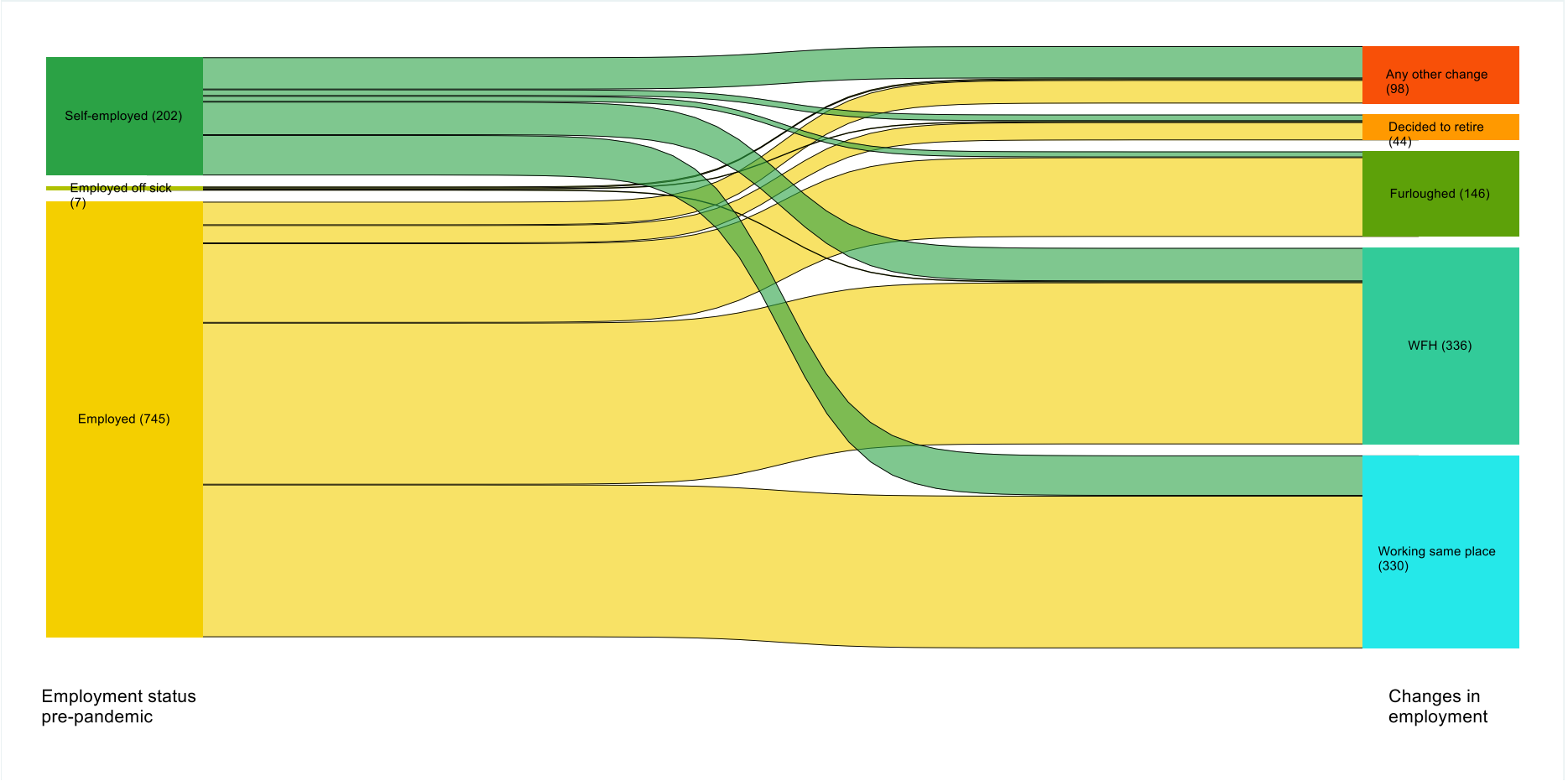


Figure 3-3: Changes in employment since the pandemic by A) employment status in February 2020, B) age, C) sex, and D) shielding advice

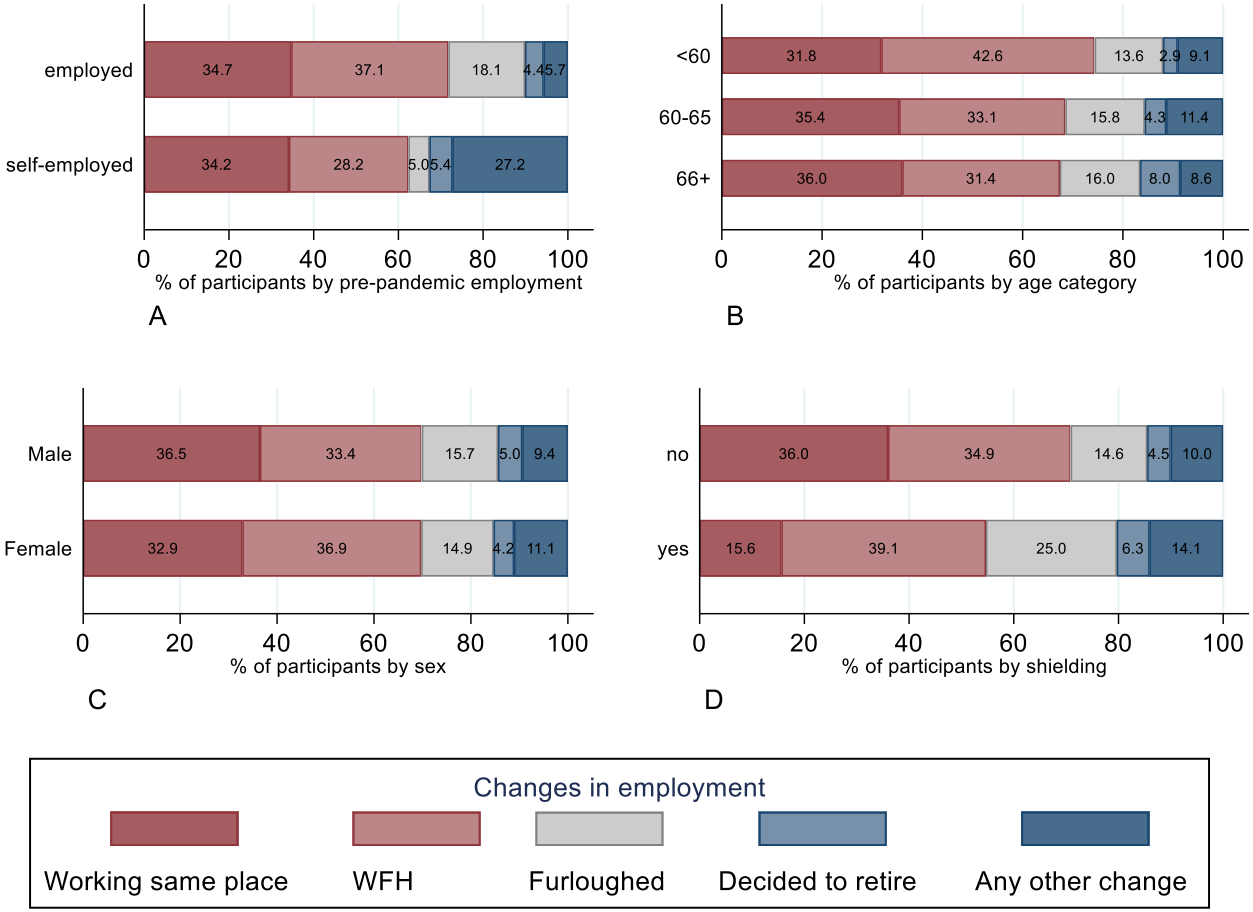
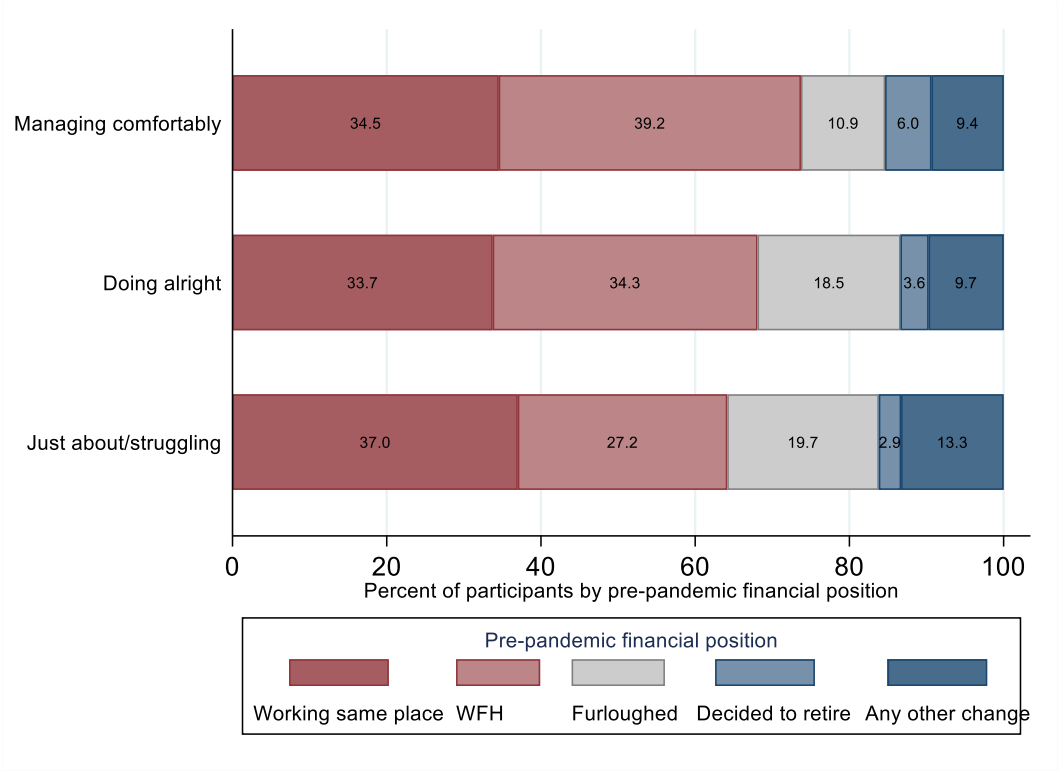


Figure 3-4: Changes in employment (for those in work pre-pandemic), by pre-pandemic financial position.



Employment changes were not equally distributed across pre-pandemic financial position categories as shown in Figure 3-4. Working remotely was more likely amongst people with greater financial security, while furlough occurred disproportionally amongst those who in 2019 were in poorer financial position.

Figure 3-5: Perception of changes in participants' overall employment situation (for those in work pre-pandemic), by type of employment change.

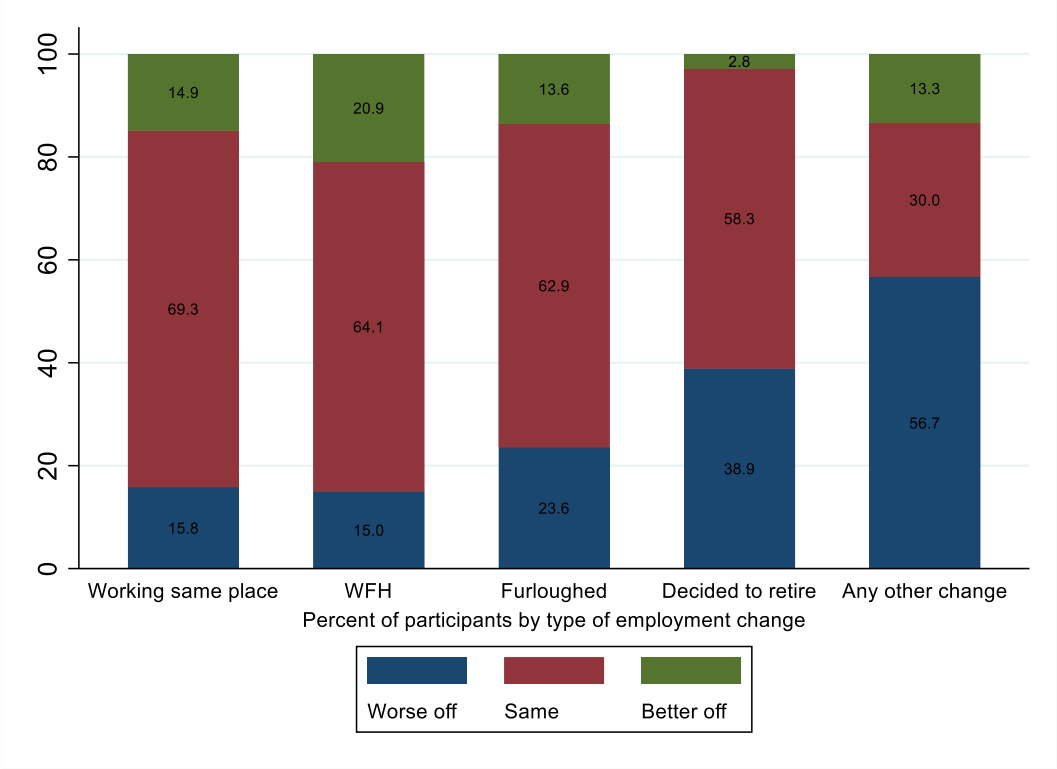


Figure 3-5 illustrates how participants perceived changes in their overall employment situation based on the type of employment change they experienced. The proportion of participants who perceived themselves worse off in employment terms was highest amongst those who experienced any other change in employment (which included redundancy), while it was lowest amongst those who either remained in the same place of work or shifted to home working. The proportion of participants who perceived themselves better off in employment terms was highest amongst those who shifted to home working (21%) and lowest amongst those who decided to retire (3%).

In the section below I focus on people who were working from home during the first lockdown for at least some of their working hours. As a measure to control the spread of the virus, in the early stages of the pandemic, the Government made home working mandatory if the type of job allowed it. A total of 385 (15%) participants in our sample worked either partly or entirely from home during the first lockdown.

Table 3-4: Experiences of home working during the first lockdown

Participants who worked from home at least partly (n=385)	N (%)
Necessary technology was available	

Yes, all	284 (73.8)
Yes, some	92 (23.9)
None	5 (1.3)
Missing	4 (1.0)
Had a separate room to work in	73 (19.0)
Had a proper desk/chair to work	86 (22.3)
All/most of the work could be done from home	296 (76.9)
I was clear about what was expected of me	336 (87.3)
I felt valued by my employer	305 (79.2)
I felt trusted by my employer	321 (83.4)
My manager was good at staying in touch	279 (72.5)
I intend to stay with my employer long term	318 (82.6)
I did not worry that decisions were taken without my input	283 (73.5)

Participants who performed at least some home working during lockdown (n=385) were asked about their experience (Table 3-4). 69% of the sample had never worked remotely before lockdown. Almost all those who replied felt they had at least some of the necessary technology to perform their work, but only about one in five had a separate room in which to work (19.0%) or a comfortable desk or chair (22.3%). Participants seemed to have enjoyed the overall experience of working from home as a high proportion reported that they felt trusted and valued by their employer and that they were clear about what was expected of them while working from home. More than 80% also reported the intention to remain with their current employer long term.

A total of 276 of the 385 who performed any home working during the first lockdown, responded to the questions about duration of home working and about feelings towards the experience at the subsequent online survey. For more than half of them (56.9%), home working (either fully or partly) was still ongoing in October 2021, while for the remainder it had been temporary and stopped within 9 months of the beginning of the pandemic. There may have been some people who started home working after the first lockdown, but their experiences are not described here. Interestingly, feelings about home working were mixed: on the one hand, 42% of participants who performed any homework during the first lockdown perceived an increase in their productivity, and 66% appreciated the reduction in commuting time. However, work stress had increased among 29% of the sample, for 38% it was difficult

to keep boundaries between home and work, and 47% agreed that the lack of social interaction meant their work was less enjoyable.

Of those who responded, 55% said that they would prefer a hybrid work arrangement in the future, 24% that they would like to switch to WFH entirely, and only 16% wished to go back to their normal workplace. Men and women were similar in terms of their experience of home working and preferences of future work arrangements.

3.3.2 Changes in financial position

HEAF participants were asked how well they managed financially at the end of the first national lockdown (August 2020). 60% of them reported that they were managing comfortably and 31% said they were doing alright, while 8% reported that they were only just about managing or struggling to make ends meet (1% had missing data).

Amongst participants with complete information, 58% reported no change to their financial position, 13% a worsening, and 30% that they were now better off compared to the period before the pandemic, suggesting an overall improvement of financial circumstances.

As shown in Figure 3-6, the distribution of changes in financial position was not equal across categories of pre-lockdown financial position. The proportion of those who thought they were now financially worse off was notably higher among those who were just about getting by or struggling financially before the pandemic (31%, compared with 7% among those who were managing comfortably pre-pandemic). Additionally, the proportion of those who thought themselves better off (green bar) financially after lockdown was higher among those who were already managing comfortably before lockdown (36% vs 15% among those who were struggling financially). This suggests that the COVID-19 pandemic affected participants differently, according to their pre-pandemic financial position, with those who were struggling financially more likely to have experienced deterioration in their financial position.

Figure 3-6: Change in financial position since lockdown, by pre-lockdown financial position.

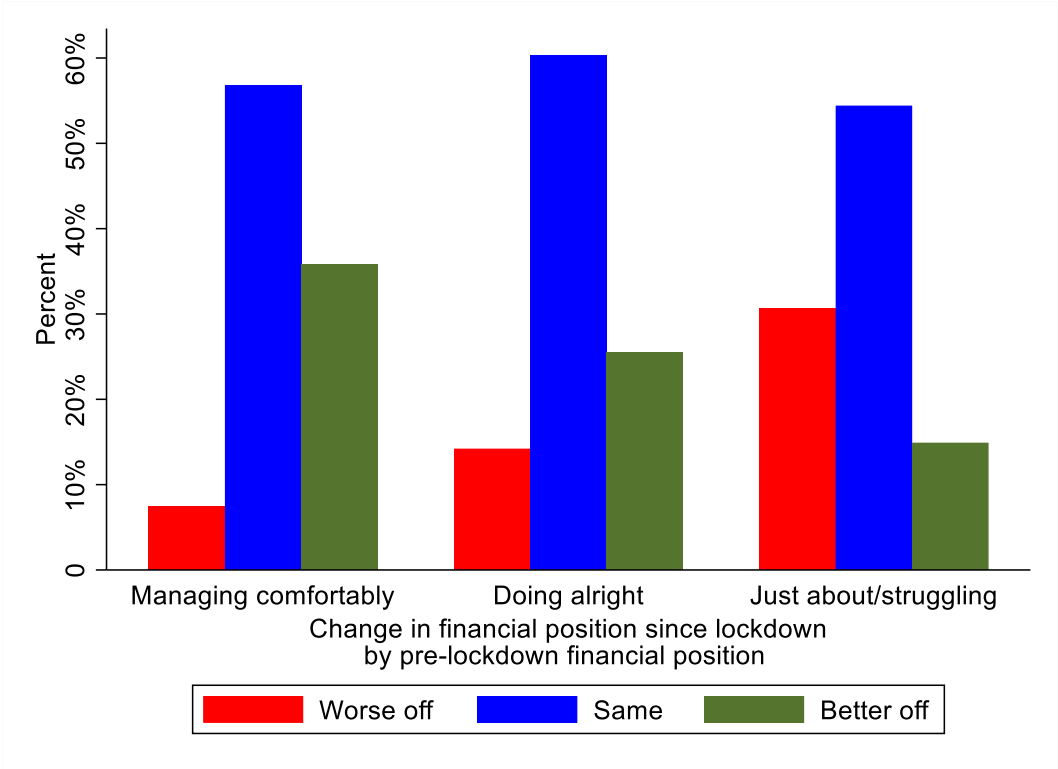


Figure 3-7: Change in financial position since lockdown, by changes in employment since lockdown.

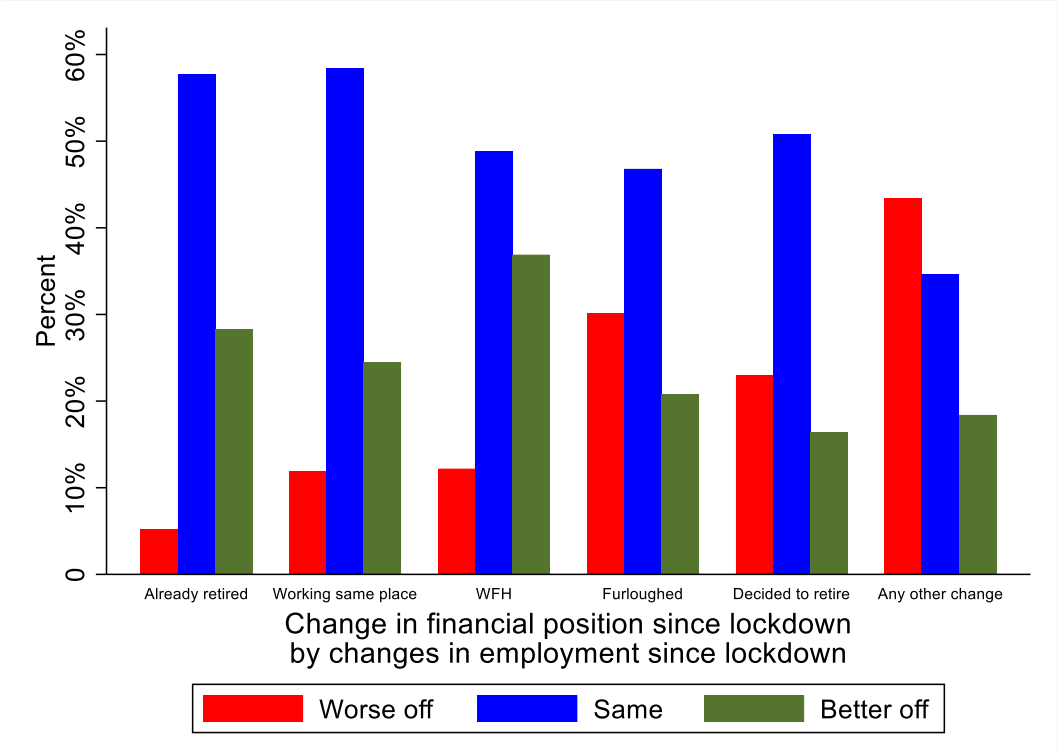
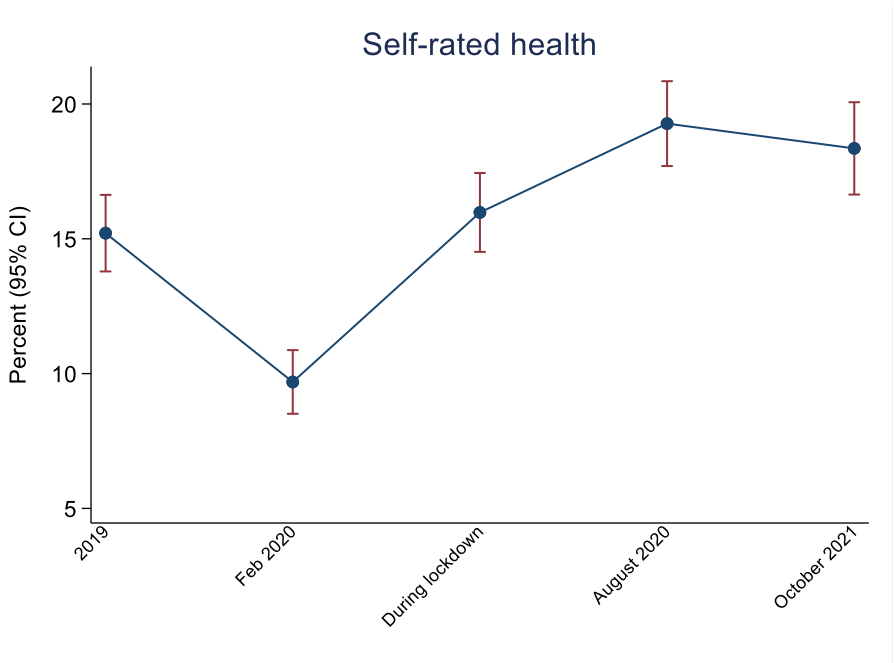


Figure 3-7 indicates that the way people perceived changes in their finances was linked to what happened to their employment. The proportion of those who perceived themselves better off (green bar) was highest among home workers. On the other hand, the proportion of participants perceiving themselves as worse off financially (red bar) was highest among those with any other change (which included those made redundant and those not performing work in lockdown for other reasons) and among those who were furloughed. Participants already retired and those working as usual, reported the highest prevalence of an unchanged financial position.

3.3.3 Changes in health

This section summarises data on health outcomes that were collected in the online surveys. Figure 3-8 shows the proportions of people who reported poor/fair SRH at five time points, from 2019 to the latest available time participants were contacted (October 2021). The prevalence of poor/fair SRH during lockdown was similar to that reported at the latest available data point pre-pandemic (June 2019). There was a slight increase in the proportion of those reporting fair/poor SRH in the period just after lockdown (19%) and in October 2021. The proportion with poor/fair SRH was slightly higher amongst women, especially from lockdown onwards (results shown in Appendix J).

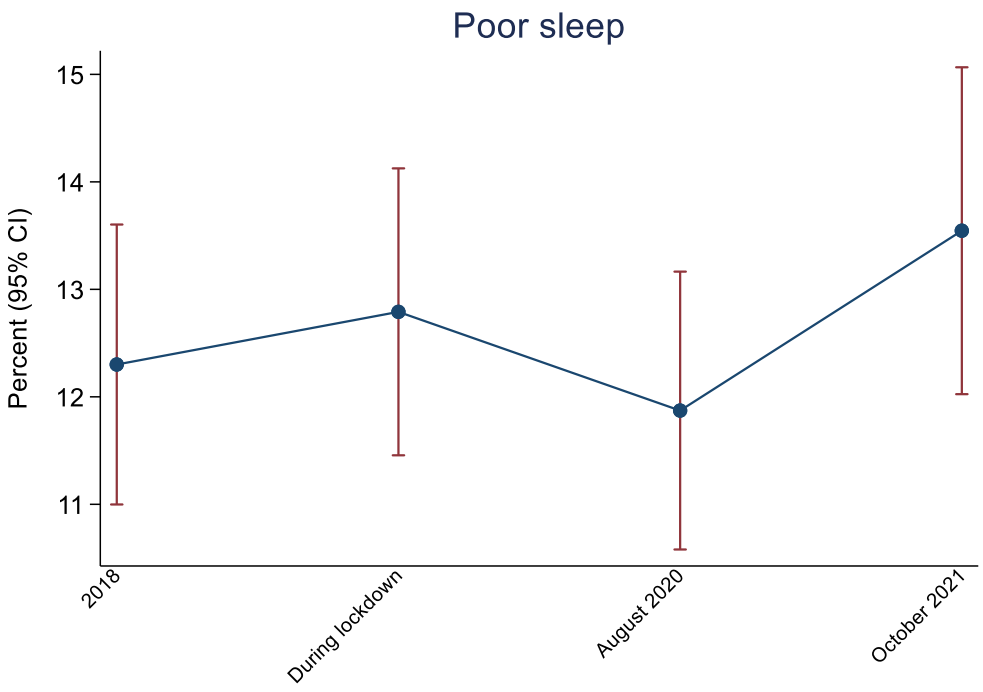
Figure 3-8: Prevalence of fair/poor SRH over time



Approximately 12% of the sample reported poor sleep either during or after lockdown, a proportion that was similar compared to the last pre-pandemic data point. The proportion of

people reporting poor sleep was stable over the course of the study. Note that the latest pre-pandemic follow-up for this variable was 2018 (and not 2019) as it was not assessed in 2019. Stratification by sex (Appendix J) shows that the prevalence of poor sleep was much higher amongst women than in men.

Figure 3-9: Prevalence of poor sleep over time

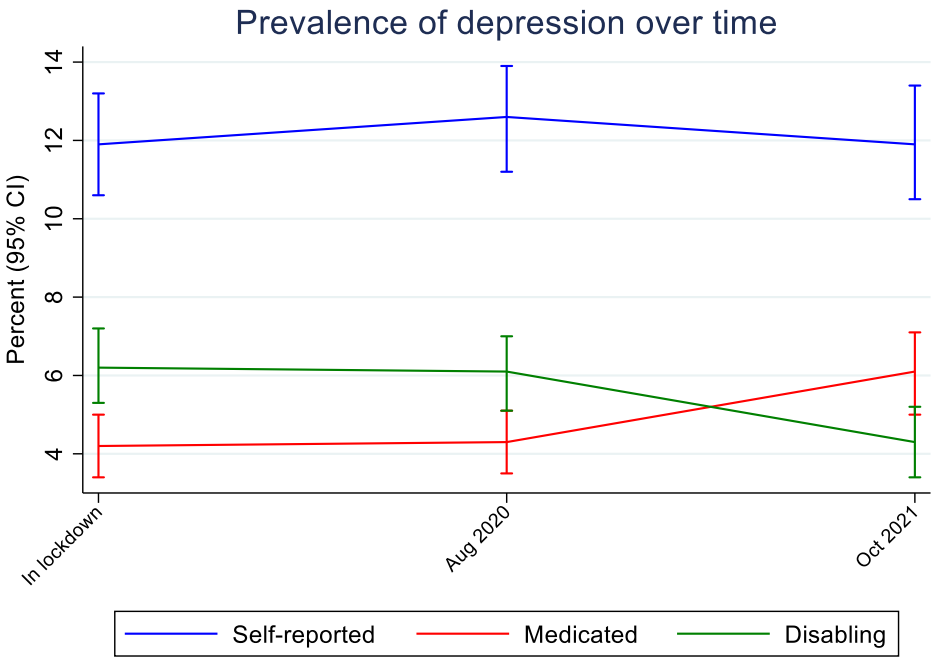


3.3.4 Mental health

This section describes the mental health data collected in the online surveys. In both the first and second online surveys, participants completed the 20-item CES-D questionnaire (173). However, the level of missingness in the first survey was such that it was impossible to compute a meaningful score. Of the 1,976 participants who completed the survey in October 2021, 21.4% scored 16 or more, indicating of the presence of depressive symptoms.

Figure 3-10 shows that self-reported levels of depression, medicated depression or disabling depression were stable between the first lockdown and October 2021, although there was an increase in the prevalence of medicated depression in the period from August 2020 to October 2021 with a parallel decrease in related disability. As shown in Appendix J, women tended to report higher prevalence of each of the three outcomes.

Figure 3-10: Depression over time



With information from pre-pandemic questionnaires, I was able to explore whether this was likely to be incident depression. Figure 3-11 shows the prevalence of depression, medicated depression, and disabling depression over time among participants who did not meet the criterion for depression in 2019 (CESD-score<16). This indicates findings similar to those seen in Figure 3-10, although the proportion of participants medicated for depression halved among those who were not depressed pre-lockdown. 14% of men and 31% of women reported themselves as having anxiety during lockdown, 3% and 6% respectively received medication for anxiety, and the condition was disabling for 5% of the men and 11% of the women. These prevalence rates remained unchanged in the two later periods. We had no data on anxiety pre-pandemic and were therefore unable to explore how much of the reported anxiety pre-dated the pandemic. Approximately 38% of participants who reported anxiety also reported depression, regardless of the time period.

Figure 3-11: Prevalence of depression over time among participants not depressed in 2019

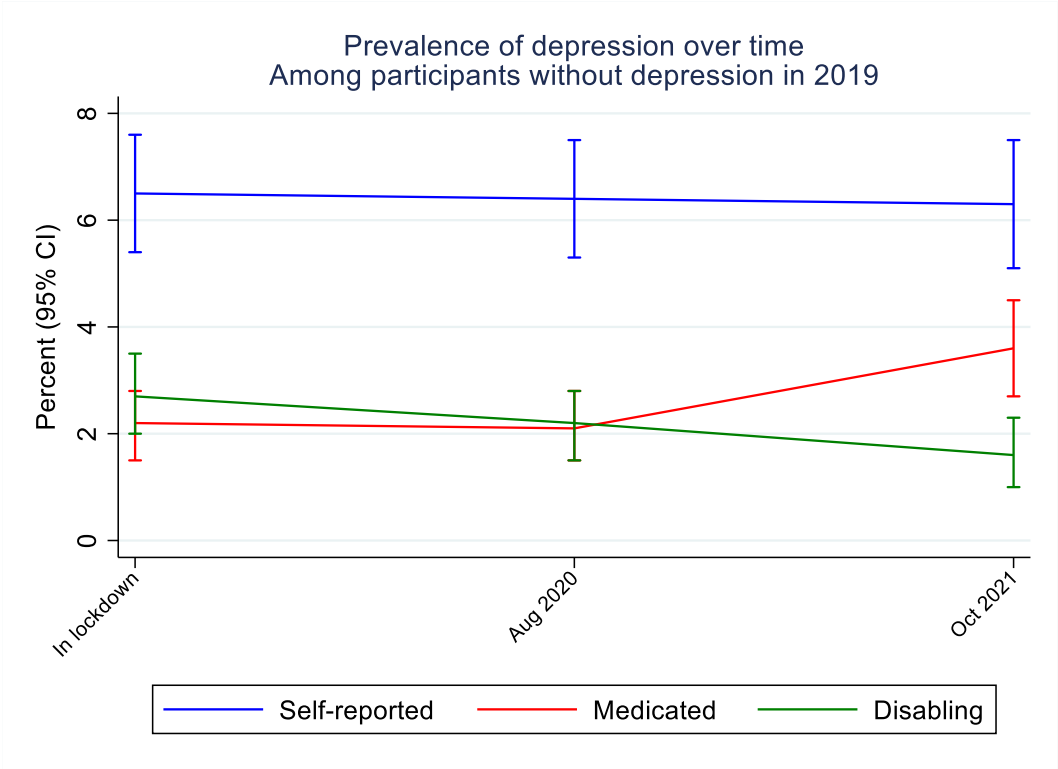
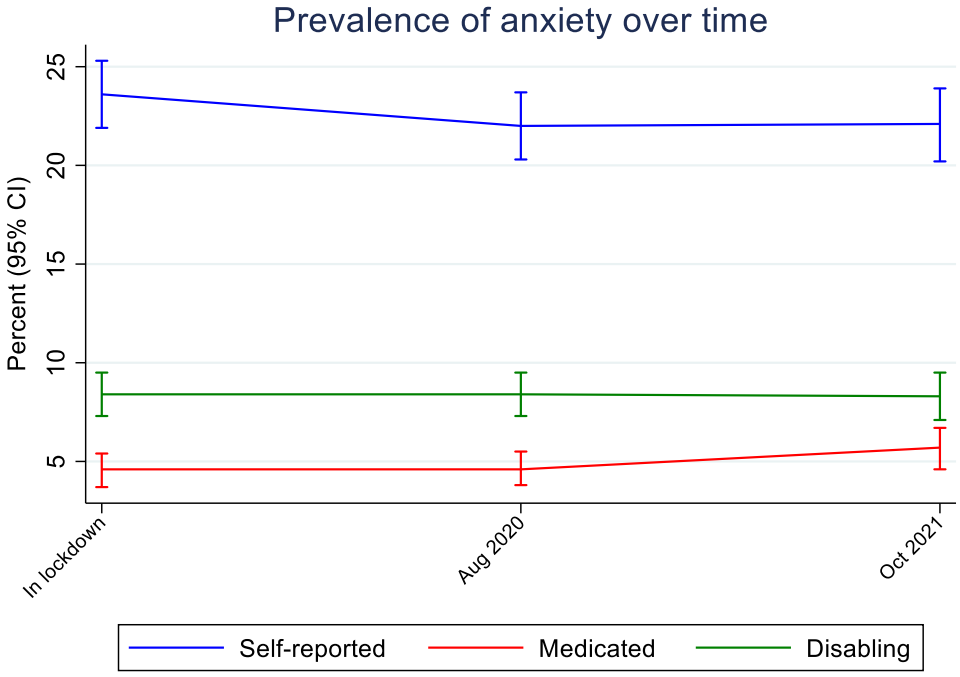


Figure 3-12: Anxiety over time



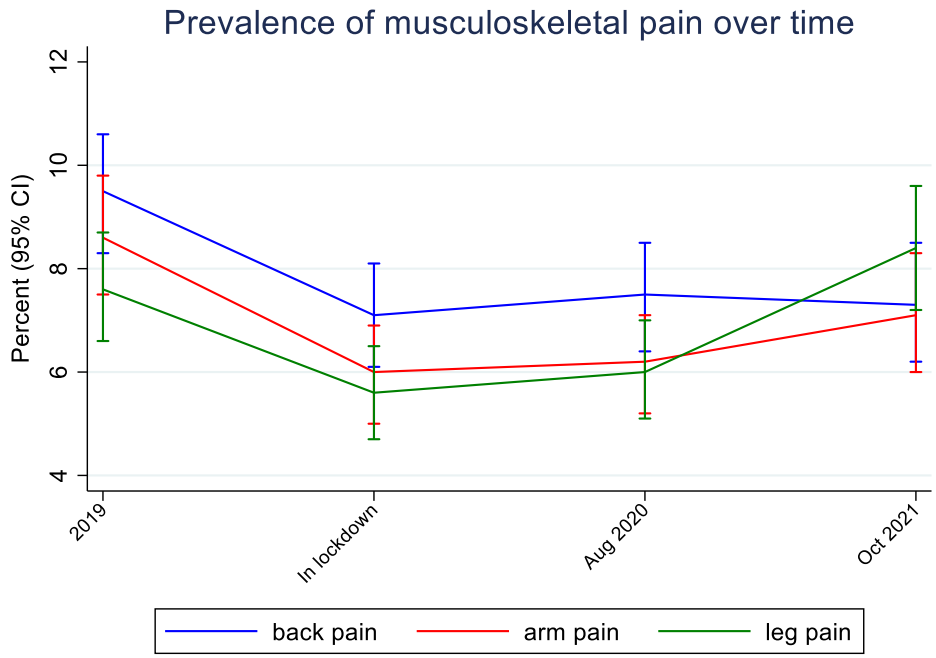
A total of 19.7% of the sample reported a worsening in their mental health within the first survey: 15% among men and 23.4% among women. In the second survey, participants were

asked to describe changes in their mental health since the beginning of lockdown, rather than limiting their responses to the period since the previous survey. A total of 16.7% reported a worsening in mental health in the second survey.

3.3.5 Physical health

Figure 3-13 reports prevalence of pain in any of the back, arm/s, or leg/s that had lasted for at least a month and made it difficult to perform daily chores. Report of such pain was slightly less frequent both during and after lockdown, as compared with in the latest pre-pandemic questionnaire, although the prevalence of leg pain in October 2021 returned to the level of 2019. Women tended to report slightly higher prevalence of back and arm pain than men, as set out in Appendix J.

Figure 3-13: Musculoskeletal pain over time



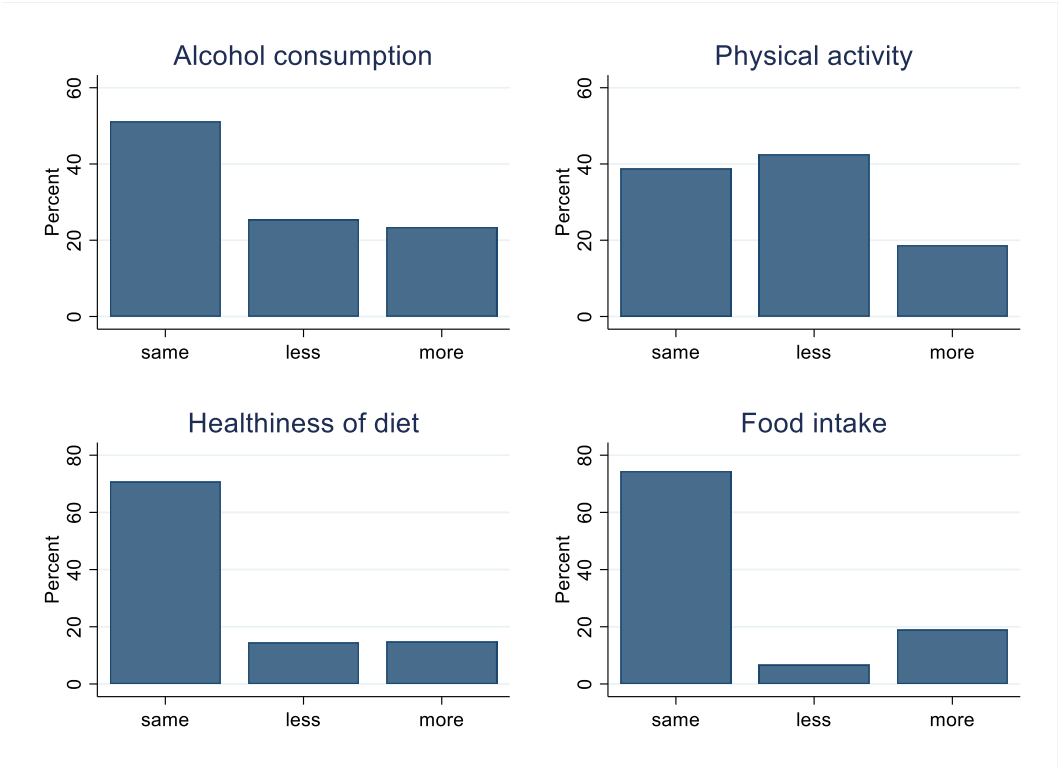
A total of 27% of the sample perceived a worsening in their physical health at the time of the first online survey (25% men, 28.5% women). This proportion did not change in the second pandemic survey, which again asked about developments since the beginning of lockdown.

3.3.6 Changes in lifestyle

During the first national lockdown, HEAF participants reported that they were doing a median of 4 hours a week of physical activity sufficient to make them sweat (IQR=1-7 hrs). Levels of physical activity changed notably, with 44% of the sample reporting themselves less

physically active compared to the pre-lockdown period. Conversely, 17% reported themselves more physically active than before, and 38% reported their physical activity to have remained unchanged. Among those with data available in each variable, 51% of those who usually drank some alcohol said that their alcohol consumption had remained the same, while similar proportions reported an increase and a decrease in consumption. The diets of HEAF participants did not change much, with 69% of participants reporting no change in the healthiness of diet, 17% a less healthy diet and 14% a healthier diet. In terms of food intake, 73% reported that it did not change since March 2020, while 20% reported themselves as eating more food and 7% less food (Figure 3-14). In Appendix J the same figure is available separately for men and women. Some minor differences were apparent, with women slightly more likely than men to have increased their alcohol consumption, changed their physical activity level in either direction, adopted a less healthy diet, and increased their food intake.

Figure 3-14: Reported changes in lifestyle during the pandemic.



3.3.7 Other life changes

Table 3-5 summarises participants perception of how their lives changed since the onset of the pandemic, overall and stratified by sex. Almost a third of participants reported themselves financially better off compared to pre-lockdown, and this percentage was higher among men (34.1% among men; 25.8% among women). When asked about their perception of employment change, 78.2% perceived this did not change, with similar proportions for men

and women. This variable was used as a potential effect modifier of the association between changes in employment and health (section 3.3.10). A positive aspect of lockdown in our cohort seems to be that people reported having more time for themselves or their family (46.1%), while only 10.2% reported to have less family time.

Table 3-5: Life changes between the first lockdown and February 2021, overall and by sex (computed for participants with no missing data)

	Overall	Men	Women
		N (%)	
Perception of change in financial position			
Worse off	294 (12.8)	138 (13.3)	156 (12.4)
Same	1326 (57.7)	547 (52.7)	779 (61.8)
Better off	679 (29.5)	354 (34.1)	325 (25.8)
Perception of change in employment			
Worse off	261 (12.5)	120 (12.8)	141 (12.2)
Same	1637 (78.2)	713 (75.9)	924 (80.1)
Better off	195 (9.3)	106 (11.3)	89 (7.7)
Perception of change in time with family			
Less time	241 (10.2)	102 (9.7)	139 (10.6)
Same time	1034 (43.7)	487 (46.4)	547 (41.5)
More time	1091 (46.1)	460 (43.9)	631 (47.9)

3.3.8 Association of changes in employment with health outcomes during the first lockdown (RQ2)

In this section I explore the effect of changes in employment on short-term self-reported health outcomes. Table 3-6 shows the proportion of participants who scored positively for each health outcome, overall and by categories of covariates. Covariates included in the tables are those identified with the DAG as well as those who I tested for inclusion but were not included in the final model. The overall proportion of participants who perceived that their SRH worsened a year after the start of lockdown was 17%, while the equivalent proportion for mental health was 20.9%, and for physical health was 27.8%. A total of 23.6% self-reported anxiety during the first lockdown and 11.9% depression. Poorer health outcomes were more common amongst younger individuals, women, those struggling financially in 2019 (as opposed to those managing comfortably), those with fair/poor SRH in 2019 (vs at least good SRH), and those with more comorbidities in 2019. Those in jobs characterised by high demand and low control reported the highest rates of poor health. Regarding lifestyle, prevalence rates of poor outcomes were higher amongst participants who started drinking more alcohol, undertook less physical activity than in the pre-pandemic period, started eating more food, and adopted a less healthy diet. The group who decided to retire after lockdown reported the highest prevalence of worsening in mental health, SRH and anxiety. Those working in the same place as before the pandemic tended to show the lowest prevalence of poor health outcomes. People working from home had intermediate rates. Furthermore, it seems that the participant's perception of their employment circumstances may have played a role in subsequent health changes, as those who perceived that their employment had changed for the worse reported the highest prevalence of each poor health outcome.

Table 3-6: Descriptive analyses of health outcomes assessed during the first lockdown *

	Derived, N (%)	Self-reported, N (%)				
	Worsening of SRH	Worsening of mental health	Worsening of physical health	Anxiety	Depression	Incident depression
Overall	409 (17.0)	486 (20.9)	664 (27.8)	566 (23.6)	284 (11.9)	128 (6.5)
Age (years)						
Below 65	192 (17.5)	260 (24.1)	318 (29.2)	291 (26.6)	157 (14.4)	74 (8.5)
65 and older	217 (16.5)	226 (18.1)	346 (26.6)	275 (21.1)	127 (9.8)	54 (4.9)
Sex						
Men	137 (12.8)	163 (15.6)	271 (25.5)	153 (14.4)	93 (8.7)	36 (4.0)
Women	272 (20.2)	323 (25.2)	393 (29.6)	413 (30.9)	191 (14.4)	92 (8.8)
Financial position (2019)						
Comfortably	169 (13.1)	190 (15.2)	271 (21.2)	213 (16.6)	97 (7.6)	62 (5.4)
Doing alright	163 (20.6)	184 (24.3)	245 (31.4)	223 (28.3)	109 (13.9)	48 (7.8)
Just about/struggling	75 (22.6)	112 (35.2)	147 (44.7)	129 (39.3)	78 (23.9)	18 (9.8)
Self-rated health (2019)						
Good/v good/excellent	330 (16.2)	364 (18.5)	456 (22.5)	410 (20.2)	190 (9.4)	113 (6.4)
Fair/poor	78 (21.4)	121 (34.9)	206 (57.5)	155 (43.1)	94 (26.4)	15 (8.5)
Number of comorbidities (2019)						
0	47 (11.2)	41 (10.1)	54 (12.9)	49 (11.6)	17 (4.0)	14 (3.5)

	Derived, N (%)	Self-reported, N (%)				
	Worsening of SRH	Worsening of mental health	Worsening of physical health	Anxiety	Depression	Incident depression
1	72 (14.0)	66 (13.3)	86 (16.9)	79 (15.4)	27 (5.3)	20 (4.2)
2+	290 (19.7)	379 (26.6)	524 (35.8)	438 (29.9)	240 (16.5)	94 (8.7)
Job type (2019)						
Low demand/high control	45 (15.6)	51 (17.9)	59 (20.8)	50 (17.4)	31 (10.8)	21 (7.9)
Active	36 (14.3)	56 (22.6)	76 (30.4)	58 (23.2)	28 (11.2)	13 (6.3)
Passive	52 (17.2)	60 (20.1)	68 (22.5)	61 (20.3)	36 (12.2)	14 (5.9)
High demand/low control	52 (21.9)	63 (26.7)	84 (35.3)	86 (36.1)	45 (19.0)	18 (10.8)
Not in work	207 (16.2)	243 (20.2)	354 (28.0)	294 (23.2)	132 (10.4)	56 (5.3)
Perceived employment change						
Worse off	60 (23.0)	89 (35.0)	96 (36.8)	83 (32.2)	51 (19.8)	25 (12.8)
Same	276 (16.9)	335 (20.5)	448 (27.5)	380 (23.4)	183 (11.3)	83 (6.2)
Better off	27 (13.9)	21 (10.8)	36 (18.8)	34 (17.6)	19 (9.8)	10 (6.0)
Change in employment						
Already retired	194 (15.8)	228 (19.8)	331 (27.3)	268 (22.0)	117 (9.7)	54 (5.3)
No change: Working same place	50 (13.9)	67 (18.6)	91 (25.6)	81 (22.6)	38 (10.6)	16 (5.5)
Working from home	81 (21.4)	86 (22.9)	110 (29.3)	87 (23.1)	53 (14.2)	27 (8.8)
Furloughed	29 (16.9)	35 (20.8)	39 (22.7)	41 (24.1)	18 (10.6)	8 (5.9)

	Derived, N (%)	Self-reported, N (%)				
	Worsening of SRH	Worsening of mental health	Worsening of physical health	Anxiety	Depression	Incident depression
Decided to retire	14 (23.7)	18 (32.1)	14 (25.0)	17 (28.3)	10 (16.7)	6 (11.3)
Any other change	27 (20.5)	29 (22.3)	41 (31.1)	34 (26.0)	25 (19.1)	13 (12.6)
Change in alcohol consumption						
Less	79 (16.0)	82 (16.9)	139 (27.9)	108 (21.8)	48 (9.7)	23 (5.6)
Same	120 (11.9)	143 (14.8)	200 (20.1)	175 (17.5)	75 (7.5)	38 (4.3)
More	110 (23.8)	145 (32.5)	163 (35.8)	142 (31.1)	72 (15.8)	37 (10.4)
Change in physical activity						
Less	258 (24.3)	295 (28.5)	508 (48.0)	303 (28.7)	176 (16.7)	75 (9.2)
Same	102 (11.0)	124 (14.0)	122 (13.3)	177 (19.3)	75 (8.2)	35 (4.4)
More	47 (11.3)	67 (16.7)	32 (7.8)	85 (20.3)	32 (7.7)	18 (5.1)
Change in food intake						
Less	35 (20.1)	46 (27.7)	64 (36.8)	53 (30.3)	26 (14.9)	9 (7.2)
Same	229 (13.0)	260 (15.3)	361 (20.8)	343 (19.6)	157 (9.0)	81 (5.4)
More	144 (30.3)	179 (38.9)	238 (50.3)	170 (35.9)	100 (21.2)	38 (11.5)
Change in healthiness of diet						
Less	118 (29.1)	160 (41.1)	218 (54.2)	157 (39.4)	99 (24.8)	37 (14.1)
Same	243 (14.7)	266 (16.6)	390 (23.7)	328 (19.9)	157 (9.6)	71 (5.1)

	Derived, N (%)	Self-reported, N (%)				
	Worsening of SRH	Worsening of mental health	Worsening of physical health	Anxiety	Depression	Incident depression
More	48 (14.0)	60 (18.1)	56 (16.5)	81 (23.6)	28 (8.2)	20 (6.7)

* Health outcomes are derived from perceptions of a change reported in the first survey. Percentages are based on non-missing values for each variable and are row percentages. Sample sizes are n=2,412 for worsening of SRH; n=2,326 for worsening of mental health; n= 2,391 for worsening of physical health; n=2,399 for anxiety; n=2,399 for depression; n=1,962 for incident depression.

Table 3-7 quantifies the associations between changes in employment after the first lockdown and health outcomes determined from the first online survey. The risk for each category of employment change is compared with that among participants who remained working in the same place.

People who started working from home after lockdown were more likely to report a worsening of SRH than those who continued at their usual place of work. Adjustment for the full set of confounders did not make any difference to the effect size or significance of this association. No other significant associations were found for those who shifted to home working, although risks of depression and of worsening of mental health were slightly elevated.

Regardless of the level of adjustment, deciding to retire after lockdown was significantly associated with worsening of SRH (RR: 1.86, 95%CI: 1.09 to 3.19 in the fully adjusted model). Participants who decided to retire were also at increased risk of experiencing a worsening of their mental health since lockdown (RR: 1.96, 95%CI: 1.26 to 3.05), and of experiencing depression during the first lockdown (RR: 1.84, 95%CI: 0.98 to 3.47). The significant association between deciding to retire and depression became stronger when analysis was restricted to participants who had not been depressed in 2019 (i.e., incident depression). Retirees were almost 3-times as likely to develop incident depression as those whose work did not change.

Having been furloughed was not associated with any of the short-term health outcomes analysed, while participants with any other change in employment (which included job loss) were at increased risk of prevalent depression and of incident depression.

In general, estimates were not altered substantially by full adjustment for confounders.

Table 3-7: Association between changes in employment and health outcomes (first lockdown)

	Worsening of SRH	Worsening of mental health	Worsening of physical health	Anxiety	Depression	Incident depression
			RR (95%CI)			
No change: Working same place	Ref	Ref	Ref	Ref	Ref	Ref
Working from home						
Sex-age adjusted	**1.51 (1.09,2.08)**	1.19 (0.90,1.58)	1.14 (0.90,1.45)	0.98 (0.75,1.27)	1.28 (0.87,1.90)	1.44 (0.80,2.62)
Model 1 †	**1.62 (1.16,2.26)**	1.20 (0.90,1.60)	1.20 (0.95,1.52)	1.05 (0.80,1.36)	1.39 (0.92,2.09)	1.78 (0.94,3.38)
Furloughed						
Sex-age adjusted	1.19 (0.78,1.82)	1.14 (0.79,1.64)	0.89 (0.64,1.24)	1.07 (0.77,1.49)	1.01 (0.59,1.72)	1.04 (0.45,2.40)
Model 1 †	1.11 (0.71,1.73)	1.04 (0.72,1.51)	0.83 (0.60,1.15)	0.99 (0.70,1.40)	1.01 (0.59,1.73)	1.27 (0.54,2.99)
Fully adjusted	1.08 (0.64,1.80)	1.05 (0.67,1.64)	0.86 (0.59,1.26)	1.10 (0.74,1.63)	1.12 (0.57,2.21)	1.79 (0.64,5.00)
Decided to retire						
Sex-age adjusted	**1.73 (1.03,2.91)**	**1.90 (1.24,2.92)**	1.01 (0.62,1.64)	1.38 (0.90,2.11)	1.72 (0.91,3.23)	**2.42 (1.02,5.76)**
Model 1 †	**1.86 (1.09,3.19)**	**1.96 (1.26,3.05)**	1.02 (0.64,1.62)	1.45 (0.95,2.21)	1.84 (0.98,3.47)	**2.91 (1.22,6.94)**
Any other change						
Sex-age adjusted	1.44 (0.94,2.21)	1.21 (0.83,1.78)	1.23 (0.90,1.67)	1.13 (0.81,1.59)	**1.80 (1.13,2.87)**	**2.20 (1.09,4.44)**

	Worsening of SRH	Worsening of mental health	Worsening of physical health	Anxiety	Depression	Incident depression
			RR (95%CI)			
Model 1 †	1.38 (0.89,2.13)	1.17 (0.80,1.71)	1.12 (0.82,1.53)	1.13 (0.80,1.59)	**1.80 (1.12,2.89)**	**2.54 (1.19,5.44)**

† Adjusted for age, sex, pre-pandemic SRH, pre-pandemic comorbidities, pre-pandemic financial position, pre-pandemic job type. Bold denotes significant at 0.05 level

3.3.9 Association of changes in employment with health outcomes during the second lockdown (RQ2)

In section 3.3.8 I explored impacts on health during the first lockdown. It was also of interest to explore the effect that changes in employment had on health in the longer-term. Therefore, in this section, I carried out similar analyses but with the outcomes determined from the second online survey in October 2021. The most striking difference from earlier was the prevalence of worsening SRH. In October 2021, more than one in three participants perceived a worsening in their SRH since February 2020, whereas in February 2021 the prevalence of perceived deterioration in SRH was only 17%. Additionally, the prevalence of each poor health outcome tended to be higher amongst women, and in those: struggling financially pre-pandemic; in poorer health pre-pandemic; who perceived that their employment had changed for the worse; who increased their alcohol consumption; who decreased physical activity; and who increased food intake. Other than for self-reported depression, the prevalence of poor health outcomes was higher among people whose jobs in 2019 were characterised by high demand and low control. Worsening of SRH was particularly prevalent among recent retirees and those who were furloughed, while people with any other change in employment (including job loss) reported the highest prevalence of anxiety and depression.

Table 3-8: Descriptive analyses of health outcomes assessed in the second survey (N=1,976 completed the survey in October 2021)

	Derived, N (%)	Self-reported, N (%)			
	Worsening of SRH*	Worsening of mental health*	Worsening of physical health*	Anxiety †	Depression †
Overall	683 (35.3)	327 (17.2)	525 (27.1)	425 (22.1)	230 (11.9)
Age					
Below 65	314 (36.2)	158 (18.3)	234 (26.7)	204 (23.5)	119 (13.7)
65 and above	369 (34.6)	169 (16.3)	291 (27.3)	221 (20.9)	111 (10.5)
Sex					
Men	279 (33.1)	95 (11.4)	205 (24.3)	117 (14.0)	69 (8.2)
Women	404 (37.0)	232 (21.8)	320 (29.2)	308 (28.2)	161 (14.8)
Financial position (2019)					
Comfortably	327 (31.4)	134 (13.2)	207 (20.0)	151 (14.7)	80 (7.7)
Doing alright	242 (38.4)	119 (19.2)	201 (31.6)	167 (26.5)	84 (13.4)
Just about/struggling	112 (42.8)	74 (28.6)	116 (43.5)	106 (40.2)	66 (25.2)
Self-rated health (2019)					
Good/v good/excellent	559 (34.0)	233 (14.5)	345 (21.0)	310 (18.9)	146 (8.9)

	Derived, N (%)	Self-reported, N (%)			
	Worsening of SRH*	Worsening of mental health*	Worsening of physical health*	Anxiety †	Depression †
Fair/poor	121 (42.5)	92 (32.7)	177 (61.7)	112 (40.0)	82 (29.5)
Number of comorbidities (2019)					
0	90 (26.2)	27 (8.1)	31 (9.0)	31 (9.0)	8 (2.3)
1	154 (36.8)	39 (9.6)	60 (14.4)	45 (10.9)	15 (3.6)
2+	439 (37.4)	261 (22.5)	434 (36.7)	349 (29.8)	207 (17.8)
Job type (2019)					
Low demand/high control	78 (35.5)	27 (12.4)	43 (19.4)	31 (14.1)	21 (9.6)
Active	74 (35.8)	26 (12.7)	56 (27.1)	40 (19.5)	23 (11.3)
Passive	87 (34.3)	37 (14.3)	61 (23.3)	50 (19.6)	36 (13.8)
High demand/low control	77 (41.4)	37 (20.1)	64 (34.4)	57 (30.7)	26 (13.8)
Not in work	355 (34.4)	191 (19.2)	283 (27.6)	236 (23.1)	119 (11.7)
Perceived direction of employment change					
Worse off	89 (43.2)	44 (22.0)	63 (30.9)	49 (24.3)	34 (16.6)
Same	457 (34.4)	228 (17.6)	370 (28.1)	287 (22.0)	156 (12.0)
Better off	48 (33.1)	17 (11.7)	26 (18.1)	29 (20.4)	14 (9.8)
Changes in employment					
Already retired	341 (34.2)	178 (18.5)	272 (27.5)	211 (21.4)	105 (10.7)
Working same place	96 (33.5)	43 (14.9)	74 (25.5)	53 (18.4)	39 (13.4)
Working from home	106 (36.2)	47 (16.3)	78 (26.4)	68 (23.0)	34 (11.5)
Furloughed	62 (43.7)	15 (10.6)	32 (22.4)	30 (21.6)	11 (7.8)
Decided to retire	21 (45.7)	9 (20.5)	12 (25.5)	7 (15.6)	4 (8.9)
Any other change	36 (35.3)	19 (18.1)	33 (31.4)	28 (27.5)	18 (17.3)
Changes in alcohol					
Less	125 (31.3)	63 (16.0)	116 (29.2)	91 (23.2)	41 (10.4)
Same	266 (32.6)	96 (12.3)	153 (19.0)	128 (16.0)	55 (6.9)
More	152 (42.9)	86 (24.9)	127 (36.2)	89 (25.5)	57 (16.2)
Changes in physical activity					
Less	336 (39.7)	190 (23.1)	325 (38.7)	213 (25.7)	137 (16.5)
Same	236 (31.3)	92 (12.7)	150 (20.1)	139 (18.8)	61 (8.3)
More	108 (32.7)	42 (13.1)	45 (13.9)	65 (20.0)	27 (8.3)
Changes in food intake					
Less	58 (39.7)	33 (22.8)	48 (33.3)	38 (26.8)	21 (14.7)
Same	459 (32.6)	184 (13.5)	306 (22.0)	267 (19.3)	130 (9.4)
More	165 (43.5)	107 (29.5)	167 (44.5)	113 (30.6)	76 (20.5)
Changes in healthiness of diet					
Less	133 (41.7)	105 (34.5)	145 (46.2)	117 (37.6)	76 (24.6)

	Derived, N (%)	Self-reported, N (%)			
	Worsening of SRH*	Worsening of mental health*	Worsening of physical health*	Anxiety †	Depression †
Same	453 (33.9)	179 (13.8)	318 (24.0)	252 (19.2)	136 (10.3)
More	94 (34.2)	40 (14.9)	58 (21.3)	49 (18.1)	15 (5.5)

* Since the beginning of the pandemic; † at the time of the second survey (October 2021).

Table 3-9: Association between changes in employment (assessed in the first survey) and health outcomes (assessed in the second survey) in the overall sample

	Worsening of SRH	Worsening of mental health	Worsening of physical health	Anxiety	Depression
			RR (95%CI)		
No change: Working same place	Ref	Ref	Ref	Ref	Ref
Working from home					
Sex-age adjusted	1.07 (0.86,1.34)	1.06 (0.73,1.55)	1.02 (0.78,1.34)	1.20 (0.88,1.64)	0.82 (0.54,1.26)
Model 1 †	1.12 (0.89,1.40)	1.20 (0.81,1.77)	1.08 (0.83,1.42)	**1.36 (0.99,1.86)**	0.86 (0.56,1.34)
Furloughed					
Sex-age adjusted	**1.31 (1.02,1.68)**	0.73 (0.42,1.27)	0.88 (0.61,1.27)	1.18 (0.79,1.76)	0.60 (0.32,1.14)
Model 1 †	**1.33 (1.03,1.71)**	0.72 (0.40,1.29)	0.79 (0.55,1.15)	1.05 (0.69,1.59)	0.61 (0.32,1.14)
Decided to retire					
Sex-age adjusted	**1.41 (0.99,2.00)**	1.53 (0.80,2.91)	1.04 (0.61,1.77)	0.91 (0.45,1.83)	0.75 (0.29,1.96)
Model 1 †	**1.46 (1.03,2.08)**	1.67 (0.87,3.19)	1.08 (0.69,1.70)	1.01 (0.51,1.99)	0.80 (0.32,2.04)
Any other change					
Sex-age adjusted	1.05 (0.77,1.43)	1.20 (0.73,1.96)	1.21 (0.85,1.71)	1.40 (0.93,2.10)	1.25 (0.74,2.10)

	Worsening of SRH	Worsening of mental health	Worsening of physical health	Anxiety	Depression
			RR (95%CI)		
Model 1 †	1.05 (0.77,1.43)	1.21 (0.73,1.98)	1.15 (0.82,1.63)	1.37 (0.91,2.07)	1.25 (0.76,2.04)

† Adjusted for age, sex, pre-pandemic SRH, pre-pandemic comorbidities, pre-pandemic financial position, pre-pandemic job type. Bold indicates significance at 0.05 level.

Table 3-9 shows relationships between changes in employment after lockdown (assessed in March 2020) and health outcomes assessed at the second survey. In contrast with what was found when looking at outcomes in the shorter term, where being furloughed was not associated with any health outcome, people who were furloughed were at higher risk of reporting a worsening of SRH since the beginning of lockdown (fully adjusted model RR: 1.33 95%CI 1.03 to 1.71). Similarly to what was found in the shorter term, those who decided to retire were at slightly increased risk of worsening of SRH. Those working from home in lockdown were at increased risk of reporting anxiety in October 2021, while this association was not seen when looking at anxiety in February 2021.

3.3.10 Associations of changes in employment with health outcomes according to pre-pandemic financial position and perceptions of changes in employment (RQ3)

To explore whether the associations reported in Table 3-7 differed according to pre-pandemic financial position or according to perceptions of changes in employment, I added multiplicative interactions to the model. None of the interactions was statistically significant but stratified analyses for some of the outcomes are illustrated below.

Figure 3-15: Percent of participants by changes in employment and pre-pandemic financial position

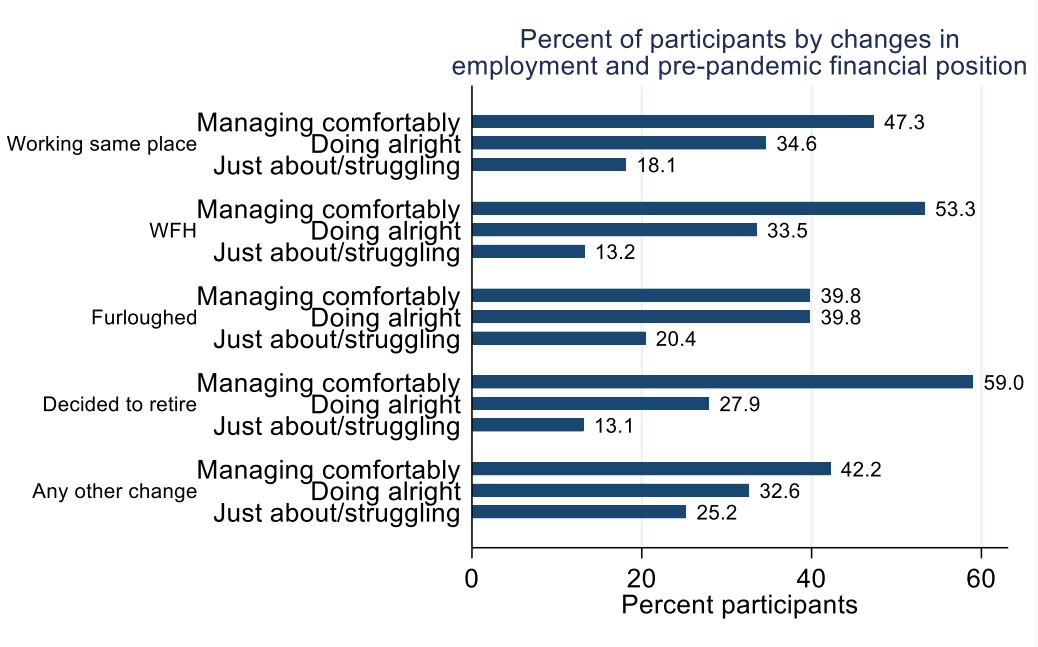
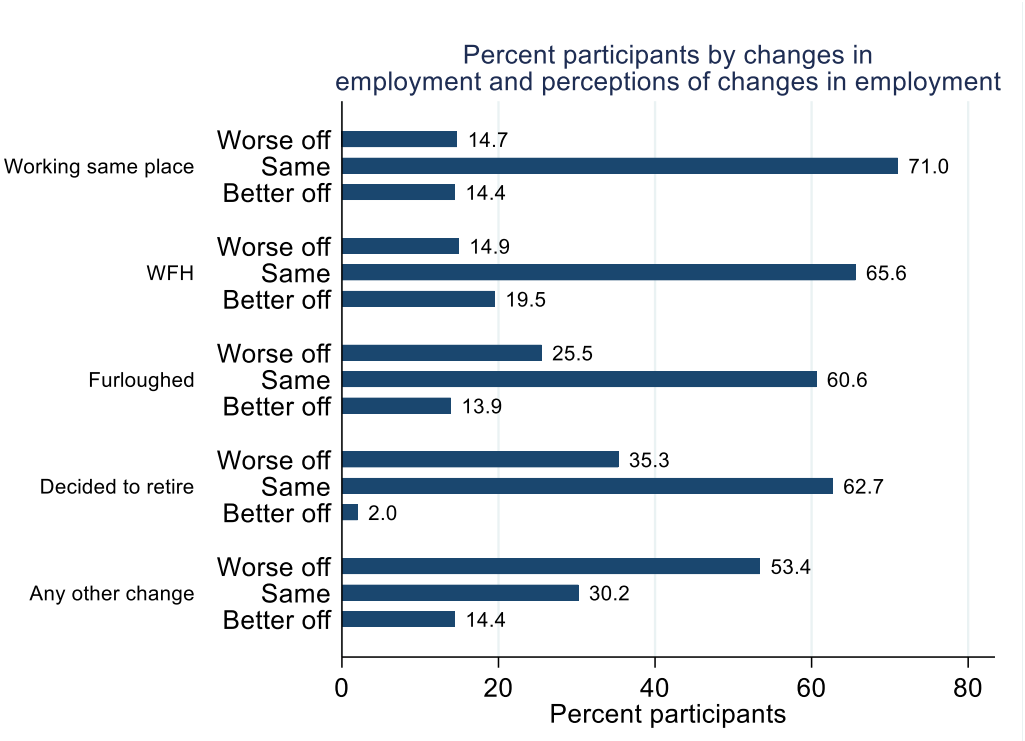


Figure 3-16: Percent of participants by changes in employment and perceptions of changes in employment



As shown in Figure 3-15 and Figure 3-16, some categories are too small to be able to draw meaningful conclusions when performing stratified analyses. Most participants perceived that, irrespective of what actually happened to their employment, their employment position was no better or worse than before the pandemic. One exception being participants who experienced any other change in their employment. More than half of them perceived that their employment had deteriorated since the onset of the pandemic.

Table 3-10: Association between changes in employment and worsening of SRH, by pre-pandemic financial position.

	Worsening of SRH (vs not) RR (95%CI) ǂ		
	Financial position in 2019		
Changes in employment	**Managing comfortably**	**Doing alright**	**Just about/struggling financially**
No change: Working same place	Ref	Ref	Ref
Working from home	1.40 (0.82,2.41)	**2.04 (1.18,3.53)**	1.54 (0.78,3.05)
Furloughed	1.63 (0.82,3.23)	0.87 (0.40,1.91)	0.92 (0.38,2.23)

	Worsening of SRH (vs not) RR (95%CI) ǂ		
	Financial position in 2019		
Changes in employment	**Managing comfortably**	**Doing alright**	**Just about/struggling financially**
Decided to retire	2.03 (0.97,4.26)	2.11 (0.87,5.12)	1.19 (0.30,4.68)
Any other change	0.96 (0.40,2.26)	1.74 (0.87,3.48)	1.45 (0.69,3.05)

ǂ Model 1: adjustment for age, sex, pre-pandemic SRH, pre-pandemic comorbidities and pre-pandemic job type.

Stratified analyses showed that the negative effect of home working on SRH was similar across categories of pre-pandemic financial position. On the other hand, the negative effect of deciding to retire on SRH was stronger for participants with a better financial position pre-pandemic compared with those struggling financially pre-pandemic.

Table 3-11: Association between changes in employment and worsening of SRH, by perception of changes in employment.

	Worsening of SRH (vs not) RR (95%CI) ǂ		
	Perception of changes in employment		
Changes in employment	**Worse off**	**Same**	**Better off**
No change: Working same place	Ref	Ref	Ref
Working from home	1.56 (0.75,3.26)	**1.83 (1.21,2.77)**	1.09 (0.45,2.61)
Furloughed	1.37 (0.61,3.06)	1.04 (0.57,1.90)	0.60 (0.17,2.13)
Decided to retire	**2.36 (1.08,5.15)**	0.85 (0.27,2.73)	-
Any other change	1.01 (0.46,2.19)	1.67 (0.92,3.03)	0.83 (0.26,2.71)

ǂ Model 1: adjustment for age, sex, pre-pandemic SRH, pre-pandemic comorbidities and pre-pandemic job type.

The negative effect of working from home on worsening SRH was only significant amongst participants who perceived their employment position as no better or worse (Table 3-11), whereas there is a strong indication that deciding to retire was associated with poorer SRH only amongst people who perceived themselves worse off employment-wise overall. This

association was not significant amongst retirees who perceived their employment position to be neither better nor worse.

Table 3-12: Association between changes in employment and mental health worsening, by pre-pandemic financial position

	Worsening of mental health (vs not) RR (95%CI) †		
	Financial position in 2019		
Changes in employment	**Managing comfortably**	**Doing alright**	**Just about/struggling financially**
No change: Working same place	Ref	Ref	Ref
Working from home	1.28 (0.74,2.24)	1.07 (0.69,1.66)	1.30 (0.79,2.14)
Furloughed	**2.00 (1.06,3.77)**	0.66 (0.37,1.19)	0.75 (0.36,1.56)
Decided to retire	**3.23 (1.72,6.05)**	1.68 (0.81,3.48)	0.51 (0.07,3.54)
Any other change	1.72 (0.89,3.31)	0.97 (0.52,1.81)	0.89 (0.44,1.80)

† Model 1: adjustment for age, sex, pre-pandemic SRH, pre-pandemic comorbidities and pre-pandemic job type.

As reported for worsening of SRH, the effect of deciding to retire on worsening of mental health was more pronounced in people who were financially comfortable before lockdown (Table 3-12). Additionally, among people who were financially comfortable in 2019, those furloughed were twice as likely to report a worsening in mental health compared to those whose job remained unchanged. In the overall analysis, without stratification by financial circumstances, having been furloughed was not significantly associated with worsening of mental health. When looking at worsening of mental health, in the analyses stratified by perception of change in employment, none of the association was found to be statistically significant (Table 3-13).

Table 3-13: Association between changes in employment and mental health worsening, by perception of changes in employment.

	Worsening of mental health (vs not) RR (95%CI) †		
	Perception of change in employment		
Changes in employment	**Worse off**	**Same**	**Better off**
No change: Working same place	Ref	Ref	Ref
Working from home	0.95 (0.57,1.59)	1.34 (0.93,1.94)	1.04 (0.40,2.70)
Furloughed	1.11 (0.66,1.86)	1.02 (0.61,1.73)	0.29 (0.04,2.59)
Decided to retire	1.63 (0.95,2.79)	1.45 (0.70,3.02)	-
Any other change	0.67 (0.39,1.15)	1.65 (0.94,2.90)	0.50 (0.07,3.77)

† Model 1: adjustment for age, sex, pre-pandemic SRH, pre-pandemic comorbidities and pre-pandemic job type.

Table 3-14: Association between changes in employment and depression, by pre-pandemic financial position

	Depression (vs not) RR (95%CI) †		
	Financial position in 2019		
Changes in employment	**Managing comfortably**	**Doing alright**	**Just about/struggling financially**
No change: Working same place	Ref	Ref	Ref
Working from home	1.01 (0.52,1.96)	1.94 (0.95,3.94)	1.44 (0.67,3.10)
Furloughed	0.54 (0.17,1.73)	1.55 (0.70,3.42)	0.82 (0.28,2.45)
Decided to retire	1.46 (0.55,3.89)	**3.13 (1.17,8.36)**	0.63 (0.10,4.07)
Any other change	**2.05 (1.03,4.11)**	1.64 (0.63,4.27)	1.38 (0.61,3.14)

† Model 1: adjustment for age, sex, pre-pandemic SRH, pre-pandemic comorbidities and pre-pandemic job type.

The overall analysis Table 3-7 highlighted a doubling of risk of depression for recent retirees. Such increased risk is particularly high among recent retirees who were better off financially

in 2019, especially among those who perceived to be doing alright financially then (Table 3-14). Finally, the increased risk of depression for recent retirees is close to the overall figure of doubling of risk only among those who perceived to be worse off employment wise. Only 2% of the sample of retirees perceived to be better off employment wise, therefore the model for this group did not converge. Participants working from home in lockdown and who perceived their employment situation to have remained the same, were more than twice as likely to experience depression in October 2021, whereas RRs for the other categories of perceived employment change were below 1 and not significant (Table 3-15). Such increased risk of depression was not observed in the main analysis.

Table 3-15: Association between changes in employment and depression, by perception of changes in employment.

	Depression (vs not) RR (95%CI) ǂ		
	Perception of employment change		
Changes in employment	**Worse off**	Same	**Better off**
No change: Working same place	Ref	Ref	Ref
Working from home	0.61 (0.26,1.45)	**2.14 (1.25,3.66)**	0.73 (0.22,2.46)
Furloughed	0.76 (0.32,1.79)	1.08 (0.50,2.32)	1.52 (0.35,6.57)
Decided to retire	1.87 (0.91,3.84)	0.47 (0.06,3.51)	-
Any other change	0.86 (0.42,1.75)	2.13 (0.99,4.61)	2.01 (0.64,6.29)

ǂ Model 1: adjustment for age, sex, pre-pandemic SRH, pre-pandemic comorbidities and pre-pandemic job type.

3.4 Sensitivity analysis

3.4.1 Analyses restricted to workers pre-pandemic

Analyses in previous sections included participants who self-defined as “retired with some work” in February 2020. In this section I report results of a sensitivity analysis restricted to 962 participants in paid work in February 2020 (either as employed or self-employed) and who did not consider themselves in any way retired. I hypothesised that the associations between changes in employment and health reported in previous sections might be stronger

amongst people more fully engaged in paid work just before lockdown as one could expect their lives to have been changed more by any change in employment.

All tables are presented in Appendix L. As anticipated, the associations reported in the whole sample were replicated in the reduced sample of workers and effect sizes were slightly stronger.

3.4.2 Analyses conducted on a common sample of individuals

Appendix K shows results of a sensitivity analysis exploring the associations between changes in employment and health outcomes in the short-term, using a common sample across different adjustments. The table shows that findings were comparable to those from models based on the maximum sample size. Therefore, the exclusion of certain participants in the main analysis (due to missing data on some confounders) is unlikely to have biased estimates. This is reassuring as its suggests that the main conclusions were not driven by differences between samples. Appendix K additionally includes a sensitivity analysis that explores the association with longer-term outcomes on a reduced sample of participants who had non-missing data on all covariates included in the final model. As for the short-term outcomes, estimates did not differ from those reported in Table 3-9.

3.5 Discussion

Data collected in 2021 as part of the COVID-19 study revealed that most HEAF participants experienced a change in their employment position and circumstances during the COVID-19 pandemic. Of participants in paid employment in February 2020, only 35% remained in work as before, while 35% relocated to home working, 15% were furloughed, 5% decided to retire, and 10% experienced other types of change (e.g. job loss).

Changes in their health were also sizeable. A total of 27% perceived a worsening in their physical health, 20% in their mental health, and 17% in their SRH. A total of 24% reported anxiety during the first lockdown and 12% depression, half of which had not been reported at the time of the last survey before the pandemic. This pattern persisted when participants were re-contacted in October 2021, although the proportion who perceived a worsening in SRH since March 2020 doubled, reaching 35%. Only a minority of people (27%) who perceived a worsening in SRH between March 2020 and October 2021 reported a worsening up until February 2021, indicating that most of them were new cases developed since. Aspects of lifestyle also changed during the pandemic, especially physical activity, and during the first lockdown, only 38% of the sample reported engaging with the same level of

physical activity as before the pandemic. The observed prevalence of changes in physical activity among HEAF participants aligns with what was reported in ELSA, a UK longitudinal cohort of a similar age group (182).

The data revealed that changes in finances since the onset of the pandemic were not equally distributed according to categories of changes in employment and according to pre-pandemic financial position. People working at home in lockdown reported on average an improvement in their finances, while all other groups reported a financial decline. Moreover, those who were already in a poor financial position prior to the pandemic were more likely to report a worsening of their financial situation.

I observed notable associations between changes in employment and some health outcomes, with varied levels of significance and magnitude of associations across the two surveys. Effects were slightly stronger when analyses were restricted to participants in paid employment pre-pandemic, as hypothesised. The group who reported the most notable subjective differences in health were those who decided to retire. When compared with participants whose job did not change, these individuals were more likely to report a worsening in SRH and mental health, and to report depression in February 2021. The first two associations were apparent also when health outcomes were re-assessed in October 2021, although associations with depression disappeared. Reverse causation is of course a possibility, so that some people selectively retired because of ill health and poor health was not a consequence of having retired.

The health worsening among retirees raises the question as to whether retirement was a choice for them, or they were forced into retirement by pandemic-related circumstances. There is no consensus whether the transition to retirement is beneficial or not to people's health, with inconsistencies possibly due to a wide variation in study designs, country-specific policies in respect to retirement, health outcomes analysed, and circumstances in which people retire. A systematic review of 22 longitudinal studies concluded that further work was needed to address the health effects of retirement, differentiating between voluntary and involuntary retirement (183). Only a few studies to date have collected detailed information on the type of retirement. For example, a study by van Solinge et al (184) found that involuntary retirement negatively impacted perceived health, while this was not the case for people who retired voluntarily. In a cohort of British civil servants, the authors found that voluntary early retirement was associated with an improvement in mental health (compared with people who remained working) although the benefit of retirement attenuated over time. In contrast, participants taking ill-health retirement did not show any change in their mental

health after retirement (185). A better categorisation in our survey would have been one that differentiated between choosing to retire and being forced into retirement.

Comparing the retirement rate in our sample with that in the UK overall is not straightforward. This is because our sample of retirees was evenly split between men and women, with ages ranging from 58 to 73 years and retirement rate at the national level varies significantly based on these characteristics. Economic activity in the UK over the years leading up to the pandemic shows large differences between men and women and between age groups. For example, among women aged 55-59, since 1989 approximately 7 to 12% retired annually, while in the age group 60-64, approximately a quarter of women retired annually pre-pandemic (20). It does appear that the retirement rate which we observed in our cohort was no higher than what would have been expected if the pandemic had not occurred. Although the online survey had limitations in the information that it provided about retirees' personal circumstances, I carried out more in-depth qualitative analyses on the recent retirees to understand the reasons behind the timing of their decision to retire. These findings are presented in Chapter 4.

Participants working from home perceived a worsening of SRH (in the short-term), and reported greater anxiety (only in October 2021), but home working was not associated with increased risk of other poor health outcomes, such as depression, or perceived worsening of mental or physical health. It is important to bear in mind that in these analyses, I focused on poor health outcomes only, and I have not explored the association of working from home or other changes in employment with improvements in health outcomes. Therefore, I can only talk about lack of negative effect and not a beneficial effect of home working. This could be explored in future research.

Other studies have evaluated the effect of home working on several components of mental health with conflicting findings. Analyses of the SHARE survey, which includes individuals over the age of 50 across Europe, found that working from home during the first lockdown was associated with an improvement in mental health amongst men and individuals not co-residing with children. They found no change in mental health for women working remotely while they found a decline in mental health for responders with co-residing children (186). A systematic review of 14 studies on the effect of telework on health concluded that the available evidence was from studies of poor quality, and that available studies investigated only a limited number of health outcomes. The authors identified an important knowledge gap and could not draw meaningful conclusions on their research question (99). In line with our findings, a study conducted on seven UK cohorts found inconclusive evidence of an association between home working and wellbeing. The most convincing evidence was of an

inverse significant association between home working and psychological distress experienced during the second lockdown (November 2020-February 2021). The strongest effects were among people aged 30-49 years (187), while workers aged 50+ were less affected. Another study conducted in the early phases of the pandemic in the UK, highlighted the importance of considering the frequency of home working, and found a negative effect on mental well-being among individuals “always” working from home. The authors detected no association among occasional home workers (188). Recently published data from SHARE showed that always working from home or working in hybrid mode due to the pandemic were both associated with poorer subjective mental health in comparison with workers who remained in their workplace. Estimates were stronger for women than men (189). The systematic review that I conducted as part of this thesis (Chapter 2), was also inconclusive as to whether working from home was beneficial or not to anxiety. Most of the featured studies were not solely based on older workers but included younger individuals, too.

Our study showed a relationship between home working and anxiety in the longer-term. The hypothesis that sustained home working might come at a cost of impaired mental health could explain these findings. A systematic review of 27 studies exploring the relationship between home working during COVID-19 and mental health corroborates this hypothesis (190). The authors of the review emphasised the complexity of the relationship, with frequency and duration of home working acting as important effect modifiers. Working from home for prolonged periods could increase feelings of isolation and loneliness which are associated with poorer mental health (191). Therefore, managers should ensure that employees remain connected with each other if working remotely for prolonged periods to decrease the potential for poor mental health outcomes. More granular information on working hours and on the duration and frequency of home working would have allowed for a more in-depth analysis.

It is important to remember that data analysed in this thesis focus on the changes in employment that occurred in March 2020 when many people were forced to shift to home working rapidly, without having the right infrastructure, and with many other worries about a new virus. Analyses of the Understanding Society Covid-19 study show that the deterioration in mental health during the first phase of the pandemic was sharp among those who were new to home working, and it was more pronounced compared with that in participants who never worked from home. However, as months went by, the difference between the groups attenuated, suggesting that working from home is not damaging to mental health once people have made the necessary adjustments (192). We conducted our second survey in October 2021, when 57% of HEAF participants were still working at least partly from home. Home working and virtual meetings, however, did not cease as the pandemic went on (193).

In Spring 2022, with all restrictions lifted, around one in seven workers in the UK worked from home exclusively, while nearly a quarter worked both in and out of home. With hybrid work (an arrangement where employees spilt their time between working in the office and at home) now a popular contractual arrangement in Britain (194, 195), people have adjusted to this way of working and several gains are widely recognised. These include improved productivity, acquisition of new digital skills, reduced commuting and travel costs and improved access to employment, among others (195). At the same time some less desirable effects are recognised such as increased sedentary behaviour, lack of personal interaction and fatigue (195). There are large differences between the circumstances around home working pre-pandemic and what happened at the height of the pandemic which make the two difficult to compare. In the pre-pandemic period home working was often by mutual agreement between the employee and their manager with several benefits deriving from it, such as better family life, higher productivity, and better concentration (89). However, when the COVID-19 pandemic struck, the element of choice was removed as home working was mandated, irrespective of personal preference. In the post-pandemic era, it seems essential to take into consideration individual preferences regarding their choice of work modality. When asked about it, most HEAF participants expressed a preference for a hybrid mode, 24% preferred to shift completely to working from home while only 16% wanted to return fully to working on site. A survey from the Institute of Employment Studies similarly found that most workers, especially over the age of 55, favoured a hybrid pattern (195), while as many as 96% participants in the Understanding Society Covid-19 study reported a preference for working from home at least sometimes (195).

There is therefore no doubt that preferences of employees have changed enormously over the past few years and one key challenge for the near future appears to be a need for managers/employers to recognise employees' preferences. Ensuring as much flexibility as possible in work location and schedule that is in line with the employee's preference seems essential to warrant a good work-retention and good employee performance. In some circumstances it may be advisable to manage employees' expectations regarding work arrangements. At the same time it is crucial for employers to maintain control of work outputs and performances to make sure that working from home is still effective (195). Many employers see a permanent shift to hybrid working as favourable. When responding to the Business Insights and Conditions Survey (BICS) in 2021, employers mentioned their staff improved wellbeing as the main reason for it, followed by reduced overhead and increased productivity (196).

Other than for deciding to retire and shifting to home working, other categories of change in employment that I investigated did not show strong effects on health outcomes. I only found

a significantly increased risk of worsening of SRH between the pre-pandemic period and October 2021 for those who were furloughed. Estimates were robust to adjustment for several pre-pandemic and pandemic related risk factors.

I did not find evidence to support the hypothesis that the effect of changes in employment on health would differ according to pre-pandemic financial position or perception of changes in employment. However, there was limited variation in these potential effect modifiers within categories of change in employment. For instance, those who decided to retire were mostly financially comfortable pre-pandemic and almost none of them perceived that their employment changed for the better. The lack of heterogeneity limited power to discriminate possible differential effects.

3.6 Limitations and Strengths

Some limitations need to be acknowledged when discussing these findings. The HEAF COVID-19 is a sub-sample of the larger HEAF cohort, which had an initial response rate that was relatively low (21%). However, we have demonstrated that the HEAF cohort was sufficiently representative of the general population aged 50-64 in terms of employment status, and marital status, although slightly older and better educated (127). In addition to this, the sample who participated to the HEAF COVID-19 study were generally in better health and with better financial circumstances than the remainder of the cohort. A possible explanation is that for the first time since the study was incepted, we asked participants to complete an online survey, which would have tended to exclude cohort members who were not technologically literate or did not have access to the internet. Caution should therefore be exercised when attempting to generalise findings to the wider population of England. Since we anticipated that the associations between changes in employment and health might be stronger among people with lower financial position, the selection bias that characterises this cohort could have resulted in an under-estimation of the true association between these variables.

Lack of statistical significance for some associations may have reflected lack of power. For instance, we were unable to analyse the category “job loss” on its own because of small numbers and this may have prevented us from detecting some associations, which were apparent in other studies. Although we collected data on whether the home working experience was full or partial, numbers were too small to be able to analyse these categories separately. Knowledge of working hours, duration and frequency of home working would have been beneficial to be able to explore outcomes of different patterns of home working. On the other hand, the definition of home working used in our study was one that captured a transition to home working. This differentiates our study from others which only assessed whether

participants were working remotely during lockdown. Additionally, the main exposure of this analysis “changes in employment” referred to what happened in the initial phase of the pandemic. For example, job losses that may have occurred after the furlough scheme ended are not captured in these data. Notably, our sample had a furlough rate of 15%, lower than the 25% reported for UK workers aged 50 and over (16).

Questions about perception of change in healthiness of diet and change in the amount of food eaten are not perfect. Other studies were better placed to evaluate these changes as they collected information about specific food items and/or snacking habits. However, the focus of our study was not solely on health behaviours and therefore we were limited in the number of variables assessed within this domain.

Some limitations in the design of the questionnaire arose when I came to analyse those data. For instance, up to date information on participants’ marital status would have been beneficial as this is something that is potentially fast changing in a sample of this age. In the Qualtrics environment I could have added prompts to participants to lower the chance of missing data. Indeed, I was unable to use CES-D scores to measure depressive symptoms collected in the first survey because of the high level of missingness of this variable. In the analyses of health outcomes, comparisons were made between participants who perceived their health had declined and those for whom it did not, and I did not distinguish between participants who perceived their health had remained stable and those who perceived an improvement. This may have diluted some effects. A further analysis that looked at risk factors for positive as well as poor health outcomes could be performed. This would complement the picture provided by the current work. Additionally, all exposures and outcomes were self-reported perception of a change rather than an objectively assessed outcome.

The possibility for reverse causation needs to be acknowledged. In the first part of the analyses, exposure and outcomes were assessed simultaneously, meaning that it’s possible some people changed their employment status due to pre-existing health issues rather than a change in employment being the cause of poor health outcomes. This however is more likely to be an issue for recent retirees as working from home was imposed by the Government and not a choice of the individual.

Since people experienced so many concurrent changes in their lives, it was difficult to disentangle whether a change in employment was what caused observed changes in health. However, we have no reason to believe that other concurrent changes may confound the association of interest. For example, financial worries are likely a consequence of job loss or having retired, while worries about infection would apply equally to those experiencing a job

change and those who did not - and, if anything, might affect the reference group more strongly. Finally, mandatory isolation could be considered as a stressor affecting people in all exposure categories.

An important strength of the study was the availability of pre-pandemic data as well as data collected since the pandemic. I was able to account for multiple factors in the statistical models thereby eliminating them as potential confounders.

3.6.1 Statistical limitations

Among the methodological limitations to note is that risk estimates were from complete case analyses. The assumption of MCAR does not hold in these data, while I was unable to differentiate between MAR and MNAR by looking at variable distributions. Multiple imputation would have ensured unbiased estimates although a level of missingness below 5% for most of the variables included in the analyses is not of concern (178, 179). Further work could replicate the analyses of this thesis by applying multiple imputations to explore whether derived estimates are comparable to those from the complete case analyses. The identification of confounders was performed rigorously with the aid of a DAG, a method that, while not data-driven, relies on the researcher's perception of the direction of associations. I recognise that some unmeasured factors could have been important. For example, although I included participants' perceptions of how well they were managing financially, I lacked an objective measure of financial strain such as household income.

3.7 Conclusions

Analyses of the HEAF COVID-19 data indicate that middle-aged people in the UK were considerably affected by the pandemic, with many experiencing changes in employment circumstances, lifestyle, financial position, and health. The study suggests that, after accounting for several pre-pandemic characteristics, certain changes in employment precipitated by the pandemic (especially deciding to retire and shifting to home working) were negatively associated with general and mental health. Changes in employment did not seem to be associated with a worsening in physical health.

Some of the negative consequences of working from home during the peak of the pandemic may be explained by the shift to home working being sudden and forced. Employees and companies were unprepared for it, lacking the right infrastructure and communication systems to ensure remote working would be successful. It's also to be expected that the transition to home working during the pandemic has affected older workers differently

compared with younger individuals. Although a transition to home working offered protection towards contracting the virus, some of the drawbacks that have been highlighted for older individuals are a decline in work engagement and the difficulty to suddenly modify established routines and work arrangements. Furthermore, workers had to acquire new skills such as learning to use new technology platform to communicate and perform work, which may have potentially placed older workers in a disadvantaged position (197). Despite the initial challenges, many employees now see hybrid working arrangements as favourable, with recognised benefits such as increased productivity, acquisition of new digital skills, reduced commuting and travel costs and improved access to employment. At the same time home working may introduce problems such as difficulty in maintaining strict boundaries between work and private life, and an increased sense of isolation. With hybrid work becoming more prevalent in the aftermath of the pandemic, it is important to implement practices which ensure it is effective for both employees and employers without compromising health or well-being.

Chapter 4 What influences the timing of middle-aged and older people retirement following the first UK national lockdown?

4.1 Introduction

This chapter has the objective to address aim 3 of the project. The aim was to explore the reasons that influenced retirement timing for people aged 50 and older who retired since the first lockdown in England.

As reported in section 1.5, extensive evidence about socio-demographic factors associated with timing of retirement was available from the pre-pandemic period and factors that have been identified as particularly important are health (25-28, 30), finances capacity (31-33), marital status (34), and gender (27, 36). In addition to those factors, there is evidence of the importance of some work-related factors as determinants of early retirement such as lack of control, conflict in work or low skills discretion (36), high work demands, feeling of isolation or under-appreciation (45).

However, most of this research refers to periods of relative economic stability while evidence about factors that affected the decision to retire since the beginning of the COVID-19 pandemic is scarce. A recent qualitative study run in Slovenia explored motivations and experiences of 9 retirement-age workers who were still in work beyond state pension age at the time of the COVID-19 pandemic and found that they mostly enjoyed the experience of lockdown (198). In February 2022 the ONS conducted 21 semi-structured interviews with people aged 50-70 who had recently left employment (this not only included retirees but also unemployed and economically inactive) and not returned, in order to understand reasons for leaving work (199). The main reasons identified in this report were: being financially able to leave work, feeling ready to enjoy retirement, experiencing work-related stress and increased work pressure, having caring responsibilities, poor health or disability, and old age.

Recent analysis of the UK Labour Force Survey data, published by the Office for National Statistics (200) shows that, contrary to the trend sustained in the previous 10 years, there has been an increase in the proportion of people aged 50 years and over who have become economically inactive (not in a job and not actively looking for a job) since the start of the COVID-19 pandemic, and this has particularly concerned highly skilled individuals. Together

will ill-health, the main reason cited becoming economically inactive was transitioning into retirement, particularly amongst people aged 60 years or more.

Therefore, the COVID-19 pandemic risks hindering efforts made so far by the Government, which are implementing policies to encourage people to remain actively in work to older ages. Among the most recent policies to incentivise highly skilled individuals to remain in work to older ages, the UK Government has increased the amount (Annual Allowance) that individuals can contribute to their pensions (workplace and personal) without paying extra tax. To support those who have left the workforce and would like to return, the Government will also increase the Money Purchase Annual Allowance, meaning that people can pay more money into their pensions and still receive a tax relief. Finally, they are also implementing further investment on the 'midlife MOT' initiative. This is a free review where individuals in their 40s, 50s and 60s can reflect on their jobs, health, and finances together with their employers. They can reflect on how their job could change to accommodate their more recent needs, what they could do to remain fit and healthy for longer, and how they can best prepare financially for the retirement they want (201).

In her report on the link between work and health, Dame Carol Black highlights the importance of good quality work in order for people to retain a good physical and mental health status (55). To plan more effective measures aimed at retaining people in work to older ages it is crucial to investigate whether people with the poorest socio-economic status were disproportionally more likely to have been forced to stop working prematurely during the pandemic compared with people from higher socio-economic position. Such premature and unexpected job losses are likely to contribute to a health decline and may exacerbate existing health inequalities. Furthermore, it is paramount to unpick which reasons have encouraged people to take retirement during this period, to assess whether this trend can be reversed in the post-pandemic era. Equally important is to understand why people have delayed their retirement, despite being close to the typical retirement age.

Informed by the existing evidence I set out the primary aim as follows: to explore what influences the timing of retirement of middle-aged and older people in England who have retired since the COVID -19 pandemic.

As a secondary aim, I sought to examine whether the retirement process differed for men and women. I hypothesised that retirement timing might differ across genders as this has been documented in literature. Additionally, there have been recent changes to the pension system in the UK. State pensions ages were 65 years for men and 60 for women until 2010 and have undergone a gradual increase which depends on the persons' sex and date of birth. By 2046 men and women are expected to reach state pension at the age of 68 (15). It

is therefore possible that this change might have had an impact on the decision process, especially for women, who have been affected by the sharpest increase.

To address these research questions, I conducted a qualitative study, and, in September 2022, I performed semi-structured interviews with participants of the HEAF study.

4.2 Methods

For this phase of the study, we adopted a qualitative design, to provide a deeper understanding of the reasons for retirement in the context of the COVID-19 pandemic.

4.2.1 Participants/Sampling

Participants eligible to take part in the qualitative interviews were nested within the HEAF study and:

- were still in paid employment in February 2020 and had retired at any point between March 2020 (i.e., the beginning of the first national lockdown in England) and October 2021 (the time of the second online COVID-19 survey)
- had responded to both online COVID-19 surveys (carried out in February 2021 and October 2021), as more likely to still be active participants at the time of receiving my invite (in August 2022).

All 118 participants eligible to take part were sent an invitation email with an introduction to the qualitative sub-study, a participant information sheet, and a link to a Qualtrics page where, if they agreed to take part, participants were asked to record their written consent and their mobile number. On receipt of a written consent form and of their telephone number, participants were contacted to arrange for a suitable time for the telephone interview. There was no reward for taking part. The aim was to include participants with a wide range of pre-determined characteristics deemed important in the retirement process (health, finances, marital status, and gender). To ensure that participants with a range of living situations, socioeconomic and health status were included in the study, I purposively selected those who had some underrepresented traits (such as living alone, poorer self-rated health, or lower self-reported financial position) among participants that consented to be interviewed.

4.2.2 Data collection procedure

Data were collected using semi-structured interviews. The interviews were conducted over the telephone by me, as face-to-face interviews were not feasible due to the scattered

location of HEAF participants. Although face-to face interviews have always been the norm in qualitative research, the COVID-19 pandemic has urged for new ways of data collection. Telephone interviews have been shown to be a good alternative to face-to-face ones (14). The interviews followed a topic guide which was developed in advance and was used as a flexible guide to the conversation, with the exact questions and their order being adapted to how the discussion developed with each participant. The interview guide was designed to build trust and rapport with the participants as advised by Barbour (202), and started with some general questions about timing of retirement and characteristics of the job left. These questions informed the order and the type of questions that followed. Then, when the interviewee was usually more at ease, I introduced questions about the main reason/s for retirement, additional factors and whether the COVID-19 pandemic had changed their retirement plans. Then I asked them to comment on their life as a retiree and whether that was different is any way from previously expected. Finally, I ended with a wrap-up question to give them the opportunity to add anything we hadn't covered yet. A series of prompt was available to be used to encourage further dialogue when needed.

The topic guide was piloted with Ilse Bloom (IB) and with another colleague of a similar age to the participants and who had recently herself retired. The interview guide is available in Appendix F.

I conducted all interviews in September 2022, and these were audio-recorded and transcribed as soon as possible afterwards. Field notes were completed after each interview to provide information about participants' tone or my impressions and complemented the interview transcripts during the analysis.

4.2.3 Theoretical assumptions

I adopted a critical realist position, a term developed by Bhaskar (203) which combines a realist approach to ontology (i.e., what is real, the nature of reality) and a subjective approach to epistemology (i.e., our knowledge of reality, all observations are theory-dependent) (204). As reported by Fletcher (204), critical realism does not deny that there is a real social world we can attempt to understand or access through philosophy and social science, but states that some knowledge can be closer to reality than other knowledge.

Within my research question, I anticipated that there would be several factors that may affect someone's decision to retire (marital status, age, health, and financial position among others), but I also accepted that our knowledge of the reality is influenced by the researcher's background and own beliefs.

The researchers who analysed these data (myself and IB) are women in their late thirties, of white ethnicity and working in epidemiological research. Throughout the analysis process we acknowledged that our beliefs about how the pandemic might have affected the retirement process might have influenced the themes identified and the interpretation of the findings. When I conducted the interviews, and in the participant information sheet I previously sent, I introduced myself as a PhD student working on a sub-project on the HEAF study. Participants might have assumed I was younger than them and far from retirement (i.e., the topic of interest), although my age was never explicitly mentioned.

Reflexive thematic analysis was implemented to analyse these data. This consists of identifying and describing patterns within the data to answer the research question.

4.2.4 Data processing and analysis

As soon as possible after the interview, I transcribed the conversation using the free online app “Otranscribe” (205). Ms Sue Curtis helped by transcribing three interviews. Transcription was carried out verbatim. Participant identifying information was removed, only ID was kept, and pseudonyms are used throughout this chapter. I read the transcripts whilst listening to the recorded interviews twice after transcription. Coding started in parallel to data collection to be able to monitor for data saturation.

For this thesis I used an inductive (data-driven) reflexive approach to thematic analysis, informed by the method outlined by Braun and Clarke (206, 207). This method consists of six steps. Step 1: Become familiar with the data, Step 2: Generate initial codes, Step 3: Generate initial themes from coded and collated data, Step 4: Review and refine themes, Step 5: Define and name themes, Step 6: Write-up. Adopting a reflexive approach emphasises the importance of the researcher’s subjectivity and sees this not as a limitation but more as a valuable resource of qualitative analysis (208). The knowledge generated through reflexive thematic analysis is inherently subjective, and the researcher’s perspective is key to ensuring a high quality and meaningful analysis. I used Office Word for managing the analysis process. We performed complete coding, meaning that we coded anything and everything in the data that might be relevant to the research questions. A semantic coding approach was adopted in this work, meaning that we identified codes and interpreted them based on what the participant said as opposed to trying to identify hidden concepts within what the participant said (209). A random selection of interviews was coded independently by both IB and me, and the derived codes were compared between us. Codes were mostly similar and differed mainly on the choice of code names. Any discrepancies between our coding were discussed and resolved. I initially coded a third of the transcripts and derived a

coding frame based upon these; however, it became apparent that experiences of each participant were so diverse that this frame would not be applicable to the remaining two thirds of the sample. Therefore, I coded all remaining transcripts to develop the initial coding frame, organising codes into candidate themes. This coding frame was used to code all interviews and then revised and updated accordingly keeping in mind a reflexive approach. The coding process was iterative, and I moved from having several themes to being able to combine some of them. Candidate themes were discussed with IB, to make sure they remained consistent with the study aim, and this ended up in further groupings. The coding frame was then tested by IB who coded a random selection of interviews. Results of this independent coding were then compared, any discrepancies resolved between us, and the coding frame was updated.

4.2.5 Ethics

The HEAF study has an ongoing ethics approval with the NHS Health Research authority, North West, Liverpool East Research Ethics Committee IRAS PROJECT ID 103258, REC Reference 12/NW/0500. Proposals to conduct this qualitative study were submitted as substantial amendment to the original protocol and favourable ethical opinion was obtained on the 3rd of September 2021 (Amendment number: 2004.A17). Appendix G shows copy the favourable opinion received from the Health Research Authority.

4.3 Results

To better contextualise the study, Appendix A shows a detailed description of the different phases of lockdown in the UK and what they entailed.

Of the 118 participants who were invited to attend the interviews, 52 agreed to be interviewed, corresponding to a response rate of 43%. A total of 26 interviews were carried out, however 2 of these had to be excluded as the participants did not meet the inclusion criteria of having retired since March 2020. 24 interviews were therefore included in the final sample and the main characteristics of the participants are shown in Table 4-1. Those characteristics are the ones reported in the last online survey available before I conducted the interviews (in October 2021). Participants' age at the time of the interview was on average 65 years (SD=3.5 years), and it ranged between 59 to 74 years. Participation was well balanced between men and women, however the sample tended to be in a better financial position and better health compared to the rest of the HEAF cohort. The interviews lasted between 15 and 30 minutes, excluding initial introduction and post interview conversations.

Table 4-1: Characteristics of participants who took part in the interviews (n=24).

Characteristics	N
Age, mean (SD)	65.0 (3.5)
Sex	
Men	10
Women	14
Timing of retirement	
March – October 2020	11
November 2020-September 2021	13
Living arrangements	
Married/living with partner	18
Living alone	6
Financial position	
Comfortable	12
Doing alright	7
Just about managing or struggling	5
Self-rated health	
At least good	21
Fair/poor	3

4.3.1 Themes identified

Six overarching themes were identified as being part of the retirement process. The first four themes summarise non-COVID-19 aspects:

- Work environment and relationship with the workplace.
- Poor health.
- End of working life.
- Financial capacity.

While the remaining two themes summarise the impact of COVID-19 on the workforce:

- Changes to work demands and practices since the pandemic.
- Perception of personal safety at work during the pandemic.

A thematic map showing how themes are related one another is shown in Figure 4-1. Themes are mostly interconnected and tend not to act in isolation. For example, poor health tended to be linked with perception of personal safety at work during the pandemic, while changes to work demand and practices since the pandemic tend to accelerate the retirement process in case the person also was in poor health. The position of “financial capacity” on the map, indicates that in most cases, participants identified this theme as important to their retirement process, although it was not reported as the main reason for their retirement decision. At the end of this section, I present four case studies that illustrate experiences of some participants and help understanding how themes are related one another. In addition to the primary objective to identify what influenced retirement timing, I wanted to explore whether those differed between men and women. However, this analysis revealed that the thinking process around retirement was similar for men and women as only minor differences were detected.

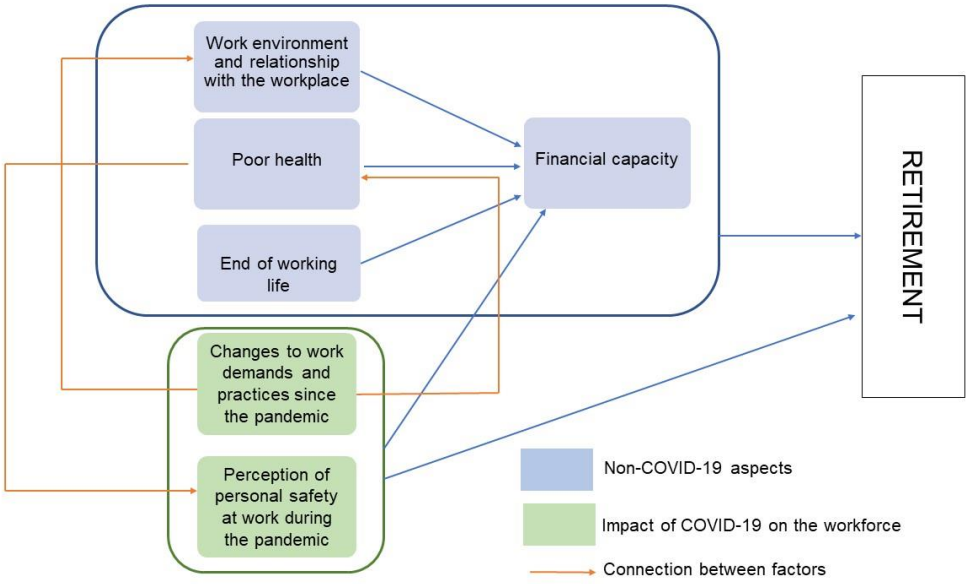


Figure 4-1: Thematic map showing factors that affected the timing of retirement

Theme 1: Work environment and relationship with the workplace

This theme captures positive and negative aspects of the work environment and relationship with colleagues and employers that were already in place before the pandemic and played a role in the timing of retirement. In most cases, the work environment acted in combination with other elements to finally result in retirement. Some participants described work stress and long working hours as important reasons for their decision:

> *'There was a lot of stress with it, trying to keep up with everything. There used to be two people in where I used to work and then they took one person away and I had to do everything by myself… so that yeah started stressing me out and that's when I turned around and said when the pandemic comes that's it bom finito'.* Phil, 67 years

While for others it was lack of staff and high work demand that were among the deciding factors:

> *'…they [manager] were also expecting more out of everyone. I have been there quite a few years, when I first started there … there were 40-50 people working in that store… I spoke to someone a couple of months ago and now they are running the whole store on 15 people... But they would constantly try to get more out of you and if you weren't willing to work when they wanted you, you've got your ordinary hours but if you also weren't willing to work you know, extra here, there, and everywhere, then you weren't one of the team. Attitudes were squeezing you'.* Iris, 61 years

Some reported conflict with a new boss or manager as the tipping point that prompted them to retire, like Karen, who was not prepared to change her way of working, following the arrival of new management:

> *'We had a new manager at work as well who was changing everything, so that didn't go down very well, so I just decided no, enough was enough really in the end'.* Karen, 66 years

On the contrary, other participants praised their employers for accommodating their individual needs and for being flexible. Some reported that a feeling of attachment and appreciation towards the employer meant that they would have felt guilty leaving the job during lockdown, when the employer needed people with long and specific expertise:

> *'I didn't feel I could leave my company at a time like that, with the experience I've got over the years and I've been treated very well by my company, so morally I didn't think it was right at the time'.* Matt, 64 years

Theme 2: Poor health

This theme includes a variety of existing health issues (tooth loss, symptomatic and painful menopause, muscle strain/pain, hip arthritis, shingle eye, knee replacement, anxiety, and depression) that had an impact on participants and contributed to the timing of their retirement. In addition to those, bereavement also features in this theme as it affected the health of some participants and in turn influenced their retirement decision.

As shown in the thematic map in Figure 4-1, poor health often acted together with pandemic-associated changes in work, increasing participants' concerns about their risk of catching the virus in the workplace and therefore leading to the decision to retire. It needs to be mentioned that there were several occasions where participants reported to be in good health and that health had no role whatsoever in their decision to retire.

Karen retired from her job as palliative care nurse for multiple reasons all related to her health. She suffered the loss of her husband and mum in a limited period which caused her to retire earlier than planned. In addition, she also started suffering with bad hip arthritis which made it impossible to carry on with the job which required lots of lifting of heavy equipment.

> *' … and when I went back I knew I really couldn't cope with looking after palliative care patients so soon after losing husband and my mum but I'd also developed really bad arthritis in my hip and couldn't cope with in and out...in district nursing you are in and*

out of a car all the time, and often at night we would drive over 200 miles a night, we've got heavy equipment to carry in and out, we do low level working and it was just that coupled with you know, losing my husband and mum and my hip...I decided that I would need to retire, I just couldn't cope with it any longer'. Karen, 66 years

Some participants retired because their job was no longer compatible with existing health issues.

'I retired because I couldn't do the job. Well, I was let go. They went through a process so that I couldn't do the job. I couldn't do the job because of my health and so I was dismissed, because I couldn't do the job'. Iris, 61 years

Theme 3: End of working life.

This theme captures factors that are related to the desire to retire once someone has worked for many years. Participants reporting this as the reason for retirement, mentioned the desire to spend time with their families or engage with hobbies and social activities after a long working life. In most cases their decision pre-dated the pandemic and was not linked to the pandemic and lockdowns, although several participants reckoned that lockdown probably accelerated the process.

The need for relaxing as a main reason for retirement was a common feature in our sample.

'I was coming up to retiring as I had been at work ever since I was 16...not really having time off at all so from job to job to ...out and so never really had gap year or anything...so forty odd years, well almost fifty years working so I thought that's about time I give myself a rest and go out enjoying my motorcycle and that'. Phil, age 67

While others wanted to spend more time with their family.

'Yes, family as well, you know, my husband was retired and I've got grandchildren who I do look after …. So … my husband being retired as well it was nice then, you know, spend a little bit of time together'. Julia, age 67

Theme 4: Financial capacity.

Although their financial status was never reported as the main reason for retiring, participants took the decision to retire only when their finances allowed it. Some participants reported having carefully planned financially for their retirement for years and having a healthy pension package.

> *'We planned for them, so we had been planning for the ten years so essentially I had a mixture of pensions...so I had… workplace pensions which were a final salary scheme with 3 companies...so it was sort of all planned out'.* Tony, 66 years

One participant obtained a very healthy redundancy package which drove him to take retirement instead of trying to find a new highly paid job, within the broader climate of uncertainty in the job market created by the pandemic.

> *'So, that meant that I then had a pay-out which kept me, sort of gave me another six months money, even though I had finished work and I decided that at the age then of 62, 63 sorry, that I didn't feel it was worthwhile going back into the employment market, one because of the stress of the previous sort of twelve months with covid and the market just wasn't there for people to be taking higher paid jobs'.* Alex, 64 years

Others decided to stop working once they no longer needed to financially support the children:

> *'… But once that [financially supporting the children] was virtually sorted, the need for work actually came to an end so hence you know, the additional reason for actually retiring'.* Leo, 66 years

For a woman who left her job as district nurse, owning her property outright put her in the position of being able to afford retirement.

> *'Because we didn't have a mortgage or anything… so my son still lives at home with me, so he was able to help me out as well, you know, he contributes to the family finances, but we've got no loans or mortgages so it's really just the day to day living'.* Karen, 65 years

Theme 5: Changes to work demands and practices since the pandemic.

This theme reflects what participants described about changes to work that occurred since lockdown, ranging from changes to work practices, responsibilities, and day-to-day job, to changes to working patterns (including shifting to home working), to workload or work demand.

Some participants reported that working from home had its challenges and resulted in increased loneliness, frustration and had a negative impact on their physical or mental health. Participants like Linda felt extremely isolated while working from home and that impacted their mental and physical health. She felt she had no choice but to retire.

‘ the kind of person I am, I like to be out and about, I am a very busy, active person and, you know, and I like to be in company, I don't like being on my own … my husband was still working from his office… he had to go into work, so I was basically in the house on my own… and I was always used to go to the gym, you know, I was very active and I put weight on, about 2 stone, and I am not a one for going for a walk on my own because I like company, so I didn't feel like the urge to get out and go for a walk, so I wasn't really getting any fresh air. So really it was a bit of a downwards period if I am honest. Obviously, a bit with my mental health. I mean I'm alright now, but I did find it really hard, luckily the house I live in, you can walk right around the staircase into the four different rooms, so I used to just pace around it (laughs), you know, imagine an animal in a cage, trapped, that's what it felt like’. Linda, 64 years

Some participants experienced IT issues when working from home.

‘Yes, I had to work from home … I had a lot of IT problems, when I was working from home, I wasn't getting the assistance … then obviously it was quite isolating working at home…’. Lucy, 59 years

While others described the frustration caused by a lack of clear communication with colleagues and managers while working remotely:

‘yeah I mean we had, well it was mostly phone calls with close colleagues but we had the usual zoom meetings, which didn't work very well because there was no such protocol in place so it could be (laughs) really frustrating, because of people taking phone calls in the middle of it, you know, there was no proper chairing of it so I found that yeah, a couple of times the connection was breaking (laughs)’. Charlotte, 65 years

On the contrary, others expressed their appreciation of home working which enabled them to keep working. They emphasised had they been required to continue working from the office and commuting, they would have retired earlier than they eventually did. They spoke of the good qualities of home working such as its flexibility:

‘…I enjoyed working at home because you didn’t have to face other people and you were out of the office politics in that case, you know, when you were working at home, so it suited me better really’.

‘And I liked not having to get up and get dressed first thing in the morning, you know. I used to start very early and then I’d do a couple of hours work and then I’d sign off for half an hour and get dressed and have some breakfast and things like that, yes I found it more flexible’. Sue, 67 years.

Some spoke of the lack of commute and not having to face office politics as characteristics that suited them better, enabling them to keep working. Another participant reported on the importance of having a good workstation set up at home and that had enabled them to feel good about continuing to work.

Drastic changes to work practices that followed lockdown made the job no longer enjoyable and motivated several participants to retire. In some cases, the employer's reaction to the pandemic was chaotic and disorganised and was not appreciated by participants.

> *'… so we went into the first lockdown and that's completely changed the way in which the community rehabilitation service was working and we just stopped going to see patients … and nobody knew about how to go about anything, and nobody knew what we should do and what we shouldn't do and at the same time as that there was a great deal of discussion about who could and couldn't be patient facing and my husband had chronic lymphocytic leukaemia so he is obviously clinically vulnerable and at the time that was a big issue, so we were getting all the letters about what we both could and couldn't do and how we should live and the decision was taken at work that people like me, who were living with clinically vulnerable people, would not be allowed to see patients until a vaccine came about. That meant that they wanted me to return to desk-based project work and research and I had done all of that 'been there, done that', that's why I chose to go back to clinical work because I wanted the hands on rehab and, I have to say, I didn't agree with the complete cessation of input to patients, so I had a number of care homes who were really struggling, obviously all the issues about care homes and patients and things so they were crying out for some support to try and keep their patients mobile and we were not even allowed to really talk to them on the phone, it was... so I took the decision in the end that if, that I didn't want to do the work that was being offered to me in lieu of clinical work...so I took retirement!'* Lily, 65 years

In other instances, the job itself completely changed, like in the case of Elaine. She stated that she couldn't bear the emotional strain she was put under since strict lockdown protocols were implemented in her workplace and she had no option than to retire:

> *'Yes, the main reason was due to COVID, my job actually became very difficult, because the hospice was no longer allowing visitors in, I was no longer able to greet visitors, say goodbye to visitors, help them in any way at all we had to wear full PPE throughout the day so it was 8 hours and because we couldn't have shared workspace it meant that I couldn't leave the desk for 8 hours…and it became very difficult, very upsetting. We had a lot of upset visitors stood outside and we couldn't offer them a cup of tea, there was nothing in my job that I used to do day in day out for hundreds of*

visitors, and we were restricted to maybe six visitors a day if the patient was actually at the point of dying. So, it became very difficult, very emotional, and very long days doing nothing, and it got to a point where I thought I can't do this anymore, I have to retire'. Elaine, 66 years.

Theme 6: Perception of personal safety at work during the pandemic

This theme has again a neutral connotation. On one side, participants expressed their anxieties and concerns about attending the workplace during the COVID-19 pandemic because safety measures were not followed properly, and they were therefore worried about contracting the virus. This perception of risk changed retirement plans and brought retirement forward for several people. Some perceived themselves to be at high risk of COVID-19 because of age or comorbidities or were afraid to contract the virus and pass it on to family members.

'I also had to shield during the pandemic because as part of the Hodgkin's I had a thymectomy so made me immune-supressed so that made me high risk, I worked in a school, a private school, a big school, so obviously I felt that was quite a risky thing, I was quite scared to go back in the offices, with all the children and people didn't really seem to be observing social distancing, and all the staff were handling the same files, it felt too risky'. Lucy, 59 years

Others were mainly afraid to pass the virus to a vulnerable family member:

'Basically... it was a kind of joint decision it might sound a bit selfish, but I was thinking my other half decided that because she has got slight...she was at slightly high risk because of asthma, she wasn't happy about me having to drive coaches with school kids around without any masks or anything like that'. Leo, 66 years

One participant describes the stress of potentially passing on the virus to her students as a contributing factor to the decision to retire.

'So it was a very tense situation because … there was also the covid thing hanging over your head, so at that point in time there were no vaccinations, so nobody had any protection against getting even covid, and we were more likely to take it into the prison than contract it from the prison, so that was a lot of stress if you like about teaching people on a 1 to 1 basis, when you didn't really know if you were infecting them'. Sophia, 65 years

On the contrary, others reported they never worried about the safety of their workplace and because they felt safe in the workplace, they delayed their retirement.

> *'No, it wasn't a worry because we have always been extremely clean and more than cautious, you know we've been more than cautious for years so every surface and every handle and everything and the windows and doors have been open forever. And every member of staff was in full PPE and nobody was actually allowed in, so it was an extremely clean environment. It was more worrying going to a local shop than it was to actually be at work'.* Elaine, 65 years

4.3.2 Gender differences

Contrary to my initial expectation, this study did not highlight major differences in the retirement process for men and women. Most themes were equally reported across genders while the only one to differ was "poor health". Women were more likely than men to bring up poor health as something that accelerated their retirement process.

4.3.3 Case studies

Case study 1: Leo, 65 years, married, just about managing/struggling financially, good health

Leo was working as a bus driver at the time of lockdown. He had been in the same job for 15-20 years and he no longer enjoyed it. He had had enough of driving and the job did not allow him to plan any social activity because of his changing rota. In March 2020 he was put on furlough, and he took this experience as a prelude to retirement. The decision to retire was a combination of reasons: first, his wife was at higher risk of catching the virus because of comorbidities, and he felt that his workplace (bus) was not a safe environment as he could easily contract the virus and pass it on to her; secondly, they were financially able to retire and he felt that he was in a better financial status compared to others, therefore it would be better to leave work to others more in need. Those factors, added to the fact that he was fed up with driving, moved his decision to retire forward by approximately a year. He had originally postponed his retirement to financially support his children, but once that was over, he could retire.

Case study 2: Sophia, 64 years, living alone, doing alright financially, good health

Sophia was working as a part-time teacher in the prison education system. She decided to bring her retirement forward by six months and retired in July 2021, mainly because the

changes to the working practices since lockdown meant she no longer enjoyed her job. The face-to-face lessons with prisoners were interrupted altogether and teachers were asked to prepare material that students would study on their own. Then, after several months, teachers were allowed back into the prison. There was a lack of communication between the prison management and the Government, and she was feeling very frustrated as she was not put in the position to do her job properly. The situation in the prison was very tense as although there were strict rules, these were not implemented, meaning that the workplace was not a COVID-19 safe environment. Sophia was worried for her own health as she was above 60 years of age, as well as for the health of prisoners as she feared she might infect them. It was a shock for her to see how many colleagues would refuse to follow the rules and would put others at risk. The stress she was under was too much to handle and she handed in her notice. However, it took her a while to appreciate the amount of stress she was under and understanding the negative impact that had on her mental health. She prefers not to think about lockdown. She was fortunate to be able to financially afford retirement which she finds very enjoyable.

Case study 3: Sue, 66 years, living alone, just about managing/struggling financially, good health

Sue retired from a full-time administrative job in 2021, after having reached state pension age. She started working from home in lockdown and she has mixed feelings about the experience. She enjoyed the flexibility of it, she was more productive, and she didn't feel isolated because communication was good, but at the same time, she was working longer hours and her workload increased significantly. Overall, she preferred home working over office working. At the end of lockdown, she was required to be back in the office in hot desking mode and she disliked this change. The reason for her retirement is multifactorial: the job had become too stressful, and she couldn't cope with it because of her long-term depression and anxiety, at the same time she no longer enjoyed the job she was in. Although financially it would have been wiser to remain for another year, she brought forward retirement as she could no longer cope with it.

Case study 4: Linda, 63 years, married, financially comfortable, very good health

Linda had been working as an administrator for a charity for the previous two years. She enjoyed the job very much and got along well with the management. Once lockdown started, she moved to working from home and she found that extremely challenging. She describes herself as a very active, fit, and sociable person and once she found herself forced to be indoors the whole day, her mental health was badly affected. The effect on her mental health had in turn a negative impact on her physical health and resulted into her suffering from

shingles in the eye. She was then unable to do her job properly as this involved working with a computer. Because she was working with a charity she didn't want to remain on sick leave for too long, and although the management were very understanding of her needs, she felt she had no choice but to retire. She shared with me her strong resentment towards the coronavirus and lockdown as she felt she could have carried on working and could have used her expertise for longer, but felt she had no choice. Luckily her pension pots are healthy and financially she was able to retire earlier than planned.

4.4 Discussion

This qualitative study identified six themes that played a role into the timing of retirement for middle-aged and older people who took retirement since March 2020. These were: work environment and relationship with the workplace, poor health, end of working life and financial capacity, which were non-COVID-19 domains, while changes to work demands and practices since the pandemic and perception of personal safety at work during the pandemic appeared to be themes describing the impact of COVID-19 on work.

These findings reveal a strong relationship between themes. COVID-19 aspects that affected the workforce interacted with existing non-COVID-19 domains in the retirement thinking process. There were instances where, if there was financial capacity, changes to work demands and practices that occurred with lockdown adversely affected health and accelerated their retirement process. While for others, such sudden changes to work interacted with their established work environment and relationship with the workplace in determining the timing of retirement. Additionally, some individuals cited poor health as a reason for premature departure from work, meaning their risk perception in the workplace was heightened by their health conditions. Despite this, changes to work demands and practices since lockdown as well as perception of personal safety were the most important aspects that influenced timing of retirement. However, it is important to highlight that the decision to retire was mostly due to a combination of factors, something that was consistently reported even in the pre-pandemic period (33, 45). Most of the aspects that encouraged participants to postpone their retirement were also work-related, such as attachment and gratitude towards the employer or appreciation of the changes to work routine that occurred since the pandemic (i.e., working from home). Most participants stated that the pandemic and its consequences changed their retirement plans and timing of retirement, as was found in The Over 50s Lifestyle study, in which 63% of adults aged 50-70 who left their job during the pandemic, reported that they did so earlier than intended (210). Another qualitative study of 19 participants who were either already retired or were over 55 years but still employed when interviewed, reported that the

pandemic had significantly changed their plans and expectations of retirement (211). In line with our findings, the effect of the pandemic was not uniform across the sample, with some appreciating the flexibility of working from home while others reporting that the pandemic had brought forward their retirement.

Data from the Quarterly Labour Force Survey have shown that women are more likely than men to be employed in sectors that were shut down during lockdown or more likely to furlough people (in retail and hospitality sector) (212). This, combined with pre-pandemic evidence showing a slight increased tendency for women to take early retirement, brought me to initially speculate there might be differences in the decision to retire between genders. When I explored whether influences on retirement differed for men and women, I was surprised to see that there were no major differences, the only one being that women reported existing health issues as an important factor more commonly than men.

The retirement transition of HEAF participants interviewed in this study took place in a period of great economic and social instability. Since the start of the pandemic the UK has experienced a sharp increase in economic inactivity, with 70% of this rise attributable to individuals aged 50 and older (213). Notably, the country has seen the biggest fall in work participation compared with other OECD countries (especially in the age group 55-64 years), although work participation in the UK remains significantly higher than other OECD countries. One of the main reasons for such an increase in economic inactivity among middle-aged people is attributable to the increase in people who have retired. Therefore, the Government, within the Spring Budget 2023 has set out new policies in an effort to bring back to work some of the early retirees (214). In contrast with the aforementioned trend, newly published data from the Labour Force Survey (March 2023) show that the trend in increased economic inactivity among 50-64 year olds might be turning, as there has been a recent significant increase in people of this age group moving back into the workforce, especially among those who had been out for less than 3 years and therefore had left since March 2020 (215). The worry however is that such ‘unretirement’ might be mainly driven by the cost-of-living crisis which is forcing people who had happily recently retired to return to work. This might also have adverse consequences for health if people return to jobs which are unsuitable for their age and their physical capability, and perhaps with irregular work contracts. It is yet to be seen however whether this recent trend will be sustained long term, and the Government will succeed in boosting older workers’ work participation.

As well as ‘healthy’ retirement, ill-health retirement has been responsible for part of the recent increase in economic inactivity. In the UK, the number of working-age people who became inactive due to long-term sickness has dramatically risen since the beginning of the

pandemic (213). Findings from the present study suggest that this may be attributed to existing health issues, coupled with participants' perceptions of not being safe in the workplace because COVID-19 safety procedures were not adequately followed, which together played an important role into their retirement decision. It must be acknowledged however, that there were several occasions where participants reported to be in good health and that health had no role whatsoever in their decision to retire. For most people, work is not only a way to fulfil their material needs, but is a key determinant of social engagement, self-esteem, sense of purpose and achievement (55), something that also came up as an observation in this study. Because of the well-known importance of good quality work as key determinant of health (59, 62) and the link between job loss and deterioration of health (55), if people who have been forced out of work prematurely are from a more disadvantaged background, this means that the pandemic might result into widening existing health inequalities. Further research is needed to investigate the extent to which people with poorest socio-economic status were forced to stop working during the pandemic.

Although it has been shown that the chances of re-entering the workforce diminish the longer people are out of work, it is crucial for society and individuals to explore whether factors that have pushed people out of the workforce might be modifiable and to investigate whether people who have retired might be willing and able to re-enter the labour force.

In these data, one theme (end of working life) is non-modifiable as people who follow this retirement pathway had mostly made the decision about retirement pre-pandemic and lockdown only marginally altered their retirement plans. It is noteworthy that this sample of participants retired soon after the new UK regulations on state pension age entitlement came into force, however participants never mentioned that having reached state pension was a reason for retiring. Financial capacity to retire acted as an important contributing factor to retirement, and in most cases, it was necessary to allow participants to make the decision, but most participants recognised it was not the triggering factor.

On the contrary, changes to work demands and practices are likely to be potentially modifiable, and, in the wake of the pandemic, employers need to take those into account if they want to avoid more people leaving the workforce prematurely. These findings also show that factors that motivated people to remain in work were feeling connected with employers and colleagues, having a work management that is understanding and accommodating towards individual's needs, and job flexibility. A change to more flexible working days and hours may provide a good balance for people thinking of exiting. These findings therefore align with the ERI model which postulates that work retention is more likely when individuals perceive the effort they place in work is reciprocated through social connection, recognition

and a rewarding environment (43, 59). Equally, from a job demand-control perspective, flexible working and supportive management may mitigate job strain by increasing perceived control (60) and therefore may increase the likelihood of remaining in paid work longer term (216). The role of those factors have been previously shown to be important to keep people in work to older ages in the pre-pandemic era (45), and need to be accounted for by employers in the aftermath of the COVID-19 pandemic. A good step in that direction was the recently passed Flexible Working Bill, which entitles employees across the UK to have more flexibility over when and where they work (217).

Several participants mentioned the shift to home working as one of the main reasons in their retirement thinking process. Although some of them enjoyed the experience and this was what made them delay their retirement, for many participants working from home was not pleasant and had a detrimental impact on their health and wellbeing, by increasing feelings of isolation and loneliness. The pandemic has accelerated changes in the mode of working in the UK, where working from home before the pandemic was far from common. The percentage of UK employees exclusively working from home rose from approximately 3% in January/February 2020 to over 30% in March/April 2020, during the peak of the first national lockdown (164). A recent analysis published by the Institute of Employment studies shows that three years on from the beginning of the first lockdown, it is unlikely that work will ever return to how it was pre-pandemic and most of the changes are here to stay (195). Hybrid working has become very much the norm in certain occupations such as professional, scientific, and technical industries, and in public administration and defence. When asked about their preference of work mode, most participants of their survey opted for a hybrid pattern (this is particularly true for people aged 55+) and one of the main challenges for the near future appears to be the need for managers/employers to align with employees' preferences. It is indeed of interest that almost half of respondents of the survey reported that their organisation offered little or no consultation about changes to working practices which might translate into a mismatch between employees' desire and what they are asked to do and in turn push them to leave the workforce.

In this study I found that the perception of an increase in work demand and of higher workload that coincided with lockdown were important factors in pushing towards retirement. It has been previously shown that the rapid increase in home working has resulted in an increase in work-life conflict (218); workplaces are moving away from the usual 9 to 5 pattern and employees are expected to be always contactable. Expectations are that such extra pressure will not be sustainable long term as it might impact employees well-being and push them out of work (195). Feeling detached from the rest of the team and poor communication with line managers were other important factors identified. With home working becoming

widely spread, there is the recognition that line managers will need to become accustomed to a new way of communicating with their staff, if they want to retain their workers (195).

These findings are important as future interventions could consider these work-related modifiable factors if the Government want to retain the workforce for longer.

4.4.1 Strengths and limitations

The sample of participants who were eligible to take part in the interviews was drawn from those who had responded to two online surveys conducted since the first lockdown. As shown in paragraph 1.12, the sample is therefore biased towards the wealthier end as only those with email access were sent a link to complete the survey. However, due to the excellent response rate (43%), I had a large pool of possible participants to select from and I purposively selected those with under-represented traits to have as wide as possible characteristics deemed important in the process. Therefore, these interviews still provide a unique and detailed picture of retirement experiences since the first national lockdown in England across a wide range of socio-economic and health factors. Although it is recognised that work-related factors might be importantly associated with the intention to retire, these are beyond the scope of this study and I focussed my attention on socio-demographic factors and health, in the sampling process. When participants were invited, I specified that my aim was to understand their personal experiences of the COVID-19 pandemic and reason/s that they considered in their decision to retire since the pandemic, therefore it's likely that only those with strong opinions about the impact of the pandemic on their decision and their life more in general, agreed to take part. In addition, some participants might have mis-remembered the decision process they went through at the time of retirement as the retirement event took place up to 2.5 years before the interviews were conducted.

I acknowledge that these findings are potentially limited to the UK, due to the difference in the implementation of lockdown regulations and to differences in the social insurance systems across different countries.

This qualitative study represents the view of this research team, and we do not exclude that other researchers might have come up with slightly different themes. Respondent validation to ensure rigor of the findings was not an option in this instance, due to time constraints however, we adopted double coding throughout the analysis phase. The research team included people with a range of expertise, who met frequently to discuss findings, resolve any discrepancy that arose during the coding process and agreed the coding frame. SD was involved in both the data collection and data analysis and was therefore fully embedded into the whole process.

The team fully embraced reflexivity in the whole process of analysis, definition and description of themes and interpretation of findings. All these aspects increased the reliability and rigor of our findings.

4.5 Conclusions

The timing of retirement for middle-aged and older people who retired since the first lockdown was influenced by multiple reasons. This qualitative study has shown that sudden changes to work arrangements and day-to-day work were mostly not appreciated by older workers, while feeling connected with employers and colleagues, having a work management that is understanding and accommodating towards individual's needs, and job flexibility motivated people to delay their retirement. Retirement transition for these participants occurred in a fast-changing socio-economic scenario and at present it is unclear whether the trend of increase in retirement rate which started during lockdown will be reversed or sustained long-term. These findings point towards certain aspects of work that could be considered by employers if they want to retain their workforce.

Chapter 5 Discussion

5.1 Summary of findings

This thesis sought to explore how employment circumstances, lifestyle, finances, and health changed among middle-aged people since the onset of the COVID-19 pandemic. Furthermore, it aimed to explore whether changes in employment circumstances precipitated by the pandemic impacted people's health. Finally, interviews with recent retirees were conducted to gain insight into factors that influenced their retirement thinking process and the timing of their retirement during the pandemic.

To achieve these objectives, I first conducted a systematic review of the literature to gather the available evidence on the association between pandemic-related changes in employment and anxiety in the adult population. In the systematic review, I focused on anxiety specifically as it was not feasible to explore a wider range of mental and physical health effects of changes in employment due to the vast number of published papers on the topic. The review included peer-reviewed quantitative studies conducted among the general population. Eligible studies were of observational design, included at least some participants aged 50 and older, and assessed the relationship between change/s in employment since the COVID-19 pandemic and risk of, or levels of, anxiety. Studies that only reported descriptive statistics were included, provided they compared anxiety across categories/levels of employment, while studies that were conducted in selected populations or settings were excluded. A total of 48 studies met the inclusion criteria, comprising 39 cross-sectional and 9 longitudinal studies.

After a critical appraisal of these papers, I complemented a narrative review with a vote-counting method to quantitatively summarise the main findings. Heterogeneity in the way exposures and outcome were assessed made meta-analysis infeasible. As reported in Chapter 2, papers included were generally rated of poor quality, primarily because they were of cross-sectional design, a design that provides a weak form of evidence as it does not allow to disentangle whether the exposure preceded the outcome or vice-versa, limiting capacity to assess causation. Additionally, they recruited participants using snowball techniques limiting the generalisability of their findings and, on several occasions, they lacked adjustment for key confounding variables. Despite these limitations, there was convincing evidence that job loss since start of the pandemic was associated with increased levels and/or risk of anxiety. However, the magnitude of this association was only moderate. This was not surprising considering the wealth of pre-pandemic data that suggested a

negative association between job loss or unemployment and poor mental health outcomes (84-86). The direction of association between working from home and anxiety was less definitive, with some studies finding home working being associated with a reduction in anxiety while others finding the opposite. I found that the effect of being furloughed on levels or risk of anxiety was rarely explored in existing studies to be able to draw meaningful conclusions.

The second part of this project expanded on the research question addressed with the systematic review by exploring the effect of changes in employment since the pandemic on several self-reported mental and physical health outcomes, using data from a large ongoing cohort of middle-aged people in England. To address this research question, I complemented data already collected from members of the HEAF cohort with new data collected since the pandemic. Chapter 3 begins with a description of the life changes participants underwent since the pandemic and shows that middle-aged people were considerably affected by the pandemic. Most of them experienced a change in employment circumstances and only 35% remained working as they had before the pandemic. Approximately 20% of the sample reported a worsening of mental health between the pre-pandemic period and February 2021, 27% reported worse physical health, and 17% worse SRH. A total of 24% reported anxiety in the period March-July 2020 and 12% reported depression, 6% of which was incident depression. In terms of lifestyle changes, most participants reported a change in their levels of leisure-time physical activity. This was not surprising as people's ability to leave their homes was significantly compromised during lockdowns. Participants' finances were also affected by the pandemic. The level of perceived changes in finances was related to participants' financial position pre-pandemic, with participants already struggling financially in 2019 more likely to perceive themselves as financially worse off since March 2020. Their perceived change in finances was also associated with changes to their employment: participants who shifted to home working were more likely to perceive themselves better off financially compared to the pre-pandemic period, while those who decided to retire, those who were furloughed or experienced any other job change were more likely to perceive themselves financially worse off.

As reported in section 3.3.8, there were significant associations between certain categories of employment changes and poorer self-reported health outcomes. Participants who decided to retire were more likely to perceive a worsening in their SRH, mental health, and to experience depression in the short-term when compared with participants whose employment remained unchanged. In contrast, those who transitioned to working from home were more likely to perceive a deterioration in mental health and to experience anxiety in October 2021. Such associations were robust to adjustment for a series of pre-pandemic and

pandemic related confounders such as age, sex, pre-pandemic financial position, pre-pandemic SRH, pre-pandemic comorbidities, and pre-pandemic job type.

To complement the findings of the quantitative survey, I conducted a qualitative study with a sample of individuals who retired since March 2020, to explore the reasons that influenced the timing of their retirement. For this phase of the study I interviewed 24 recent retirees, aged 65 years on average, to gain insight about the reasons behind their decision to retire when they did. With their permission, I audio recorded the interviews, I transcribed them, and I thematically analysed these data. Their retirement process was summarised using six overarching themes: four of which were not COVID-19 related while the other two were summarised as the impact of COVID-19 on the workforce. Unless specifically reported in the theme name, themes tended to have a neutral connotation, meaning that they included aspects that accelerated the retirement process and others which delayed it.

This qualitative study highlighted the complexity of retirement decision-making. Similar to literature published in the pre-pandemic period, retirement timing was dictated by a combination of factors, none of which acted in isolation (33, 45). Overall, although work-related factors were usually reported as the main contributor to retirement timing, considerations relating to COVID-19 and its impact on the workplace were also important. Differently to what I originally anticipated, the retirement process did not seem to differ between the men (n=10) and women (n=14) that I interviewed.

5.2 Strengths and limitations

Before discussing the findings of this thesis and their potential implications, it is important to highlight some overall limitations and strengths.

This study is nested within the wider HEAF cohort which, while reasonably representative of the general population of 50-64 year-olds in England in terms of employment, and marital status, had an initial response rate of only 21% (1). Additionally, the HEAF cohort is predominantly composed by people of White Caucasian ethnicity which limits the ability to generalise the findings to a more ethnically diverse population. Furthermore, the sample who responded to the COVID-19 surveys and formed the pool of potential interviewees were healthier and better off financially compared with those who did not take up our invitation to complete the online surveys. Although potentially reason for concern, I do not believe that this selection bias has caused a difference in the direction of effects found in this thesis. However, it is likely that the exclusion of participants in poorer finances and poorer health might have led to an under-estimation of the association between changes in employment

and health outcomes. Despite this, the sample included participants with a wide range of characteristics, which I controlled for in the quantitative analyses. Additionally, when selecting participants for the qualitative study, I was able to interview individuals from a diverse socio-economic background, marital status, sex, and health status, ensuring that a large variation of experiences was incorporated.

A main strength of this thesis was that it followed a mixed methods approach which integrated quantitative data from a well-characterised cohort with qualitative data. This combination allowed for a comprehensive analysis of life changes since the pandemic alongside the association between employment changes and health outcomes. Statistical modelling provided effect estimates while data from the interviews offered an in-depth understanding of people's lived experiences during the retirement process. In addition to using data from the HEAF study, this thesis included evidence from other published manuscripts through a systematic review. The use of data from an existing cohort with a wealth of pre-pandemic data represented a notable strength of the current research and made it easier to re-contact participants for additional data about their pandemic experiences.

The supervisory team and I were working from home on a regular basis when we designed the content of the online surveys. Because we were not used to working remotely, we faced some challenges with holding effective meetings on Teams to develop the content of the questionnaires, especially in the early phases of the pandemic. Additionally, we were uncertain whether study participants would be willing to engage with the online surveys as they were accustomed to receiving postal questionnaires. Despite these challenges and initial concerns, this project proved to be successful in terms of cohort engagement, as participants were still keen to participate regardless of the modality of data collection. In the post-pandemic period, we have retained the online data collection for part of the cohort who can access internet, as this has proven to be quicker and cheaper than postal data collection.

5.3 Reflections on study findings

The pandemic offered a unique opportunity of exploring life changes during a global pandemic as effectively a "natural experiment" imposed on us all. Unlike a traditional randomised controlled trial, in which researchers control the intervention being administered, in this case the pandemic acted as an intervention at population level (219). With the pandemic and subsequent lockdowns, people's lives changed suddenly from an economic, employment, and a social point of view (220). In this project I was able to observe changes to

several aspects of people's lives that occurred in parallel. The overlap of several stressors makes it challenging to disentangle the effect of employment changes from those of other stressors, in their impact on poor health outcomes. However, we have no reason to believe that these stressors may confound the associations of interest. For example, financial worries are likely a consequence of job loss, while worries about infection would apply equally to those experiencing a job change and those who did not - and, if anything, might affect the reference group more strongly due to them still attending the workplace as usual. Finally, mandatory isolation could be considered as a stressor which was affecting both groups and could be seen as a consequence of a job change and not a confounder of the association.

The strategies for containing the virus differed significantly between countries, making it challenging to generalise these findings to a different context. For instance, while the UK encouraged people to stay at home during the lockdown period, its lockdown measures were comparatively less restrictive than those of other countries, permitting individuals to exercise outdoors in the vicinity of their homes, once a day. Consequently, the associations between variables observed in this country may be weaker compared to other countries with stricter lockdown measures or may not even be applied to other countries.

When analysing changes in employment in relation to poor health outcomes, it became evident that the term "had to retire" would have been more appropriate than "decided to retire" for describing recent retirees. Interviews with a sample of recent retirees revealed that, in most cases, they felt that they had little control over the timing of retirement. This decision was dictated by a combination of factors which often included changes to the workplace since COVID-19 or worries about contracting the virus in the workplace. Many retirees reported bringing forward their decision to retire by several months or even years because of the pandemic and its consequences. Interestingly, most participants spoke very positively of their retirement experience, which seems to be somewhat in contrast with the negative effect of retirement on health outcomes reported in the quantitative analysis. It is of course a possibility that only a selective group of people agreed to participate in the interviews, being mostly those who wanted to share their positive experiences of retirement, while perhaps people whose retirement experience had not been positive refrained from taking up the opportunity of an interview. Another possibility is that reverse causation played a role, with people in poorer health deciding to take retirement as soon as the opportunity arose.

The HEAF cohort does not appear to have experienced a significant surge in retirement since the onset of the pandemic. This is somewhat in contrast with data at the national level which have shown an increase in economic inactivity across the general population.

Amongst people aged 50-64 years the economic inactivity rate in September 2024 was at 27.4%, remaining higher than the pre-pandemic rate of 25.5% recorded in 2019 (221). For this age group, the single main factor for being economically inactive is being sick, injured or disabled, with 44.9% of individuals reporting this as the main reason. Retirement is the second most reported reason, and its prevalence increases significantly with age. In the years 2018-19, economic activity amongst individuals aged 55-65 years was highly related to the person's wealth. Those in the intermediate categories of wealth were the most likely to still be in paid work at this age. In contrast, individuals in the 20% lowest level of wealth were less likely to be in paid work and more likely to be economically inactive for reasons other than retirement. While those in the wealthiest fifth of the distribution were the most likely to be economically inactive because of retirement (20). If not in paid employment, people with higher levels of education were more likely to be economically inactive because of retirement rather than because of unemployment or for other reasons. Employment rates were highest amongst people in this age group who were still paying a mortgage, while those with disabilities had the lowest employment rates and were more likely to be economically inactive for non-retirement-related reasons (20).

Participants of the HEAF study were particularly vulnerable to the COVID-19 virus because of their age (222), and 9% of the sample was advised to shield during the first lockdown because of health conditions that made them particularly vulnerable. Especially in the early phase of the pandemic, when the mechanisms of virus transmission were still unclear, concerns about older people's risk of death were common. These concerns likely contributed to the spread of ageism during the pandemic (223), and this may partially explain some of the negative effects on health that we observed in this study.

Another group of participants that showed an increased risk of some poor health outcomes were those who began working from home since the pandemic. Both employees and employers faced an abrupt and unintentional shift in their work circumstances for which they were largely unprepared. These findings align with other evidence suggesting that it was not home working itself that affected the risk of adverse health effects but rather the sudden transition to home working without choice. Data from the UK show that, during the first lockdown, the mental health of the general population worsened significantly, with large variation depending on working arrangements (192). Participants who worked from home at least some of the time reported poorer health outcomes compared to those who continued attending the usual workplace. Similarly, those already working remotely pre-pandemic reported a smaller decline in mental health compared with those who began working from home. However, the differences in mental health depending on work mode attenuated

significantly as the pandemic went on, suggesting home workers required some time to adjust to a new work modality but were generally able to do so eventually.

5.4 Future work

This thesis focused on a limited range of health outcomes, primarily on mental health. Future work could be undertaken on specific measures of physical health such as musculoskeletal pain. To expand on the findings presented here, future studies could examine health outcomes that were objectively assessed at different time points, rather than relying on perceived changes. Moreover, future research could explore whether changes in employment were associated with improvements in health outcomes providing a more comprehensive understanding of the potential benefits and losses of employment transitions.

Exploring the long-term effects of the pandemic was beyond the scope of this study, as the online surveys covered only the most immediate periods after lockdowns. Future studies should monitor long-term health outcomes to better understand the enduring consequences of the pandemic.

A few studies exploring the long-term health impact of the pandemic are available at the time of writing. Among those is a representative cohort study of adults (28% of whom were aged 50-64 years) from the US that assessed the long-term effect of early loss of income (the individual or household) or job loss on psychological distress (224). The authors found a 9% and 11% increase in psychological distress at 6-10 months and 25-29 months post-pandemic respectively among those experiencing either job or income loss during the first phase of the pandemic, compared with individuals without income or job loss. This study highlighted the importance of monitoring long-term health outcomes for individuals who experienced a job loss and demonstrated that the negative impact of job loss, although small in magnitude, may persist longer-term.

A cross-sectional study, conducted among workers in an Italian research organisation, investigated whether working from home since the onset of the pandemic was associated with a change in depressive symptoms (225). The study compared self-reported symptoms of depression from before to after the transition to home working, with the symptoms retrospectively assessed. The authors found that the transition to home working was accompanied by an increase in the prevalence of mild and moderate depressive symptoms for some people while others, who reported depressive symptoms previously, experiencing an improvement. It was apparent therefore that the effect of home working may differ depending on individual characteristics. Although with the potential limitation of recall bias,

their study is novel in gathering data among individuals working from home for at least 18 months since the onset of the first lockdown. Mental health outcomes in the study were assessed once the transition to home working was established, which differentiated this study from others exploring the effect of the transition to home working (225).

Undoubtedly one of the main changes brought by the pandemic was to the way in which we work. Working from home is now an integral part of post-pandemic societies and offers new opportunities which were unthinkable only a few years back. Managers had to adapt to this new work mode and had to learn new skills to ensure they were still able to communicate effectively with their staff and supportive of their well-being while employees worked at home. Hybrid work has now become the preferable work arrangement for many employees who have that option as they identify several gains like reduced commuting, increased trust between employees and managers, and improved access to work for people with disability (195). On the other hand, with the increase in work flexibility, there have also been accompanying higher expectations from managers that employees remain contactable outside of traditional working hours and a blurring of the traditional home/work boundaries (195). There is also a potential rise in social isolation and possibly more stress derived from the use of technology (195). A recent scoping review of 132 studies (covering quantitative, qualitative, and mixed methods research) explored the effect of home working on well-being in adults aged 18 and above (226). This review gathered evidence published up to 2022 and suggested that a one-size-fits-all approach was ineffective. The potential benefits of home working on the employee's health depended largely on their working environment, the intensity of homework and the worker's personality.

Different sectors of the population may have different needs in relation to hybrid working, with women more likely to be exposed to multiple household roles, and people from a low socio-economic position more likely to have a home environment less suitable for home working. Additionally, because of the increased importance of technology while working remotely, older workers may be in a more disadvantaged position and may need additional support for a healthy home working (227).

5.5 Implications of the findings

These data showed clear disparities in how the pandemic affected different sectors of the population. Individuals who were in a poorer financial position pre-pandemic were more likely to perceive a worsening in finances and those who were in poorer health in 2019 were the ones who were more likely to perceive poor health outcomes after the start of the pandemic. Moreover, this thesis found that job losses and furloughing impacted disproportionally people

struggling financially, whereas the prevalence of home working was higher among those whose financial position was comfortable (39%) compared with those who reported struggling financially (27%). Furthermore, the highest proportion of individuals who perceived an improvement in their financial situation were those who transitioned to home working, while the lowest was among those who retired during the pandemic.

This demonstrated that, although infective diseases should theoretically affect everyone equally, COVID-19 amplified long-standing systemic inequalities (228). The pandemic deepened structural disparities, disproportionately affecting those who were already vulnerable. The COVID-19 pandemic occurred against a backdrop of inequalities in social determinants of health such as in living conditions, access to healthcare, food, sanitation, and good-quality work as well as pre-existing inequalities in non-communicable diseases (171, 229).

Experiences of lockdown restrictions were also unequal, as overcrowded housing and no access to green space disproportionally affected people from more disadvantaged background, while reduced access to healthcare had a greater negative impact on those with pre-existing health conditions. Furthermore, the ability of working from home – an important protective factor against the virus - was largely limited to those with higher earnings (230). The COVID-19 outbreak was not unique in this regard; similar inequalities in disease prevalence and mortality were observed during previous pandemics, such as the 1918 Spanish influenza (229).

In preparation for future pandemics, we should anticipate that disparities can become larger and adopt a prevention plan that offers greater support to the most marginalised groups such as people in poorer finances and with impaired health. Although social isolation in the form of lockdowns and quarantine may be a necessary solution to limit the spread of a virus in case of a future pandemic, Governments need to carefully consider the unintended effects that such restrictions may have on mental health (54) (231).

This research brought up evidence that work-related factors could be targeted in an attempt to extend working lives for middle-aged people and decrease their economic inactivity. These findings align with both the job demand-control and effort-reward imbalance models, showing that, when workers have greater autonomy and control over their tasks - such as a through a flexible job which can accommodate individual needs - this can mitigate the stress of a demanding job and support work retention. Similarly, feeling connected with colleagues and managers and appreciated within the workplace reflects a balance between effort and reward and can contribute to encourage work at older ages.

These findings align well with a qualitative study conducted pre-pandemic within the HEAF cohort in which recent retirees identified aspects such as supportive relationships with colleagues, a feeling of being appreciated, and flexible hours as work-related factors that could potentially encourage people to delay their retirement (45).

5.6 Conclusions

When I began this study, we were in the midst of the pandemic. Nearly five years after its onset and the first lockdown, it is evident that the COVID-19 pandemic has substantially changed people's lives. Individual characteristics have played an important role in determining the effects of the pandemic, with people from poorer financial position and poorer health more likely to bear the strongest effects. Moving forward it will be essential to monitor the mental and physical health of the general population, with particular focus on those who have been most affected by employment disruptions and were least resilient to those changes. This will help disentangling long-term pandemic-related influences and facilitate provision of support where needed.

Appendix A Phases of lockdown in the UK

March 2020:

- 20th: schools of any grade closed (except for vulnerable children and children of essential workers).
- 23rd: ‘stay at home’ ordering comes into force.
- ‘Work from home’ where possible.
- Essential work only: Healthcare, Care work, police, prison staff, food retail, communications, post office, pharmacy.

April 2020:

- Lockdown extended for at least 3 more weeks.
- 23rd: garden centres and DIY centres re-open.

May 2020:

- 10th: people can exercise more than once a day.
- 10th: workers that cannot work at home encouraged to return e.g. Manufacturing and Construction.
- 13th: recycling plants, sports outdoors, house moves, and viewings resume.
- 18th: more train services resumed and some jury trials re-start.

June 2020

- 1st: phased re-opening of schools in England.
- 15th: non-essential shops reopen in England.
- 23rd: Prime Minister (PM) announces relaxing of restrictions and 2m social distancing rule.

July 2020

- 4th: reopening of pubs, restaurants, hairdressers.
- Max 2 households can gather.

August 2020

- 14th: reopening of theatres, soft play, and bowling alleys.
- Sheltering of vulnerable people officially ends.

- ‘Continue to work from home if possible’.

September 2020

- 14th: ‘rule of six’ - indoor and outdoor social gatherings above six banned in England.
- 22nd: new restrictions announced including a return to working from home and curfew for hospitality.

November 2020

- 5th: second lockdown comes into force in England.

December 2020

- 2nd: second lockdown ends after four weeks, and England enters a three-tier system of restrictions.
- 21st: Tier 4 (‘Stay at Home’) restrictions come into force in London and Southeast England.
- 26th: more areas enter Tier 4 restrictions.
- Rollout of vaccination started for selected groups of people.

January 2021

- 6th: England enters thirds national lockdown.

March 2021

- 8th: schools in England reopen. Outdoor recreation allowed between 2 people. ‘Stay at Home’ order still in place.
- 29th: outdoor gatherings of 6 people or 2 households allowed. ‘Stay at Home’ order ends.

April 2021

- 12th: non-essential retail, hairdressers, public buildings reopen. Outdoor venues (including restaurants/pubs) reopen. No indoor mixing allowed.
- The rollout of vaccination extended to people in younger age groups.

May 2021

- 17th: limit of maximum of 30 people for outdoor mixing. ‘Rule of six’ or 2 households for indoor gatherings. Indoor venues like restaurants, cinemas reopen.

July 2021

- 19th: most legal limits on social contacts removed in England and reopening of last remaining closed employment sectors.

September 2021

- 14th: PM unveils England's winter plan for Covid - 'Plan B' to be used if the NHS is coming under pressure and includes measures such as face masks.
- 30th: end of furlough scheme.

Appendix B Systematic review protocol

Section 1: ADMINISTRATIVE INFORMATION

Item 1: Identification. The effect of changes in employment that occurred since the COVID-19 pandemic on anxiety of the adult population: protocol for a systematic review.

Item 2: Registration. In accordance with the guidelines, our systematic review protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) on 15/06/2021 (registration number CRD42021260499)

Item 3a: Contact information.

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Other authors: Georgia Ntani (gn@mrc.soton.ac.uk), Holly Syddall (hes@mrc.soton.ac.uk), Karen Walker-Bone (kwb@mrc.soton.ac.uk), Ilse Bloom (ib2@mrc.soton.ac.uk)

Item 3b: Contributions. SD is the guarantor. SD, GN, HES, KWB, IB drafted the protocol. All authors contributed to the development of the selection criteria, the risk of bias assessment strategy and data extraction criteria. SD developed the search strategy. All authors read, provided feedback, and approved the final manuscript.

Item 4: Amendments. If we need to amend this protocol, we will give the date of each amendment, describe the change, and give the rationale in this section. Changes will not be incorporated into the protocol.

Item 5a: Sources. N/A

Item 5b: Sponsor. N/A

Item 5c: Role of sponsor and/or funder. N/A

Section 2: INTRODUCTION

Item 6: Rationale.

Changes of employment status (e.g. unemployment, relocation to home-working and furloughing) have been common since the start of the COVID-19 pandemic in 2020. As

previous studies have shown that job loss can be harmful for mental and physical health, we anticipate that people that have lost their job during the pandemic will have experienced worsening in their mental health. The effect of remote working on mental health is unclear.

Item 7: Objectives. The aim of this systematic review is to evaluate how changes in employment status that occurred with the COVID-19 pandemic have impacted people's anxiety. The proposed systematic review will answer the following question:

> What have been the effects of changes in employment status that occurred due the COVID-19 pandemic on anxiety of working-age adults?

Section 3: METHODS

Item 8: Eligibility criteria. Studies will be selected according to the criteria outlined below.

Study designs

We will include cohort studies, as well as cross-sectional or case-control studies.

Participants

Inclusion

We will include studies examining the general working adult population (aged 18 or over) as long as the group aged 50+ is represented. We will only include papers that explore how employment changes that occurred since the COVID-19 pandemic affected people's anxiety.

Exclusion

We will exclude papers whose sample does not include the age group 50+. We will exclude papers that do not describe changes in job circumstances or status that occurred since the COVID-19 pandemic as a predictor of anxiety. We will also exclude papers focussing on specific occupational groups or on people with specific health conditions as these will not be generalisable to the population. We will exclude papers from qualitative studies as well as evidence from systematic reviews and/or meta-analyses.

Intervention

Of interest are studies looking at changes of employment status after the start of the pandemic and subsequent impact on anxiety.

Comparison

People whose job has not changed or has changed but not due to the pandemic.

Outcomes

Anxiety measured with any validated or not validated tool.

Setting

Studies included will be those carried out in any country, not just the UK

Language

We will include articles reported in English or Italian.

Item 9: Information sources.

Literature search strategies will be developed using medical subject headings (MeSH). We will search MEDLINE (OVID interface), EMBASE (OVID interface), Web of Science and PsycINFO (EBSCO). The literature search will be limited to the English or Italian languages. To ensure literature saturation, we will scan the reference lists of included studies or relevant reviews identified through the search. Conference abstracts, editorials, notes, and letters will be excluded.

Item 10: Search strategy.

All published quantitative studies will be searched. No study design limits will be imposed on the search. Evidence from qualitative studies will not be included.

The specific search strategies will be developed with the support of a Health Services librarian. A draft MEDLINE search strategy is included in Appendix C. PROSPERO will be searched for ongoing or recently completed systematic reviews. As relevant studies are identified, reviewers will check for additional relevant cited and citing articles.
Publication dates of papers will range from 01/01/2020 to the date when the search is performed. We anticipate the initial search to be performed in May 2022 and will be updated towards the end of the review (July 2023).

Item 11a: Data management.

Literature search results will be uploaded to EndNote and duplicates will be removed.

Item 11b: Selection process.

All extracted papers will then be exported to the online free software Rayyan. The review authors will then independently screen the titles and abstracts yielded by the search against the inclusion criteria.
We will obtain full reports for all titles that appear to meet the inclusion criteria or where there is any uncertainty. We will then screen the full text reports and decide whether these meet the inclusion criteria. We will seek additional information from study authors where necessary, to resolve questions about eligibility.

Item 11c: Data collection process

A bespoke data extraction form has been developed for the research question between the reviewers (Appendix 2). This will be completed independently by SD and another member of the team. Any disagreements will be discussed and where resolution cannot be achieved, a third reviewer (KWB) will provide a final decision.

Item 12: Data items

- Author, Year, Study type (research article, report, conference paper), Country
- Study design
- Eligibility criteria met (yes/no/unclear)
- Age and gender of sample
- Study sample description: a description of the sample, recruitment technique and recruitment period
- Definition of main exposure/s used (job loss, unemployment, remote work etc.)
- Definition of the health outcome/s used: details of tools used to measure anxiety
- Number and percentages with the exposure/s of interest
- Number and percentages or summary statistics of the outcome/s of interest (depending of the nature of the outcome/s)
- Study type (only descriptive statistics/inference)
- Methodology used to control for confounders in the analysis (adjusting for confounders, stratification, matching etc.)
- List of confounders considered
- Statistical methods used
- Results of the analysis (risk estimates with 95%CI)

Item 13: Outcomes and prioritisation

Outcomes of interest will be: anxiety, assessed with any tool. No secondary outcomes

Item 14: Risk of bias individual studies

Risk of bias will be assessed using a form based on the Scottish Intercollegiate Guidelines Network (SIGN) checklists which will be compiled for individual studies. This will be modified and piloted so that it is suitable for assessment of the risk of bias from the papers returned by the search terms. Separate forms will be created for case control studies and cohort studies as necessary.

After piloting, the risk of bias for each included paper will be independently assessed by two reviewers (SD and KWB) and any disagreement will be discussed. Risk of bias will be discussed and reported in the review.

Item 15: Data synthesis.

A systematic narrative synthesis will be provided with information presented in the text and tables to summarise and explain the characteristics and findings of the included studies.

We will use a vote counting approach based on direction of effect method, which consists in categorising each study's effect estimates according to the direction of the exposure effect on the outcome (positive, negative, inconsistent).

We will consider a meta-analysis if the extracted measures are suitably homogeneous.

If practicable we will conduct a sensitivity analysis looking at adults aged 50+.

Appendix C Systematic review search strategies

C.1 MEDLINE (Ovid)

1. Unemployment/

2. Employment/

3. ((work* or job*OR employ*) adj3 (loss or losing or exit or chang*)).mp.

4. "unemploy*".mp.

5. "employ*".mp.

6. "furlough*".mp.

7. 1 or 2 or 3 or 4 or 5 or 6

8. ((exp Coronavirus/ or Coronavirus Infections/ or pneumonia virus*.mp. or cov.mp.) and (outbreak or wuhan or novel or '19' or '2019' or epidem* or epidemy or epidemic* or pandem* or new).mp.) or (coronavirus* or 'corona virus*' or ncov or '2019ncov' or 'covid*' or "sars cov 2" or 'sars2' or sarscov2 or sarscov-2 or "ncov 2019" or "sars coronavirus 2" or "sars corona virus 2" or "severe acute respiratory syndrome cov 2" or "severe acute respiratory syndrome cov2" or "severe acute respiratory syndrome cov*").mp.

9. "lockdown*".mp.

10. "lock-down*".mp.

11. 8 or 9 or 10

12. Anxiety/

13. Anxiety Disorders/

14. anxi*.mp.

15. 12 or 13 or 14

16. 15 and 11 and 7

17. limit 16 to (yr="2020 -Current" and (english or italian))

C.2 CINAHL (EBSCO)

S5	**Limiters** - Published Date: 20200101-20230731; Language: English, Italian	610
S4	S1 AND S2 AND S3	631
S3	(MH "Unemployment") OR (work* OR job* OR employ*) N3 (loss OR losing OR exit OR chang*) OR (unemploy* OR furlough*) OR employ*	(233,560)
S2	(MH "COVID-19") OR "covid-19" OR "covid19" OR "coronavirus" OR "corona virus" OR (MH "SARS-CoV-2") OR "lockdown*" OR "lock-down*" OR (MH "COVID-19 Pandemic") OR (MH "Coronavirus Infections+") OR (MH "Coronavirus+")	(139,930)
S1	(MH "Anxiety") OR "anxi*" OR (MH "Anxiety Disorders")	(132,495)

Appendix D Systematic review Quality assessment tool

Title: **First Author and ID number:** **Assessor:**

	Yes	No	Unclear	Not applicable	Comments
1. The study addresses an appropriate and clearly focused question					
PARTICIPANTS					
2. Were the criteria for inclusion in the sample clearly defined?					
3. Were the study subjects and the setting described in detail?					
4. The two groups being studied (exposed/not exposed) are selected from source populations that are comparable in all respects other than the factor under investigation					
5. The percentage of participants who dropped out before the study was completed is given *					
6. Comparison is made between full participants and those lost to follow-up, by exposure status*					

ASSESSMENT					
7. The outcome (anxiety) is clearly defined					
8. The outcome (anxiety) is measured in a valid and reliable way					
9. The exposure was measured in a valid and reliable way					
CONFOUNDING					
10. The main potential confounding factors were identified and considered in the design and analysis ±					
STATISTICAL ANALYSIS					
11. Confidence intervals have been provided ±					
OVERALL ASSESSEMENT					
12. Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, do you think there is clear evidence of an association between exposure and anxiety? ±					

13. Are the results of this study potentially generalizable to other older workers?					

* Only applicable to cohort studies

± Not applicable to descriptive studies

	High quality (+++)	Medium quality (++)	Acceptable (+)	Unacceptable (0)
14. How well was the study done to minimise risk of bias/confounding				

Appendix E Systematic review data extraction form

Researcher extracting data:			
Date form completed:			
Title:			
First Author, Publication date:			
Publication type: *(article, report)*			
Location (Country):			
Data collection period (*specify when data collection took place*)**:**			
Study design *(please delete)*	Cohort studies Cross sectional Case-control RCT/Intervention		
Eligibility criteria met *(please delete)*	Yes No Unclear		
Sample (Participants included)	**Individuals**		
	Total N(%) =	Men N(%) =	Women N(%) =
	Age (*mean, median, range)*		
	Age ≥50 years N(%) = (if specified)		
	Study sample description *(name of the cohort, recruitment method and other important information)*:		
	Response rate (%) (if specified)		
Definition of exposure(s)	*Describe exposure/s used*		
N (%) participants with the exposure/s	Total, Men, Women, Age ≥50 years N(%)		
Definition tool(s) used to assess Anxiety	*Describe outcome/s used*		
N (%) cases (participants with the outcome)	Total, Men, Women, Age ≥50 years N(%)		
Study type *(please delete)*	Only descriptive statistics shown Effect estimates between variables shown		
If descriptive study, summarise			

findings relevant to the research question				
Controlled confounders (*please delete***)**	*Adjusting for confounders with statistical modelling* *Matching by variables* *Restricting the sample studied (i.e; by age)*			
Statistical methods used *(describe method)*				
Risk estimate with 95%CI *(add lines if necessary)*				
	Description *(enter exposure/outcome each line refers to)*	Effect size	95%CI	p-value
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Have estimates been adjusted for confounders? *(if so, list them)*				
Estimates provided for age group 50+	Yes, No			
Risk estimate age group 50+ with 95%CI *(add lines if necessary)*				
	Description *(enter exposure/outcome each line refers to)*	Effect size	95%CI	p-value
1				
2				

Appendix F Publications and presentations from the thesis

Publications

D'Angelo, S., Bloom, I., Ntani, G. *et al.* Why did middle-aged and older people retire since the first COVID-19 lockdown? A qualitative study of participants from the Health and Employment After Fifty study. *BMC Public Health* 24, 103 (2024). https://doi.org/10.1186/s12889-023-17548-w

D'Angelo S, Ntani G, Bloom I, Walker-Bone K. Pre-pandemic socio-economic status and changes in employment during the first lockdown (2020) on the health of middle-aged people in England: a longitudinal study. BMC Public Health. 2022 Oct 12;22(1):1902. doi: 10.1186/s12889-022-14248-9. PMID: 36224577; PMCID: PMC9555689.

D'Angelo S, Zaballa E, Ntani G, Bloom I, Walker-Bone K. The impact of changes to work circumstances enforced by COVID-19 on anxiety: a systematic review. Under review with Systematic Reviews

Conferences

Oral presentation: EPICOH 2021, online.

Invited speaker: British Society for Rheumatology 2021, online.

Oral presentation: Faculty of Medicine Conference 2022, University of Southampton, UK.

Poster presentation: Society for Social Medicine and Population Health 2023, Newcastle, UK.

Poster presentation: Occupational Health 2024, Belfast, UK.

Webinar: Lunch and Learn sessions organised by the London Centre for Work and Health, 2024, online.

Oral presentation: Occupational Health 2025, Brighton, UK.

Poster presentation: EPICOH 2025, Utrecht, Netherlands.

Appendix G Ethics approval

Health Research Authority

North West - Liverpool Central Research Ethics Committee

3rd Floor
Barlow House
4 Minshull Street
Manchester
M1 3DZ

Tel: 02071048016

Please note: This is the favourable opinion of the REC only and does not allow the amendment to be implemented at NHS sites in England until the outcome of the HRA assessment has been confirmed.

27 September 2021

Dear Professor Karen Walker-Bone

Study title:	**Health risks and benefits of extended working life**
REC reference:	**12/NW/0500**
Protocol number:	**RGO ref: 8569**
Amendment number:	**2004.A17**
Amendment date:	**N/A**
IRAS project ID:	**103258**

The above amendment was reviewed at the meeting of the Sub-Committee held on 03 September 2021 by the Sub-Committee in correspondence.

Ethical opinion

The members of the Committee taking part in the review gave a favourable ethical opinion of the amendment on the basis described in the notice of amendment form and supporting documentation.

Approved documents

The documents reviewed and approved at the meeting were:

Document	*Version*	*Date*
Completed Amendment Tool [12-NW-0500_2004.A17_Locked11082021]	1	11 August 2021
Interview schedules or topic guides for participants [HEAF COVID-19 interview guide V1 040821]	1	04 August 2021
Letters of invitation to participant [HEAF COVID-19 Second survey Invite email V1 020821]	1	02 August 2021
Letters of invitation to participant [HEAF COVID-19 Interviews Invite email V1 020821]	1	02 August 2021
Other [HEAF COVID-19 Second survey INFO SHEET emails V2 200921]	2	20 September 2021
Participant information sheet (PIS) [HEAF COVID-19 Interviews INFO SHEET emails V1 020821]	1	02 August 2021
Validated questionnaire [HEAF COVID-19 Second survey V1 020821]	1	02 August 2021

Membership of the Committee

The members of the Committee who took part in the review are listed on the attached sheet.

Working with NHS Care Organisations

Sponsors should ensure that they notify the R&D office for the relevant NHS care organisation of this amendment in line with the terms detailed in the categorisation email issued by the lead nation for the study.

Amendments related to COVID-19

We will update your research summary for the above study on the research summaries section of our website. During this public health emergency, it is vital that everyone can promptly identify all relevant research related to COVID-19 that is taking place globally. If you have not already done so, please register your study on a public registry as soon as possible and provide the HRA with the registration detail, which will be posted alongside other information relating to your project.

Statement of compliance

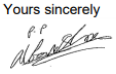
The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

HRA Learning

We are pleased to welcome researchers and research staff to our HRA Learning Events and online learning opportunities– see details at: https://www.hra.nhs.uk/planning-and-improving-research/learning/

IRAS Project ID - 103258:	**Please quote this number on all correspondence**

Yours sincerely



Appendix H Interview guide

Timing of retirement and characteristics of job left

- Please can you tell me when (approximately) you retired?
- What was your job at the time you retired? What did it involve? How many hours were you working?

Experience of retirement

- How are you finding retirement? Is life in retirement as you had anticipated? [expand by asking them in which way] What do you think about retirement life at this stage? [Are you satisfied with your decision of retiring?]
- What are your thoughts about going back to work in any kind of form in the foreseeable future?
- How did COVID-19 affect yourself and your family, apart from your work? Were you afraid of catching covid?

Reasons for retirement

- Now, please think about the reason/s that were responsible for your decision to retire. I appreciate there might be a combination of reasons behind this decision. Could you tell me what you believe was the main factor?
- What were any other reasons that led you to retirement?
- What made the decision to retire more difficult? [Depending on whether this is mentioned above or not] What were your retirement plans before the pandemic. How did they change since lockdowns? [Would you have retired at the same time if COVID-19 had not occurred] [if applicable: What caused this change to happen?]
- What, if anything, might have encouraged you to work for longer than you did?

Wrap-up question

- Is there anything we haven't mentioned yet which you would like to discuss?

Appendix I HEAF COVID-19 survey questions

Question	Response categories	Variable coded for the analysis
DEMOGRAPHIC QUESTIONS		
8: Date of completion		
9: Date of birth		Age or participant derived using date of birth and date of completion of survey
10: Sex	Men; Women	
COVID-19 SECTION		
11: Have you had any of the symptoms of COVID-19 (a new continuous cough, high temperature, a loss of, or change of taste or smell)?	yes; no	
If [yes] in Q11 **11a: How many times?**	Once; more than once	
If [yes] in Q11 **11b: How long did you have symptoms for? (Please, refer to the time your symptoms were worst, if you had them more than once)**	1 week or less; more than 1 week and up to 3 weeks; more than 3 weeks and up to a month; 1 month or longer	
12: Have you been tested for COVID-19?	Yes; no, I was not offered the option; No, a test was available but I chose not to have one	
If [yes] in Q12 **12a: Were any of your tests for COVID-19 positive?**	yes; no	
If [yes] in Q12 **12b: Did you need hospital admission because of COVID-19?**	yes; no	

If [yes] in Q12b **12c: How long were you an inpatient for?**	1 week or less; more than 1 week and up to 2 weeks; more than 2 weeks but less than a month; 1 month or longer	
If [yes] in Q12b **12d: Whilst you were an inpatient were you ventilated?**	yes; no	

SHIELDING SECTION

13: Since the beginning of lockdown in March have you received an official letter that advised to 'shield' yourself (i.e. avoid any contact with other people because of being clinically extremely vulnerable)?	yes; no	
If [yes] in Q13 **Who gave this advice? (Tick all that apply)**	The Government; Healthcare professional; others (specify)	
If [yes] in Q13 **13b: Have you followed that advice?**	yes; no	Q13 and Q13b combined to obtain the following: not advised to shield; advised and followed; advised and not followed
If [yes] in Q13 **13c: Since the end of July 2020, have you come out of shielding?**	Yes, totally; yes, partially; no	
If [yes] in Q13c **13d: Since the end of July 2020, at what level of risk of infection do you perceive yourself?**	High; medium; low	
14: Since the end of July 2020, have you been contacted by the NHS Track and Trace service and been told to self-isolate?	No, never; yes, once; yes, more than once	

15: Has someone close to you (i.e. member of your family or friends) been affected by coronavirus?	yes; no
If [yes] in Q15 **15a: In what way? (Tick all that apply)**	They had symptoms; they were hospitalised; they died; other (specify)

HEALTHCARE USE SECTION

16: At the time of the first lockdown (23rd March 2020) did you have any healthcare appointments planned (e.g. with a doctor, nurse or other healthcare professional?)	yes; no
If [yes] in Q16 **16a: I had a planned appointment with my GP**	yes; no
If [yes] in Q16a **Please state what happened to this appointment**	It took place as planned face to face; It took place as planned remotely (telephone /video); It was delayed but has happened since; It was cancelled and I am still waiting
If [yes] in Q16 **16b: I had a planned appointment with a Practice Nurse**	yes; no
If [yes] in Q16b **Please state what happened to this appointment**	It took place as planned face to face; It took place as planned remotely (telephone /video); It was delayed but has happened since; It was cancelled and I am still waiting
If [yes] in Q16	yes; no

16c: I had a planned appointment with a physiotherapist	
If [yes] in Q16c **Please state what happened to this appointment**	It took place as planned face to face; It took place as planned remotely (telephone /video); It was delayed but has happened since; It was cancelled and I am still waiting
If [yes] in Q16 **16d: I had a planned appointment with a podiatrist**	yes; no
If [yes] in Q16d **Please state what happened to this appointment**	It took place as planned face to face; It took place as planned remotely (telephone /video); It was delayed but has happened since; It was cancelled and I am still waiting
If [yes] in Q16 **16e: I had a planned appointment with a dentist**	yes; no
If [yes] in Q16e **Please state what happened to this appointment**	It took place as planned face to face; It took place as planned remotely (telephone /video); It was delayed but has happened since; It was cancelled and I am still waiting
If [yes] in Q16 **16f: I had a planned appointment with a psychologist**	yes; no
If [yes] in Q16f **Please state what happened to this appointment**	It took place as planned face to face; It took place as planned remotely (telephone /video); It was delayed but has happened since; It was cancelled, and I am still waiting
If [yes] in Q16	yes; no

16g: I had a planned appointment with an optician		
If [yes] in Q16g **Please state what happened to this appointment**	It took place as planned face to face; It took place as planned remotely (telephone /video); It was delayed but has happened since; It was cancelled, and I am still waiting	
17: I had at least one planned outpatient appointment at the hospital	yes; no	
If [yes] in Q17 **17a: How many outpatient hospital appointments did you have planned?**	One; two; three; four; five or more	
17b: For each outpatient appointment that you were due to have, what happened to this appointment?	It took place as planned face to face; it took place as planned remotely; it was delayed but has happened since; it was cancelled, and I am still waiting	
18: I had at least one planned appointment to go into hospital for an operation	yes; no	
If [yes] in Q18 **18a: What happened to this operation?**	It took place as planned; it was delayed but has happened since; it was cancelled, and I am still waiting	
If [yes] in Q18 **18b: What was the operation for?**	Joint replacement for arthritis; heart disease; cancer; other (specify)	
19: I had at least one planned appointment to go into hospital for treatment	yes; no	Q18 and Q19 combined: no operation or treatment; either operation or treatment planned
If [yes] in Q19 **19a: What happened to this treatment?**	It took place as planned; it was delayed but has happened since; it was	Q18a and Q19a combined: none of operation or treatment was cancelled; at least one was cancelled

	cancelled, and I am still waiting	
If [yes] in Q19 **19b: What was the treatment for?**	Arthritis; heart disease; cancer; other (specify)	
20: Since the first lockdown (23rd March 2020) did you need any emergency healthcare *for any reason other than COVID-19* (from your GP)?	yes; no	
If [yes] in Q20 **20a: Were you able to make an appointment with your GP?**	Yes, it took place face to face; yes, it took place remotely; yes, it was delayed but has happened face to face since; yes, it was delayed but has happened remotely since; no, I could not make an appointment and I am still waiting; no, I could not make an appointment, and I have given up	Disruption to emergency healthcare calculated and categorised as: Yes, it took place; it was delayed or cancelled
21: Have you done any of the following since the first lockdown began, because of worries or challenges related to COVID-19? (Tick all that apply)	Not reported symptoms of an illness to a GP or other health professional when you usually would have done so; Not spoken to a health professional about your mental health when you usually would have done so; Stopped taking medication because you could not access it (e.g. unable to collect prescription); Not gone for tests or treatment even though they were available; None	
22: If during the COVID-19 pandemic you needed to access healthcare virtually, did you do this by: (tick all that apply)	Landline; Smartphone/computer/laptop; email; not applicable	
23: If during the COVID-19 pandemic you needed to access healthcare virtually, did you have a	Yes; no; not applicable	

choice about the method of consultation?		
24: If during the COVID-19 pandemic you needed to access healthcare virtually, did you receive advice about how to make the most of your appointment?	Yes; no; not applicable	
25: If during the COVID-19 pandemic you needed to access healthcare virtually did you experience any technical difficulties?	I had difficulty hearing the other person; I had difficulty seeing the other person; The other person had difficulty hearing me; The other person had difficulty seeing me; Not applicable, I did not need to access healthcare	
26: If during the COVID-19 pandemic you needed to access healthcare virtually, how satisfied were you with your appointment/s overall?	Very dissatisfied to very satisfied	

EMPLOYMENT SECTION

27: What was your employment status before the start of the COVID-19 pandemic (February 2020)?	Employed; employed off sick; self-employed; self-employed off sick; unemployed and seeking work; unemployed and not seeking work; retired but doing some paid work; retired and not doing any paid work	In work pre-pandemic defined as: employed/employed off sick/self-employed/self-employed off sick vs retired/unemployed
28: Had your employment status (as above) changed since we last contacted you in June 2019?	I did not have a paid job when you contacted me in June 2019 and I did not have a paid job in February 2020; I had the same employment position in June 2019 and February 2020; My employment position had changed between June 2019 and February 2020	
If [my employment has changed] in Q28 **28a: Had you left the main job you were doing last time we contacted you (in June 2019)?**	yes; no	

If [yes] in Q28a **28b: When did you leave the job?**	Month/year	
If [yes] in Q28a **28c: Did you leave because of a health problem?**	Not at all; yes health was the main reason; yes health was part of the reason	
If [yes] in Q28a **28d: If there was a health problem, what type of problem was it?**	A problem with your back; a mental health problem or stress; a problem with your heart or lungs; another health problem; not applicable	
If [yes] in Q28a **28e: Have you started a new paid job since June 2019?**	yes; no	
If [yes] in Q28e **28f: What job have you started since June 2019?**	Free text	
If [yes] in Q28e **28f: In what industry?**	Free text	
If [yes] in Q28e **28g: When did you start this job?**	Month/year	
If [work pre-pandemic = yes] **28i: Did you ever lie awake worrying about work or angry about work?**	Often; sometimes; rarely/never	Recoded as: sometimes/rarely vs often
If [work pre-pandemic = yes] **28j: How satisfied were you with your job as a whole, taking everything into consideration?**	Very satisfied; satisfied; dissatisfied; very dissatisfied	Recoded as: very satisfied/satisfied vs dissatisfied/very dissatisfied
If [work pre-pandemic = yes]	Easily; just about; with some difficulty; with great difficulty; not coping	Recoded as: easily vs just about or worse

28k: How well did you cope with the physical demands of your job?		
If [work pre-pandemic = yes] **28l: How well did you cope with the mental demands of your job?**	Easily; just about; with some difficulty; with great difficulty; not coping	Recoded as: easily vs just about or worse
29: Did your employment status change after the start of the COVID-19 pandemic (March 2020) compared to what it was before (February 2020)? *(Please tick all options that apply to you)*	No, I was not working at either time; No, I remained in the same job for the same employer; I was still employed but had to take paid leave; I was still employed but had to take unpaid leave; I was re-deployed by the same employer; I was furloughed; my employer cut my working hours; I was made redundant; I decided to retire; my job changed and the change was related to COVID-19; my job changed and the change was unrelated to COVID-19	
If [My job changed and the change was related to COVID-19, My job changed and the change was unrelated to COVID-19, I decided to retire] in Q29 **29a: Have you left the main job you were doing before the COVID-19 pandemic?**	yes; no	
If [yes] in Q29a **29b: Did you leave because of a health problem?**	Not at all; yes health was the main reason; yes health was part of the reason	
If [yes] in Q29a **29c: If there was a health problem, what type of problem was it?**	A problem with your back; a mental health problem or stress; a problem with your heart or lungs; another health problem; not applicable	
If [yes] in Q29a	yes; no	

29d: Have you started a new paid job since June 2019?		
If [yes] in Q29a **29e: What job have you started since June 2019?**	Free text	
If [yes] in Q29a **29f: In what industry?**	Free text	
If [yes] in Q29a **29g: When did you start this job?**	Month/year	
If [No, I was still doing the same job for the same employer, I was re-deployed by the same employer, my employer cut my working hours] in Q29 **Is your job a "key worker" role as identified by the UK Government?**	yes; no	
30: During the COVID-19 pandemic, did you?	Begin working from home entirely; Begin working from home but were still going to the place of work occasionally; Keep working in the same location/s, circumstances as before (e.g., home, office, outdoor site, etc.); I was no longer working	Recoded as: working in the usual place; working from home; no longer working
If [Begin working from home entirely; Begin working from home but were still going to the place of work occasionally] in Q30 **30a: As part of working from home did you have all the necessary technology to perform your role?**	Yes, all; yes, some; none	
If [Begin working from home entirely; Begin working from home but	I do not have a separate room I could work in; I do not have a proper desk or chair	

were still going to the place of work occasionally] in Q30 **30b: As part of working from home did you face any challenges with setting up your workstation? *(Tick all that apply)***	to work at home; I didn't face any challenges like this	
If [Begin working from home entirely; Begin working from home but were still going to the place of work occasionally] in Q30 **30c: What proportion of your work do you feel can be done from home?**	All; most; some; none	Recoded as: all/most; some/none
31a: I was clear about what was expected of me as I worked from home	Strongly agree; agree; disagree; strongly disagree	Recoded as: agree; disagree
31b: I felt valued by my employer	Strongly agree; agree; disagree; strongly disagree	Recoded as: agree; disagree
31c: I felt trusted by my employer	Strongly agree; agree; disagree; strongly disagree	Recoded as: agree; disagree
31d: my manager was good at staying in touch	Strongly agree; agree; disagree; strongly disagree	Recoded as: agree; disagree
31e: I intend to stay with my employer during and post COVID	Strongly agree; agree; disagree; strongly disagree	Recoded as: agree; disagree
31f: I worried that decisions were taken without my input	Strongly agree; agree; disagree; strongly disagree	Recoded as: agree; disagree
31g: how would you describe the level of support received from your manager?	Free text	
31h: what additional support could have helped to enhance your working experience from home	Free text	
32: During lockdown, did caring responsibilities have a significant impact	No, I was still able to work as usual; To some extent, as I could share caring	

on your ability to work? *(Tick the box that best applies to the majority of this period)*	responsibilities with others; Yes, I needed to care full time for others; Not applicable, I did not have any caring responsibilities	
If [No, I was still able to work as usual; To some extent; not applicable] in Q32		
32a: Thinking about the job you had during the first lockdown, did you ever lie awake worrying about work or angry about work?	Often; sometimes; rarely/never	Recoded as: sometimes/rarely vs often
32b: Thinking about the job you had during the first lockdown, how satisfied were you with your job as a whole, taking everything into consideration?	Very satisfied; satisfied; dissatisfied; very dissatisfied	Recoded as: very satisfied/satisfied vs dissatisfied/very dissatisfied
32c: Thinking about the job you had during the first lockdown, how well did you cope with the physical demands of your job?	Easily; just about; with some difficulty; with great difficulty; not coping	Recoded as: easily vs just about or worse
32d: Thinking about the job you had during the first lockdown, how well did you cope with the mental demands of your job?	Easily; just about; with some difficulty; with great difficulty; not coping	Recoded as: easily vs just about or worse
33: Have you returned to your usual place of work since the social distancing measures were eased?	yes; no	
If [yes] in Q33 **33a: When?**	Month	
33b: Are you travelling to work using the same transport as before the first lockdown?	yes; no	

34: Since the first lockdown, travelling to work	Takes about the same time; takes less time than before; takes longer than before	
If [I was furloughed/my employer cut working hours/I used paid or unpaid leave] in Q29 **35: Is the change in your employment status that happened as a consequence of COVID-19 still in place?**	yes; no	
If [no] to Q35 **35a: What was your employment status in October 2020 (before the second lockdown)?**	Employed; employed off sick; self-employed; self-employed off sick; unemployed and seeking work; unemployed and not seeking work; retired but doing some paid work; retired and not doing any paid work	In work post-pandemic defined as: employed/employed off sick/self-employed/self-employed off sick vs retired/unemployed
If [employed, employed off sick, self-employed, self-employed off sick] in Q35a **35b: Thinking about your employment position in October 2020, did you ever lie awake worrying about work or angry about work?**	Often; sometimes; rarely/never	Recoded as: sometimes/rarely vs often
If [employed, employed off sick, self-employed, self-employed off sick] in Q35a **35c: Thinking about your employment position in October 2020, how satisfied were you with your job as a whole, taking everything into consideration?**	Very satisfied; satisfied; dissatisfied; very dissatisfied	Recoded as: very satisfied/satisfied vs dissatisfied/very dissatisfied
If [employed, employed off sick, self-employed, self-employed off sick] in Q35a **35d: Thinking about your employment position in October 2020, how well were you coping with the**	Easily; just about; with some difficulty; with great difficulty; not coping	Recoded as: easily vs just about or worse

physical demands of your job?		
If [employed, employed off sick, self-employed, self-employed off sick] in Q35a **35e: Thinking about your employment position in October 2020, how well were you coping with the mental demands of your job?**	Easily; just about; with some difficulty; with great difficulty; not coping	Recoded as: easily vs just about or worse

FINANCES

36: How well were you managing financially in October 2020 (before the start of the second lockdown)?	Living comfortably; doing alright; just about getting by; finding it difficult to make ends meet; finding it very difficult to make ends meet	Recoded as: living comfortably vs doing alright vs just about/struggling
37: Are there things which you used to have, and which you would like to have now, but can no longer afford?	No; a few things; many things	Recoded as: no vs a few/many things
38: Are you currently receiving any state benefits?	yes; no	
If [yes] to Q38 **38a: Please tick below which benefits you receive**	Income support; incapacity benefit; jobseeker allowance; disability living allowance; housing benefit; working tax credit; statutory sick pay; employment and support allowance; universal credit; personal independence payment; carer's allowance; others (specify)	
39: Because of the COVID19 pandemic have you chosen to make any changes to your pension arrangements?	yes; no	
If [yes] to Q39 **39a: Yes, I have taken some or all of my pension early**	yes; no	
If [yes] to Q39	yes; no	

39b: Yes, I have taken some or all of my pension earlier than I had planned		
If [yes] to Q39	yes; no	
39c: Yes, I have drawn down my pension lump sum earlier than I had planned		
If [yes] to Q39	Free text	
39d: others (specify)		

SOCIAL ISOLATION

40: Do/did you leave alone		
40a: Before lockdown	yes; no	Social isolation score obtained by giving 1 point to each of living alone; less than monthly contact with children, relatives, friends, and social activities. Social isolation: low (score 0); average (score 1); high (score 2-5)
40b: During lockdown	yes; no	
40c: After lockdown	yes; no	
41: Have you had contact with your children (either face-to-face, by telephone, by video calls, or by instant messaging)		
41a: Before lockdown	Weekly; monthly; less than monthly; never	
41b: During lockdown	Weekly; monthly; less than monthly; never	
41c: After lockdown	Weekly; monthly; less than monthly; never	
42: Have you had contact with other relatives (either face-to-face, by telephone, by video calls, or by instant messaging)		

42a: Before lockdown	Weekly; monthly; less than monthly; never	
42b: During lockdown	Weekly; monthly; less than monthly; never	
42c: After lockdown	Weekly; monthly; less than monthly; never	
43: Have you had contact with friends (either face-to-face, by telephone, by video calls, or by instant messaging)		
43a: Before lockdown	Weekly; monthly; less than monthly; never	
43b: During lockdown	Weekly; monthly; less than monthly; never	
43c: After lockdown	Weekly; monthly; less than monthly; never	
44: Have you taken part in activities such as evening classes, social groups, residents associations, or religious gatherings etc. (either face to face or virtually)		
44a: Before lockdown	Weekly; monthly; less than monthly; never	
44b: During lockdown	Weekly; monthly; less than monthly; never	
44c: After lockdown	Weekly; monthly; less than monthly; never	
HEALTH		
45: In general how would you say your health was before lockdown (February 2020)?	Excellent; very good; good; fair; poor	Excellent/very good/good vs fair/poor
46: In general how would you say your health was during lockdown (March – July 2020)?	Excellent; very good; good; fair; poor	Excellent/very good/good vs fair/poor
47: In general how would you say your health was	Excellent; very good; good; fair; poor	Excellent/very good/good vs fair/poor

after lockdown (October 2020)?		
48: What is your current weight?	Weight reported in stones and pounds, or kilograms	Converted to weight in kilograms. Body mass index (BMI) in kg/m^2 was calculated as self-reported weight in kilograms, divided by the square of self-reported height in metres (from baseline questionnaire), and categorised as: normal/underweight (<25 kg/m^2); overweight (25-29.9 kg/m^2); obese (30+ kg/m^2)
49: Which of the following best describes your walking speed?	Unable to walk; very slow; stroll at an easy pace; fairly brisk; fast	Recoded as: unable/very slow vs stroll at an easy pace/fairly brisk/fast
50a: I was bothered by things that usually didn't bother me	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time	CESD score obtained by adding up 50a to 50t. Score ranges between 0 and 60. Recoded as less than 16 vs 16 or more (depressed). Score set to missing if 4 or more items are missing
50b: I did not feel like eating; my appetite was poor	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time	
50c: I felt that I could not shake off feeling low, even with help from my family and/or friends	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time	
50d: I felt I was just as good as other people	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time	
50e: I had trouble keeping my mind on what I was doing	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time	

50f: I felt depressed	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time
50g: I felt that everything I did was an effort	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time
50h: I felt hopeful about the future	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time
50i: I thought my life had been a failure	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time
50j: I felt fearful	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time
50k: My sleep was restless	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time
50l: I was happy	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time
50m: I talked less than usual	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time
50n: I felt lonely	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time
50o: People were unfriendly	Rarely or none of the time; some or little of the time;

	occasionally or a moderate amount of the time; most or all of the time	
50p: I enjoyed life	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time	
50q: I had crying spells	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time	
50r: I felt sad	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time	
50s: I felt that people dislike me	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time	
50t: I could not get "going"	Rarely or none of the time; some or little of the time; occasionally or a moderate amount of the time; most or all of the time	
52: During the first lockdown (since March 2020), how much have you been troubled by the following sleep problems?		Sleep problem defined as: a severe problem in at least one of the symptoms in 52a-52d. Score set to missing if one of the items is missing. The same score has been computed for the period after lockdown
52a: Difficulty falling asleep	No problem; mild problem; moderate problem; severe problem	
52b: Difficulty staying asleep	No problem; mild problem; moderate problem; severe problem	
52c: Waking up too early	No problem; mild problem; moderate problem; severe problem	

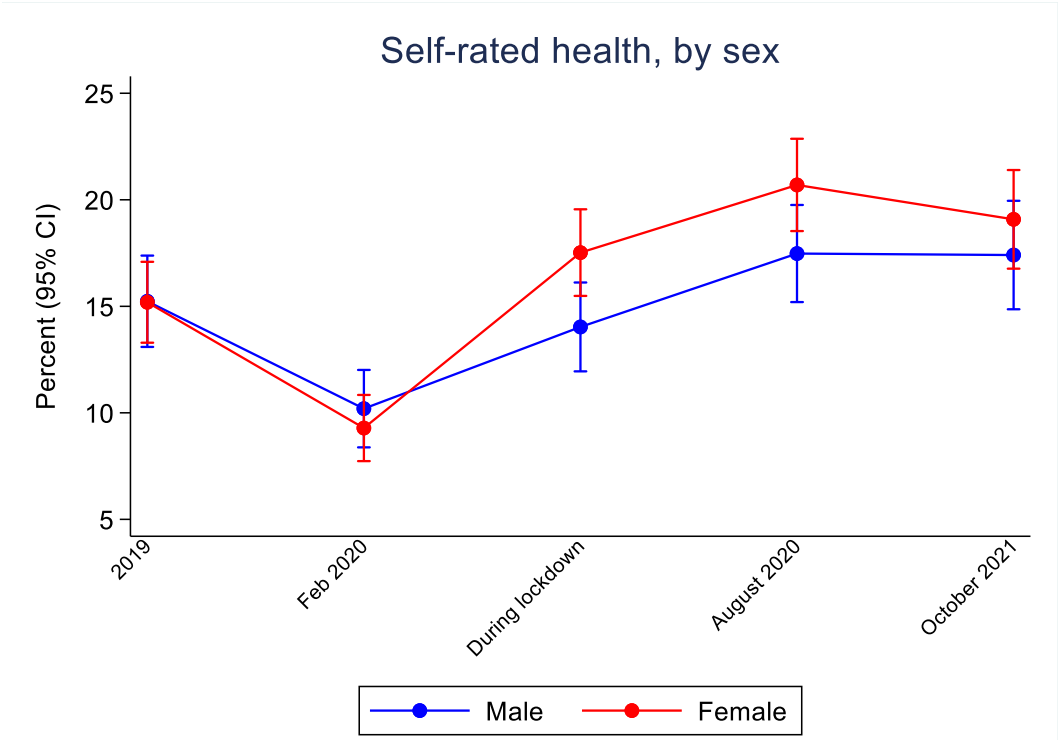
52d: Not feeling refreshed in the morning	No problem; mild problem; moderate problem; severe problem	
54a: During the first lockdown did you have depression?	yes; no	Questions 54a and 55a were assessed also for the period after lockdown
During the first lockdown did you receive treatment for depression?	yes; no	
During the first lockdown did depression limit your activities?	yes; no	
54b: During the first lockdown did you have anxiety?	yes; no	
During the first lockdown did you receive treatment for anxiety?	yes; no	
During the first lockdown did anxiety limit your activities?	yes; no	
56: Since the start of the COVID-19 pandemic have you had pain in your back or neck for a month or longer that made it difficult or impossible to get washed or dressed or do household chores?	Yes, only during lockdown; yes, only since August 2020; Yes, during lockdown and also after August; no	2 new variables derived as: back pain during lockdown (yes vs no) Back pain after lockdown (yes vs no)
57: Since the start of the COVID-19 pandemic have you had pain in your arms or shoulders for a month or longer that made it difficult or impossible to get washed or dressed or do household chores?	Yes, only during lockdown; yes, only since August 2020; Yes, during lockdown and also after August; no	2 new variables derived as: arm pain during lockdown (yes vs no) arm pain after lockdown (yes vs no)
58: Since the start of the COVID-19 pandemic have you had pain in your legs for a month or longer that made it difficult or impossible to get washed or dressed or do household chores?	Yes, only during lockdown; yes, only since August 2020; Yes, during lockdown and also after August; no	2 new variables derived as: leg pain during lockdown (yes vs no) leg pain after lockdown (yes vs no)

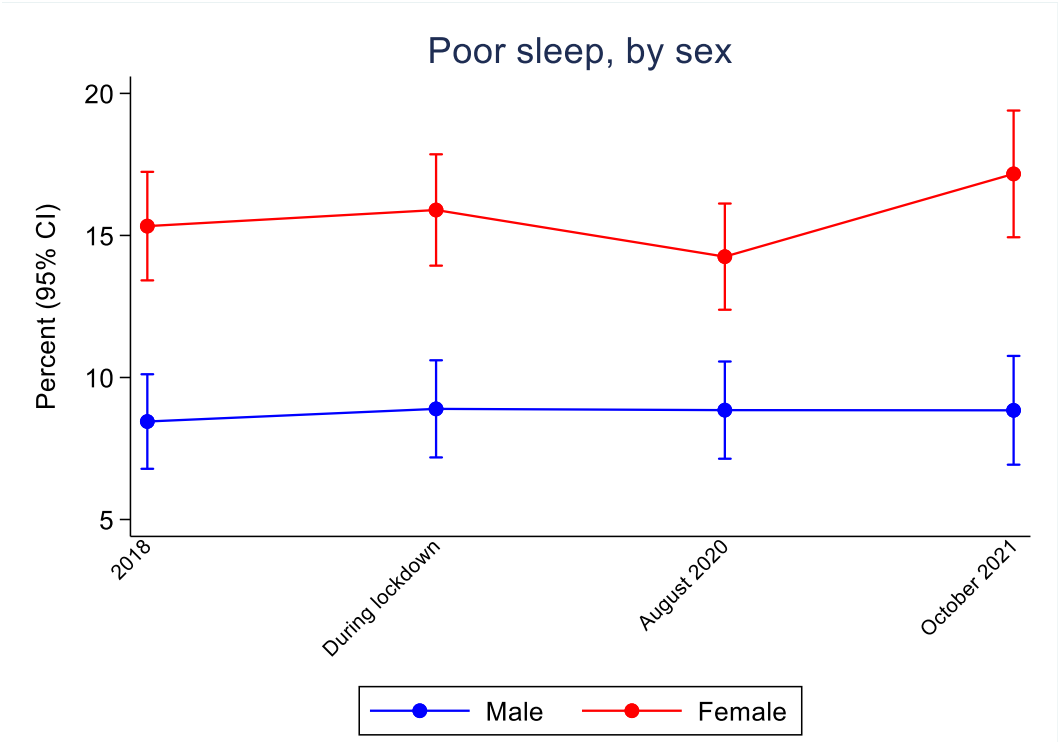
HEALTH BEHAVIOURS		
59: How much of the following do you drink per week, on average?	beer, cider, lager (pints); wine, sherry (glasses); spirits, liqueurs (measures)	Converted to units of alcohol per week
60: Since the beginning of lockdown in March 2020 has your consumption of alcoholic drinks changed?	I have drunk less than usual; I have drunk about the same; I have drunk more than usual; I don't drink	
61: Since the beginning of lockdown in March 2020 have you smoked cigarettes?	Less than usual; about the same; more than usual; I don't smoke	
62: Since the start of the COVID-19 pandemic, how many hours a week have you spent doing physical activities sufficient to make you hot or sweaty? (Enter a number)	Enter a number	
63: Has your level of physical activity changed since the beginning of lockdown in March 2020?	I am less active than usual; I am as active as usual; I am more active than usual	
64: Over the period since March lockdown, how has your diet been?	Less healthy than usual; about the same; more healthy than usual	
65: Over the period since March lockdown, how much have you eaten?	Less than usual; about the same; more than usual	

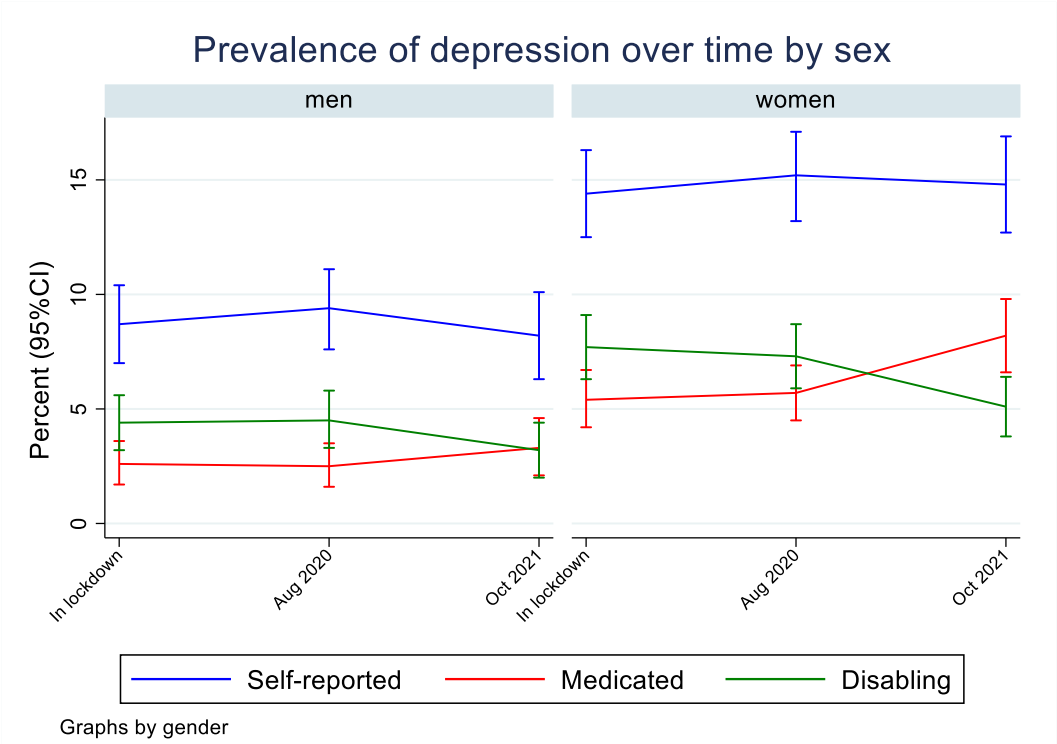
LIFE CHANGES		
66a: My employment situation has worsened	All coded as Strongly agree; agree; neither agree not disagree; disagree; strongly disagree	All recoded as strongly agree/agree vs neither agree not disagree/disagree/strongly disagree
66b: I am enjoying my work more		Q66a and Q66b have been combined and **employment change** has been derived: worse off/same/better off
66c: My household finances have worsened		Q66c and Q66d have been combined and **financial**

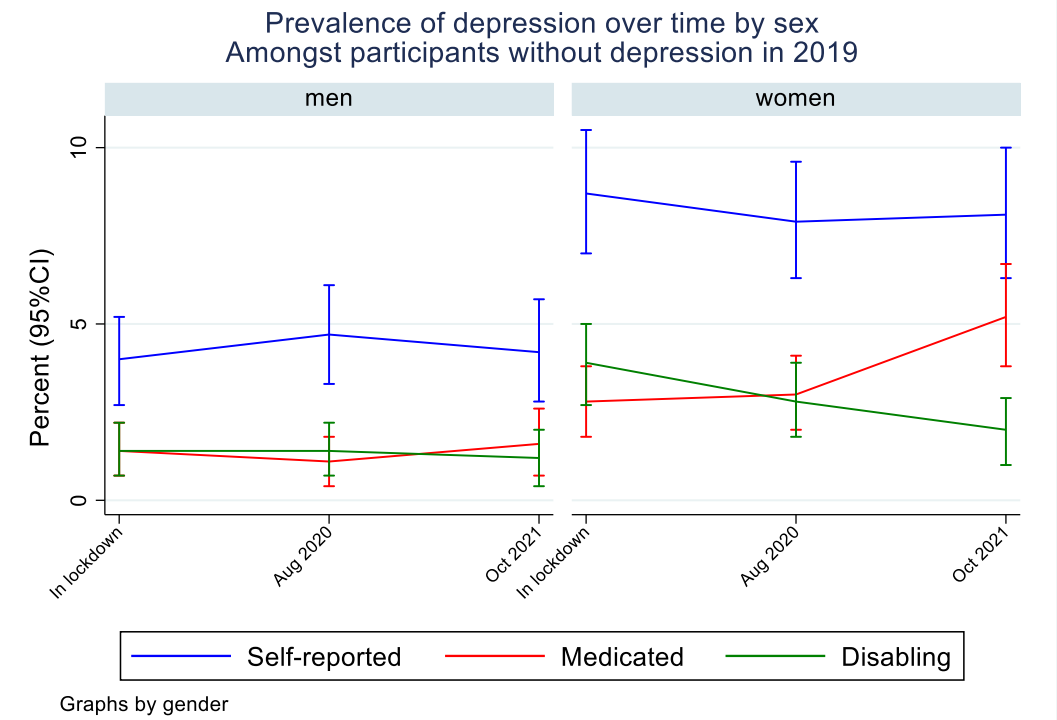
		change has been derived: worse off/same/better off
66d: My household finances have improved		
66e: My mental health has deteriorated		
66f: My physical health has deteriorated		
66g: I have more time for myself/my family		Q66g and Q66h have been combined and **change in time with family** has been derived: worse less time/same/more time
66h: I have less time for myself/my family		
66i: I feel safe travelling by bus		
66j: I feel safe travelling by taxi		
66k: I feel safe travelling by car		
66l: I feel safe travelling by bicycle		
66m: I feel safe travelling by train		
66n: I feel safe accepting a lift in somebody else's car		
67: Lastly, please tell us in your own words how you think the COVID-19 pandemic has affected your life and/or your loved ones.	Free text	

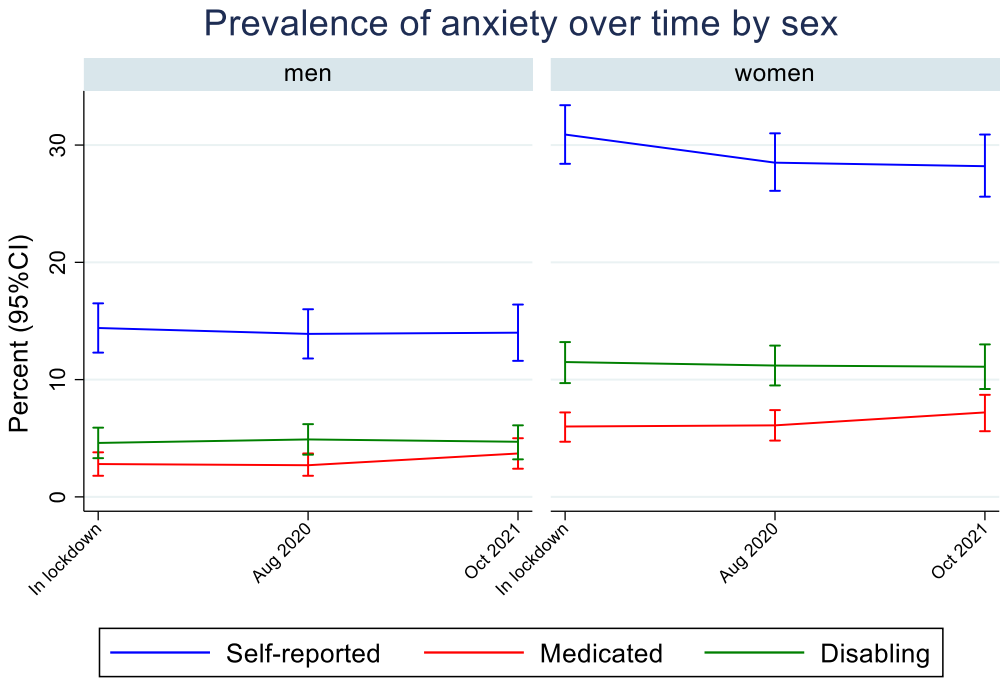
Appendix J Figures by sex

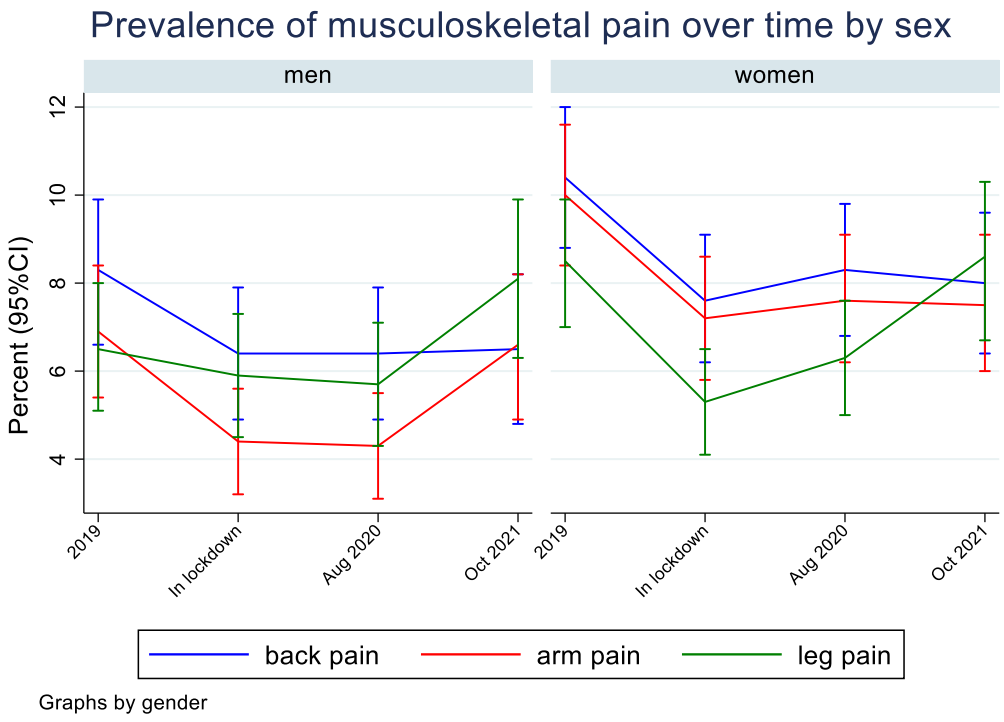





Prevalence of depression over time by sex
men
women
Percent (95%CI)
0
5
10
15
In lockdown
Aug 2020
Oct 2021
Self-reported
Medicated
Disabling
Graphs by gender


Prevalence of depression over time by sex
Amongst participants without depression in 2019
men
women
Percent (95%CI)
0
5
10
In lockdown
Aug 2020
Oct 2021
Self-reported
Medicated
Disabling
Graphs by gender


Prevalence of anxiety over time by sex
men
women
Percent (95%CI)
0
10
20
30
In lockdown
Aug 2020
Oct 2021
Self-reported
Medicated
Disabling
Graphs by gender


Prevalence of musculoskeletal pain over time by sex
men
women
Percent (95%CI)
4
6
8
10
12
2019
In lockdown
Aug 2020
Oct 2021
back pain
arm pain
leg pain
Graphs by gender

Appendix J

dash line shows overall values

Appendix K Sensitivity analysis: Complete case analysis

Table 5-1: Association between changes in employment and health outcomes (first lockdown) - complete case analysis

	Worsening of SRH	Worsening of mental health	Worsening of physical health	Anxiety	Depression	New depression
	RR (95%CI)					
No change: Working same place	Ref	Ref	Ref	Ref	Ref	Ref
Working from home						
Sex-age adjusted	**1.47 (1.00,2.16)**	1.30 (0.93,1.81)	1.25 (0.94,1.67)	1.01 (0.74,1.38)	1.44 (0.87,2.39)	1.89 (0.84,4.24)
Model 1 †	**1.58 (1.08,2.32)**	1.36 (0.99,1.89)	**1.33 (1.01,1.75)**	1.07 (0.79,1.45)	1.51 (0.92,2.47)	1.91 (0.86,4.27)
Furloughed						
Sex-age adjusted	1.07 (0.63,1.82)	1.09 (0.70,1.71)	0.85 (0.56,1.30)	1.17 (0.79,1.73)	1.11 (0.55,2.21)	1.68 (0.60,4.70)
Model 1 †	1.03 (0.60,1.74)	1.02 (0.66,1.60)	0.77 (0.52,1.14)	1.11 (0.75,1.64)	1.02 (0.51,2.01)	1.70 (0.61,4.74)
Decided to retire						
Sex-age adjusted	**1.88 (1.04,3.41)**	1.67 (0.97,2.89)	1.10 (0.63,1.93)	1.33 (0.77,2.31)	**2.35 (1.12,4.91)**	**4.19 (1.50,11.69)**
Model 1 †	**1.93 (1.05,3.57)**	1.64 (0.93,2.92)	1.04 (0.60,1.80)	1.35 (0.78,2.33)	**2.24 (1.07,4.67)**	**4.29 (1.59,11.46)**
Any other change						

Sex-age adjusted	1.37 (0.81,2.31)	1.21 (0.76,1.94)	1.30 (0.88,1.91)	1.28 (0.86,1.90)	**2.28 (1.27,4.09)**	**3.36 (1.36,8.32)**
Model 1 †	1.29 (0.78,2.15)	1.18 (0.75,1.87)	1.22 (0.85,1.77)	1.24 (0.83,1.85)	**2.17 (1.21,3.88)**	**3.30 (1.31,8.31)**

† Adjusted for age, sex, pre-pandemic SRH, pre-pandemic comorbidities, pre-pandemic financial position, pre-pandemic job type. Bold denotes significant at 0.05 level

Table 5-2: Association between changes in employment and health outcomes (second survey) - complete case analysis

	Worsening of SRH	Worsening of mental health	Worsening of physical health	Anxiety	Depression
			RR (95%CI)		
No change: Working same place	Ref	Ref	Ref	Ref	Ref
Working from home					
Sex-age adjusted	0.97 (0.75,1.27)	1.30 (0.83,2.04)	1.04 (0.75,1.44)	**1.56 (1.05,2.34)**	0.79 (0.48,1.31)
Model 1 †	1.00 (0.77,1.30)	1.44 (0.93,2.24)	1.14 (0.83,1.55)	**1.70 (1.15,2.52)**	0.85 (0.51,1.42)
Furloughed					
Sex-age adjusted	**1.33 (1.00,1.78)**	0.88 (0.45,1.70)	0.78 (0.48,1.25)	1.50 (0.90,2.51)	0.74 (0.36,1.52)
Model 1 †	1.31 (0.98,1.75)	0.83 (0.43,1.61)	0.72 (0.46,1.13)	1.41 (0.86,2.31)	0.71 (0.35,1.42)
Decided to retire					
Sex-age adjusted	1.45 (0.96,2.20)	**2.08 (1.00,4.34)**	1.09 (0.57,2.11)	0.57 (0.15,2.17)	0.94 (0.32,2.80)

	Worsening of SRH	Worsening of mental health	Worsening of physical health	Anxiety	Depression
			RR (95%CI)		
Model 1 †	1.47 (0.99,2.20)	**2.17 (1.03,4.58)**	1.14 (0.63,2.04)	0.59 (0.16,2.16)	0.97 (0.33,2.90)
Any other change					
Sex-age adjusted	0.97 (0.66,1.41)	1.29 (0.70,2.37)	1.29 (0.85,1.95)	1.55 (0.90,2.69)	0.99 (0.49,2.00)
Model 1 †	0.95 (0.65,1.38)	1.27 (0.71,2.27)	1.23 (0.84,1.80)	1.56 (0.92,2.66)	0.98 (0.50,1.93)

† Adjusted for age, sex, pre-pandemic SRH, pre-pandemic comorbidities, pre-pandemic financial position, pre-pandemic job type. Bold denotes significant at 0.05 level

Appendix L Sensitivity analysis: restricted to workers in February 2020

Table 5-3: Association between changes in employment and health outcomes (first lockdown) among workers pre-pandemic (RQ2)

	Worsening of SRH	Worsening of mental health	Worsening of physical health	Anxiety	Depression	Incident depression
			RR (95%CI)			
No change: Working same place	Ref	Ref	Ref	Ref	Ref	Ref
Working from home						
Sex-age adjusted	**1.67 (1.17,2.37)**	1.13 (0.84,1.52)	1.17 (0.91,1.49)	0.93 (0.71,1.22)	1.22 (0.81,1.82)	1.33 (0.73,2.43)
Model 1 †	**1.86 (1.28,2.68)**	1.16 (0.86,1.56)	1.25 (0.98,1.59)	1.05 (0.80,1.38)	1.30 (0.85,2.00)	1.58 (0.83,3.01)
Furloughed						
Sex-age adjusted	1.19 (0.74,1.92)	1.04 (0.70,1.53)	0.81 (0.57,1.17)	0.93 (0.65,1.33)	0.94 (0.53,1.65)	0.84 (0.34,2.11)
Model 1 †	1.07 (0.64,1.80)	0.92 (0.61,1.37)	0.75 (0.52,1.08)	0.83 (0.57,1.21)	0.93 (0.52,1.65)	1.03 (0.41,2.62)
Decided to retire						
Sex-age adjusted	**2.03 (1.14,3.61)**	**1.94 (1.24,3.05)**	0.94 (0.53,1.67)	1.29 (0.80,2.07)	**1.92 (1.00,3.67)**	2.27 (0.90,5.69)
Model 1 †	**2.18 (1.19,3.99)**	**1.99 (1.24,3.20)**	0.90 (0.53,1.54)	1.38 (0.86,2.21)	**2.07 (1.07,4.01)**	**2.63 (1.05,6.55)**
Any other change						

	Worsening of SRH	Worsening of mental health	Worsening of physical health	Anxiety	Depression	Incident depression
			RR (95%CI)			
Sex-age adjusted	1.15 (0.65,2.02)	0.91 (0.57,1.48)	1.09 (0.75,1.57)	1.08 (0.73,1.58)	1.58 (0.93,2.67)	1.67 (0.74,3.76)
Model 1 †	1.07 (0.59,1.96)	0.87 (0.54,1.40)	0.96 (0.66,1.41)	1.08 (0.73,1.61)	1.52 (0.89,2.61)	1.78 (0.72,4.41)

† Adjusted for age, sex, pre-pandemic SRH, pre-pandemic comorbidities, pre-pandemic financial position, pre-pandemic job type. Bold denotes significant at 0.05 level

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