Health & Place 90 (2024) 103376

Contents lists available at ScienceDirect

Health and Place

journal homepage: www.elsevier.com/locate/healthplace

Does the health of local populations modify occupational differences in employment rates of older workers? Findings from the ONS Longitudinal Study 2001–2011

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A B S T R A C T

Poor health is a key reason for early exit from the labour market. Few studies have explored how the health of local populations is related to occupational differences in employment outcomes among older people. Our study used data for England and Wales from the ONS Longitudinal Study linked with 2001 Census measures of the health of the older working age population at local authority level. We included 128,710 people aged 40-64y in 2001 who were in paid work in the previous five years. We investigated the associations of both occupation and area level with two employment outcomes ten years later (in 2011): i) in paid work or not; ii) economic activity (employed (reference), unemployed, retired, sick/disabled, other). People in elementary occupations were more likely to not be in paid work in 2011 compared to those in managerial occupations (RRR 1·55 [95%CI 1·47,1·64]). Compared to the healthiest third of local authority areas, being resident in the unhealthiest third was associated with greater likelihood of not being in paid employment ten years later (RRR 1·25 [95% CI 1·18,1·33]). While area level health was associated with employment outcomes for all major occupation groups, the gap between the healthiest and unhealthiest areas was most marked for skilled trades; process, plant and machine operatives; and elementary occupations. Occupational differences for the economic activity outcome were most marked for the sick/disabled category. Policies to improve the health of local populations may support retention and reduce occupational inequalities in employment rates of older workers.

1. Introduction

Previous research has shown that a person's health is associated with the likelihood of being in paid work, including among older workers (which we consider to be age 50 and over in the context of the research presented in this paper). Poor health is related to early exit from the labour market, with associations particularly marked for the transition to disability pension but also observed for transition to retirement (van Rijn et al., 2014). Exit from the labour market among older people has been shown to be associated with several measures of health (Burdorf et al., 2023; van Rijn et al., 2014), including self-rated health (van Rijn et al., 2014), mental health (Clark et al., 2017; Harber-Aschan et al., 2020), chronic conditions (van Rijn et al., 2014) and sickness absence rates (Farrants et al., 2023). The systematic review by Van Rijn showed that associations were strongest for self-rated health compared with mental health or chronic disease (van Rijn et al., 2014).

There are also inequalities in early labour market exit by type of occupation with employees in manual occupations more likely to leave work early for health reasons (Carr et al., 2018) and occupational differences in health-related job loss for older workers in England (Syddall et al., 2020). These inequalities reflect known occupational inequalities in health status (numerous studies have shown that socio-economic position measured by occupation is related to general health as well as specific chronic diseases). This may partly reflect the nature of the occupation, for example, people in physically demanding jobs, or in poor quality jobs are more likely to be out of work before statutory pension age (Karpansalo et al., 2002).

Where a person lives is also important, as there are geographical variations in both the health of local populations and employment rates (The Health Foundation, 2019). Despite evidence that inequalities in the health of local populations are entrenched (Norman et al., 2022), very few studies have examined how the health of the local population where people live relates to retention of older workers in the labour market over and above their own health status. A cross-sectional study in England and Wales found that residing in the unhealthiest third of local authorities was associated with employment outcomes, with the strongest associations observed for area measures based on self-reported health (Murray et al., 2022a). Furthermore, to our knowledge, no

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https://doi.org/10.1016/j.healthplace.2024.103376
Received 9 April 2024; Received in revised form 7 October 2024; Accepted 25 October 2024
Available online 11 November 2024

previous studies have investigated whether the health of local populations modifies occupational differences in employment of older workers. In this paper which aims to address this research gap, we refer to measures of the health of local populations at subnational geographies as measures of 'health in a place' (Murray et al., 2022a, 2022b).

This research is important for several reasons. As there are occupational differences in both individual health and age of exit from the labour market, it is possible that part of the reason that area health measures correlate with employment rates is due to differences in types of occupation in different areas. But also, it may be that healthy areas are an asset that have broader economic benefits and it has been suggested that the health of people in places should be viewed as a social and economic asset in its own right (Marshall et al., 2018). In recent years, there has been some recognition of the importance of health for tackling regional inequalities, for example, the 'levelling up' agenda of recent UK government administrations (HM Government, 2022; Local government funding in England | Institute for Government," 2020). Our research is also important in the context of increasing pension ages and policies to extend people's working lives.

Using nationally representative longitudinal data for England and Wales linked to measures of health in a place based on self-reported health, we seek to address this gap. The aim of this paper is to investigate whether occupational differences in employment outcomes are modified according to the health of local populations where people live, a 'health in a place' effect. This research is relevant to policies that target local health inequalities and might indicate that investment in reducing health inequalities can have wider economic benefits and lead to improved economic outcomes in local areas. We address the following specific research questions.

- To what extent are there occupational differences in employment outcomes at ages 50–74, after taking account of individual health and health in a place?
- Do occupational differences contribute to the variation in employment outcomes by health in a place?
- Are occupational differences in employment outcomes modified by health in a place?

2. Methods

2.1. Study participants

We used data from the Office for National Statistics Longitudinal Study (LS), a 1% representative sample of the population of England and Wales, drawn initially from respondents to the 1971 Census that had been born on one of four birthdays (Shelton et al., 2019). New members are added to the LS if either newly born or immigrants with the same birthdays. Subsequent census records and life events data (including births, deaths, and cancer registrations) for LS members have been continuously recorded in the LS dataset. For this study, we included people aged 40–64 in 2001 who were in paid work either in 2001 or in the previous five years.

2.2. Employment outcomes

Employment outcomes were measured 10 years later, in 2011, when people were aged 50–74. At the 2011 Census, LS respondents completed a series of questions relating to paid employment in the week preceding the census ("CeLSIUS data dictionary," n.d.). LS members were also asked 'Last week, were you: (tick all that apply)': 'retired', 'a student', 'looking after home or family', 'long term sick or disabled' or 'none of the above'. We analysed two outcomes: i) In paid work or not in the week preceding the 2011 census and ii) economic activity classified as employed, unemployed, retired, sick/disabled, or other. As more than one non-work category could be chosen, any mention of 'long term sick/disabled' was prioritized first, followed by retired. For both employment outcomes, deaths occurring between 2001 and 2011 were recorded as an additional category.

2.3. Occupation

Occupation in 2001 was categorised in two ways, into Standard Occupational Classification (SOC) major groups (9 categories) and into the more detailed SOC minor groups ("SOC, 2000 - Office for National Statistics," n.d.). For the latter, we included only those minor groups with at least 200 individuals in the selected LS sample.

2.4. Health in a place measures

We measured 'health in a place' using data from the 2001 Census for the whole population aged 50-74y usually resident in each local authority. As we wanted to use 2011 boundaries for local authority areas, this 2001 data was aggregated directly into 2011 local authority areas. For each local authority area, the proportion of census respondents aged 50-74y who reported 'fair', 'bad' or 'very bad' self-rated health (as opposed to 'good' or 'very good') was calculated. Local authority areas were divided into three equal sized groups: 'healthiest', 'medium', and 'unhealthiest'. This health measure was chosen because in a previous study, it was found to be most strongly associated with employment outcomes when compared with other health indicators that are measured for the whole population and available at local authority level (Murray et al., 2022a). We also used disability-free life expectancy at age 50 in 2001 as an alternative indicator of 'health in a place' as it combines mortality and morbidity to give the average number of years after age 50 spent free from a limiting long-term illness or disability.

Staff at the Centre for Longitudinal Study Information and User Support (CeLSIUS) linked each LS member's local authority identifier in 2001 to provide us with local authority level 'health in a place' measures for LS members.

2.5. Covariates

Individual level covariates were taken from 2001 LS data and included age in years of the LS respondent in 2001, sex, individual self-rated health, hours providing informal care, highest qualification level, whether self-employed or not, and whether in part-time or full-time work. The question on self-rated health asked individuals 'over the last 12 months would you say, your health has on the whole been: very good, good, fair, bad or very bad?'.

Area level local unemployment rates and Townsend deprivation scores for each local authority in 2001 were also linked to individual level data for LS members.

2.6. Statistical analysis

First, distributions of employment outcomes, occupational groups, health-in-a-place measures and covariates were described for the LS analysis sample used in this paper.

Multilevel multinomial logistic regression was used to investigate associations of both occupation and area level health in 2001 with the two employment outcomes in 2011. This confirmed that there was variation in employment outcomes at both area and occupational levels.

The main analyses used generalized structural equation modelling, with a random intercept at local authority level, to assess associations of occupational group and health-in-a-place measures with the two multinomial employment outcomes.: in paid work or not (reference group = in paid work) and economic activity (reference group = employed). For both outcomes, deaths between 2001 and 2011 were included as an additional category. Results from these models with multinomial outcomes are presented as relative risk ratios (RRR).

Models for health in a place (model 1a) and occupational group (model 1b) were initially adjusted for age and sex. Models 2a and 2b

were additionally adjusted for individual self-rated health, hours of caring, and highest qualification level. Model 3 included both health in a place and occupational group plus the individual level covariates. Finally, model 4 added a further adjustment for area unemployment rate. Age and area unemployment rates were included as continuous variables after checking for departure from linearity. All other variables were included as categorical variables.

To assess whether differences in employment outcomes by individual occupations were modified by area health, an interaction term between occupational group and area health was added to the model with adjustment for all covariates. Results from this analysis are presented for each combination of occupational group and area health relative to individuals in managerial occupations resident in the healthiest areas.

Our analyses of the more detailed SOC minor occupation groupings were restricted to those minor occupations with more than 200 people. We included minor occupation as a random intercept in a model with adjustment for other covariates to test whether there was variation in the likelihood of being in paid work in 2011 among the minor occupation groups. To illustrate these occupational differences, we present results as a caterpillar plot showing the random intercepts for each minor occupations ranked by the likelihood of not being in paid work in 2011. To assess whether the health in a place modified minor occupational group differences in employment outcomes, we fitted a model with a random slope for area health. To illustrate this, results are presented as a caterpillar plot showing the random slopes for each minor occupation ranked by the difference in the likelihood of not being in paid work between the unhealthiest areas and the healthiest areas.

Further analyses were run for men and women separately, as a previous study found that associations of area self-rated health with employment outcomes were slightly stronger for men than women (Murray et al., 2022a). We also analysed data stratified by age split into two groups based on whether or not they had reached State Pension age in 2011 (age 60 for women born up to May 1950, then rising incrementally to 61 for those women born up to May 1951; age 65 for men). To illustrate these differences in employment outcomes by area health and occupational group, we estimated predicted probabilities of being in work in 2011 for men and women separately as a function of single years of age before and after State Pension age.

Additionally, we ran three sensitivity analyses: a) with analyses restricted to those in work in 2001, with further adjustment for additional individual level covariates that were only measured for those LS members who were in paid work in the week preceding the 2001 census (full-time or part-time work; whether self-employed or not); b) with disability-free life expectancy at age 50 as an alternative measure of health in a place; and c) with adjustment for Townsend deprivation score as an alternative to local unemployment rates.

All analyses were carried out using Stata 17.

3. Results

Our eligible sample included people aged 40–64 in 2001 who were in paid work either in 2001 or in the previous five years, and who were either in the 2011 Census or died before 2011. Exclusion of a very small number of LS members (<10) living in two local authority areas (City of London and Isles of Scilly) where the health in a place measure and deprivation data were not available, resulted in an analysis sample of 128,710 (67,597 men and 61,113 women).

Table 1 describes the characteristics of the sample included in analyses for this paper. Of the 128,710 people in paid work in 2001 or the preceding five years, 53% were in paid work in 2011 when they were aged 50–74, 41·7% were not in paid work and 5·3% had died between the two censuses. In terms of economic activity, 32·4% were retired in 2011, 2% were unemployed and 3·2% reported being long-term sick or disabled. Table 2 gives the percentage of the total sample in each of the SOC major occupation groups, as well as the corresponding percentages for men and women separately. Table 2 also shows that people living in the healthiest third of areas were more likely to be in the 'Managers and senior officials' or 'Professional' SOC major occupation groups in 2001 and less likely to be in the 'Elementary' major occupation group than people living in the unhealthiest third of areas ($p < 0.001$).

Table 1
Distribution of outcomes, area health measures, and covariates for analysis sample: all, men, women aged 50–74 in 2011, ONS Longitudinal Study (n = 128,710).

	All aged 50–74 in 2011	Men	Women
N	128,710	67,597	61,113
Employment outcomes in 2011			
Employment status, %			
In paid work	53·0	55·7	50·1
Not in paid work	41·7	38·0	45·6
Died	5·3	6·4	4·1
Economic activity in 2011, %			
Employed	54·2	56·6	51·4
Unemployed	2·0	2·6	1·4
Retired	32·4	29·3	35·8
Sick/disabled	3·2	3·3	3·2
Other	3·0	1·8	4·3
Died	5·3	6·4	4·1
'Health in a place' measures in 2001			
Area level self-rated health 2001, age 50–74, %			
Healthiest third	28·6	28·6	28·8
Medium	31·4	31·3	31·6
Unhealthiest third	39·9	40·1	39·7
Individual level covariates in 2001			
Poor self-rated health, %	34·1	32·9	35·5
Hours providing informal care, %			
No care provided	81·8	84·3	79·0
1–19 h a week	14·0	12·4	15·9
20–49 h a week	1·8	1·4	2·2
50+ hours a week	2·4	2·0	2·9
Highest qualification, %			
No qualifications	30·7	29·7	31·8
Level 1:GCSE/O Level	15·9	15·3	16·5
Level 2:5 O level/GCS	15·9	14·4	17·6
Level 3: 2 A Level/HS	5·4	5·5	5·3
Degree level and above	21·1	21·0	21·1
Other	11·1	14·2	7·6
Area level unemployment rate in 2001			
Mean, range	2·85 (1·24- 6·73)	2·85 (1·24- 6·73)	2·84 (1·24- 6·73)

The analysis of the more detailed SOC minor occupation grouping was restricted to those occupations with at least 200 people and included 75 out of a total of 81 SOC minor occupations, giving an analysis sample of 127,990 (see footnote to supplementary Table 1 for a list of the six minor occupations that were excluded). There was some variation in area health between the more detailed SOC minor groupings. For example, within the SOC major grouping 'elementary occupations', the proportion resident in the unhealthiest third of areas ranged from 55·8% for the SOC minor occupation grouping 'Elementary Process Plant Occupations to 23·5% for 'Elementary Agricultural Occupations' (supplementary Table 1).

3.1. SOC major groups

Initial multilevel analysis confirmed that there is both area-level and

Table 2
Distribution of major occupations in 2001 for analysis sample: all, men, women aged 50–74 in 2011, and by area level health in 2001, ONS Longitudinal Study (n = 128,710).

	Total			Area level self-rated health 2001, age 50-74		
	All aged 50–74 in 2011	Men	Women	Healthiest areas	Middle	Unhealthiest areas
N	128,710	67,597	61,113	36,866	40,467	51,377
Major occupation group in 2001, %						
1. Managers and senior officials	15·8	20·5	10·6	19·8	16·0	12·9
2. Professional	11·2	12·2	10·2	13·8	11·0	9·6
3. Associate professional and technical	11·4	11·4	11·4	12·5	11·7	10·4
4. Administrative and secretarial	13·6	4·9	23·2	14·8	13·9	12·5
5. Skilled trades	12·1	20·1	3·2	11·2	12·2	12·6
6. Personal service occupations	7·2	2·1	12·8	6·6	7·3	7·5
7. Sales and customer service	6·1	2·3	10·3	5·2	6·3	6·6
8. Process, plant and machine operatives	10·2	15·5	4·3	6·9	9·5	13·1
9. Elementary	12·5	11·0	14·1	9·4	12·1	14·9

occupational-level variation in employment outcomes. Both area-level health and occupational group were associated with not being in paid work ten years later, after adjusting for age and sex (Table 3, models 1a and 1b). These associations were attenuated but persisted after adjusting for individual-level covariates (Table 3, models 2a and 2b). Both the health in a place and individual-level occupation were independently associated with employment outcomes ten years later, after adjusting for each other (Table 3, model 3). In a final model, we additionally adjusted for area unemployment rates (Table 3, model 4), which showed an increased risk of not being in paid work for those living in the unhealthiest areas relative to the healthiest areas (RRR 1·25 (95% CI 1·18, 1·33)). Those in elementary occupations were less likely to be in paid work in 2011 compared to those in managerial occupations (RRR 1·55 (95%CI 1·47, 1·64)).

Table 4 shows associations of occupational group and area-level health with the 2011 economic activity outcome. There were occupational group differences for each possible economic activity outcome (unemployed, retired, sick/disabled, other) compared to the reference employed group. Occupational group differences were most marked for the sick/disabled and unemployed categories (age- and sex-adjusted RRRs for 'Elementary' occupations vs 'Managers and senior officials': 4·15 and 1·87 respectively). These associations of occupation with economic activity remained after adjustment for area-level health and other covariates (RRRs from model with all adjustments: unemployed 1·62, retired 1·22, sick/disabled 2·26).

Area-level health in 2001 was also associated with the economic activity outcomes in 2011 after adjusting for occupation and other individual level covariates. Living in the unhealthiest areas compared to the healthiest areas was associated with an increased likelihood of being unemployed (RRR 1·44), being retired (RRR 1·30), and being sick/disabled (RRR 1·88). However, further adjustment for local unemployment rate reduced the magnitude of the association of area-level health with being sick/disabled (RRR 1·57) and there was no longer an association with likelihood of being unemployed (RRR 0.94). In contrast, the

Table 3
Adjusted Relative Risk Ratio[a] of not being in paid work in 2011 (vs. in paid work) by tertile of local authority level self-rated health in 2001 and major occupation in 2001, ONS Longitudinal Study (n = 128,710).

	Model 1a: occupation adjusted for age & sex	Model 1b: area health adjusted for age & sex	Model 2a: occupation adjusted for individual level covariates[b]	Model 2b: area health adjusted for individual level covariates[b]	Model 3: occupation, area health & individual level covariates[b]	Model 4: Model 3 + area level unemployment
Area level self-rated health 2001, age 50–74						
Healthiest tertile		1		1	1	1
Medium tertile	–	1·17 (1·12, 1·22)	–	1·12 (1·07, 1·17)	1·11 (1·06, 1·16)	1·08 (1·03, 1·13)
Unhealthiest tertile		1·49 (1·42, 1·55)		1·36 (1·30, 1·41)	1·33 (1·28, 1·38)	1·25 (1·18, 1·33)
Major occupation 2001						
1. Managers and senior officials	1		1		1	1
2. Professional	1·13 (1·07, 1·20)	–	1·19 (1·12, 1·26)	–	1·17 (1·11, 1·25)	1·18 (1·11, 1·25)
3. Associate professional and technical	1·10 (1·04, 1·17)		1·10 (1·04, 1·17)		1·09 (1·03, 1·16)	1·09 (1·03, 1·15)
4. Administrative and secretarial	1·24 (1·17, 1·30)		1·23 (1·17, 1·30)		1·22 (1·15, 1·28)	1·22 (1·15, 1·28)
5. Skilled trades	1·17 (1·11, 1·25)		1·06 (1·00, 1·13)		1·04 (0·98, 1·11)	1·04 (0·98, 1·11)
6. Personal service occupations	1·32 (1·24, 1·40)		1·21 (1·13, 1·28)		1·18 (1·11, 1·26)	1·18 (1·11, 1·26)
7. Sales and customer service	1·52 (1·42, 1·62)		1·36 (1·26, 1·45)		1·33 (1·24, 1·42)	1·33 (1·24, 1·42)
8. Process, plant and machine operatives	1·58 (1·49, 1·67)		1·35 (1·28, 1·44)		1·30 (1·23, 1·38)	1·30 (1·23, 1·38)
9. Elementary	1·91 (1·81, 2·01)		1·60 (1·52, 1·69)		1·55 (1·47, 1·64)	1·55 (1·47, 1·64)

[a] Relative Risk Ratios for Died versus In paid work not shown.
[b] Adjusted for age, sex, individual self-rated health, hours of caring, highest qualification level.

Table 4
Adjusted Relative Risk Ratio[a] of economic activity in 2011 (vs. employed) by tertile of local authority level self-rated health in 2001 and major occupation in 2001, ONS Longitudinal Study (n = 128,710).

	Model 1a: occupation adjusted for age & sex	Model 1b: area health adjusted for age & sex	Model 2a: occupation adjusted for individual level covariates[b]	Model 2b: area health adjusted for individual level covariates[b]	Model 3: occupation, area health & individual level covariates[b]	Model 4: Model 3 + area level unemployment
(A) Unemployed (vs employed):						
Area level self-rated health 2001, age 50–74						
Healthiest tertile		1		1	1	1
Medium tertile	–	1·22 (1·09, 1·38)	–	1·18 (1·05, 1·33)	1·17 (1·04, 1·32)	0·98 (0·86, 1·12)
Unhealthiest tertile		1·58 (1·40, 1·78)		1·48 (1·31, 1·67)	1·44 (1·28, 1·62)	0·94 (0·79, 1·10)
Major occupation 2001						
1. Managers and senior officials	1		1		1	1
2. Professional	0·89 (0·76, 1·04)	–	0·92 (0·78, 1·08)	–	0·90 (0·77, 1·06)	0·90 (0·77, 1·06)
3. Associate professional and technical	1·01 (0·87, 1·18)		1·01 (0·87, 1·18)		0·99 (0·85, 1·15)	0·98 (0·84, 1·15)
4. Administrative and secretarial	1·38 (1·18, 1·62)		1·37 (1·17, 1·61)		1·34 (1·15, 1·57)	1·33 (1·14, 1·56)
5. Skilled trades	1·21 (1·05, 1·39)		1·14 (0·98, 1·31)		1·11 (0·96, 1·28)	1·10 (0·95, 1·28)
6. Personal service occupations	0·87 (0·68, 1·10)		0·83 (0·65, 1·05)		0·80 (0·63, 1·02)	0·79 (0·62, 1·01)
7. Sales and customer service	1·47 (1·20, 1·80)		1·39 (1·13, 1·70)		1·34 (1·09, 1·64)	1·33 (1·08, 1·62)
8. Process, plant and machine operatives	1·60 (1·38, 1·87)		1·47 (1·27, 1·71)		1·40 (1·20, 1·62)	1·38 (1·19, 1·61)
9. Elementary	1·87 (1·62, 2·16)		1·70 (1·47, 1·97)		1·64 (1·42, 1·89)	1·62 (1·40, 1·86)
(B) Retired (vs employed):						
Area level self-rated health 2001, age 50–74						
Healthiest tertile		1		1	1	1
Medium tertile	–	1·11 (1·05, 1·18)	–	1·10 (1·03, 1·16)	1·09 (1·03, 1·16)	1·13 (1·06, 1·21)
Unhealthiest tertile		1·35 (1·29, 1·42)		1·31 (1·24, 1·38)	1·30 (1·24, 1·37)	1·42 (1·30, 1·55)
Major occupation 2001						
1. Managers and senior officials	1		1		1	1
2. Professional	1·29 (1·20, 1·39)	–	1·28 (1·19, 1·38)	–	1·27 (1·18, 1·37)	1·27 (1·18, 1·37)
3. Associate professional and technical	1·13 (1·06, 1·20)		1·11 (1·04, 1·19)		1·10 (1·03, 1·18)	1·10 (1·03, 1·18)
4. Administrative and secretarial	1·23 (1·16, 1·31)		1·23 (1·15, 1·31)		1·22 (1·14, 1·30)	1·22 (1·15, 1·30)
5. Skilled trades	0·92 (0·86, 0·99)		0·88 (0·82, 0·94)		0·87 (0·81, 0·93)	0·87 (0·81, 0·93)
6. Personal service occupations	1·11 (1·03, 1·19)		1·06 (0·98, 1·14)		1·04 (0·97, 1·12)	1·04 (0·97, 1·12)
7. Sales and customer service	1·25 (1·16, 1·36)		1·19 (1·10, 1·29)		1·17 (1·08, 1·27)	1·17 (1·08, 1·27)
8. Process, plant and machine operatives	1·19 (1·11, 1·27)		1·11 (1·04, 1·20)		1·07 (1·00, 1·15)	1·08 (1·00, 1·16)
9. Elementary	1·35 (1·27, 1·44)		1·25 (1·17, 1·33)		1·21 (1·14, 1·29)	1·22 (1·14, 1·30)
(C) Sick/disabled (vs employed):						
Area level self-rated health 2001, age 50–74						
Healthiest tertile		1		1	1	1
Medium tertile	–	1·56 (1·41, 1·74)	–	1·36 (1·23, 1·50)	1·32 (1·20, 1·46)	1·23 (1·10, 1·37)
Unhealthiest tertile		2·59 (2·33, 2·87)		1·97 (1·79, 2·18)	1·88 (1·71, 2·07)	1·57 (1·34, 1·82)
Major occupation 2001						
1. Managers and senior officials	1		1		1	1
2. Professional	0·63 (0·52, 0·76)	–	0·80 (0·66, 0·97)	–	0·78 (0·64, 0·95)	0·78 (0·64, 0·95)
3. Associate professional and technical	1·07 (0·91, 1·25)		1·11 (0·95, 1·29)		1·08 (0·92, 1·26)	1·08 (0·92, 1·26)
4. Administrative and secretarial	1·27 (1·10, 1·47)		1·23 (1·06, 1·42)		1·20 (1·03, 1·38)	1·19 (1·03, 1·37)
5. Skilled trades	2·18 (1·90, 2·51)		1·53 (1·32, 1·78)		1·47 (1·26, 1·70)	1·46 (1·26, 1·70)
6. Personal service occupations	2·22 (1·91, 2·57)		1·72 (1·48, 2·00)		1·65 (1·42, 1·92)	1·64 (1·41, 1·91)

(*continued on next page*)

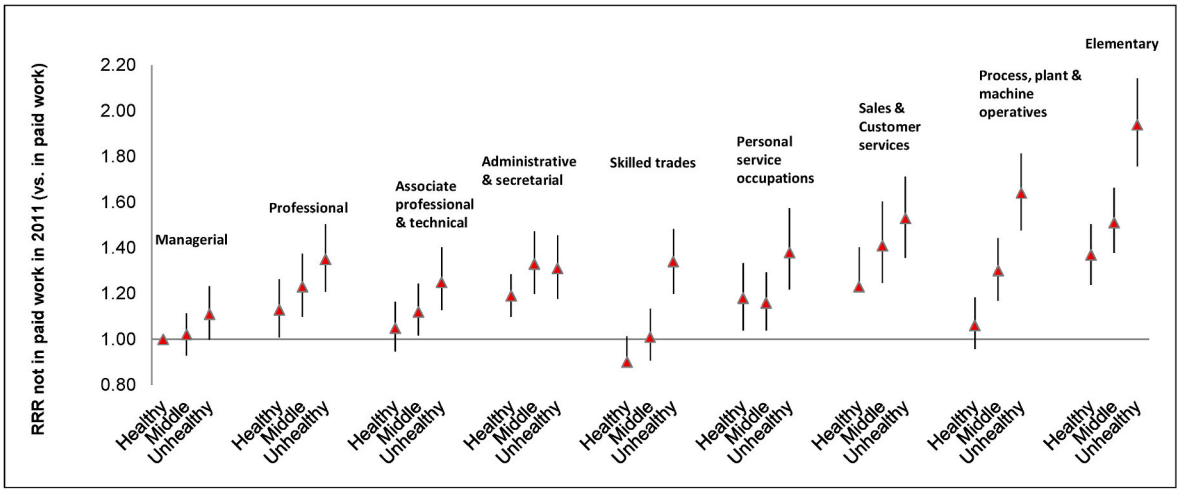
Table 4 (*continued*)

	Model 1a: occupation adjusted for age & sex	Model 1b: area health adjusted for age & sex	Model 2a: occupation adjusted for individual level covariates[b]	Model 2b: area health adjusted for individual level covariates[b]	Model 3: occupation, area health & individual level covariates[b]	Model 4: Model 3 + area level unemployment
7. Sales and customer service	2·39 (2·01, 2·84)		1·65 (1·38, 1·98)		1·57 (1·31, 1·88)	1·56 (1·30, 1·87)
8. Process, plant and machine operatives	3·37 (2·93, 3·87)		2·04 (1·76, 2·37)		1·87 (1·62, 2·17)	1·87 (1·61, 2·16)
9. Elementary	4·15 (3·65, 4·70)		2·41 (2·11, 2·77)		2·28 (1·99, 2·61)	2·26 (1·97, 2·59)
(D) Other (vs employed):						
Area level self-rated health 2001, age 50–74						
Healthiest tertile		1		1	1	1
Medium tertile	–	1·25 (1·14, 1·37)	–	1·16 (1·06, 1·28)	1·14 (1·04, 1·26)	1·05 (0·94, 1·16)
Unhealthiest tertile		1·36 (1·24, 1·49)		1·18 (1·08, 1·30)	1·15 (1·05, 1·26)	0·92 (0·80, 1·07)
Major occupation 2001						
1. Managers and senior officials	1		1		1	1
2. Professional	0·81 (0·70, 0·94)	–	0·88 (0·75, 1·04)	–	0·88 (0·74, 1·04)	0·88 (0·74, 1·04)
3. Associate professional and technical	0·95 (0·82, 1·09)		0·97 (0·84, 1·12)		0·96 (0·83, 1·11)	0·96 (0·83, 1·11)
4. Administrative and secretarial	1·05 (0·91, 1·20)		1·06 (0·92, 1·22)		1·05 (0·91, 1·21)	1·05 (0·91, 1·21)
5. Skilled trades	1·43 (1·24, 1·66)		1·27 (1·09, 1·47)		1·26 (1·08, 1·46)	1·25 (1·08, 1·45)
6. Personal service occupations	1·54 (1·34, 1·76)		1·38 (1·20, 1·59)		1·37 (1·19, 1·57)	1·36 (1·18, 1·57)
7. Sales and customer service	1·87 (1·61, 2·18)		1·62 (1·38, 1·90)		1·60 (1·36, 1·88)	1·60 (1·36, 1·88)
8. Process, plant and machine operatives	1·80 (1·54, 2·09)		1·45 (1·24, 1·69)		1·43 (1·22, 1·66)	1·42 (1·22, 1·66)
9. Elementary	2·32 (2·06, 2·62)		1·82 (1·60, 2·08)		1·80 (1·58, 2·05)	1·79 (1·57, 2·05)

[a] Relative Risk Ratios for Died versus employed not shown.
[b] Adjusted for age, sex, individual self-rated health, hours of caring, highest qualification level.

increased likelihood of being retired for people living in the unhealthiest areas was slightly more marked (RRR 1.42) after adjustment for unemployment rate.

There was a significant interaction between health in a place and occupational group. While health of a place was associated with employment outcomes for all major occupation groups, the strength of



* Interaction between health of a place and major occupation (baseline group: managerial occupation and healthiest area level self-rated health in 2001); adjusted for age, sex, individual self-rated health, hours of caring, highest qualification level, and area level unemployment rate

Fig. 1. Adjusted* Relative Risk Ratio (95%CI) of not being in paid work in 2011 (vs. in paid work) from model with interaction between tertile of local authority level self-rated health in 2001 and major occupation in 2001, ONS Longitudinal Study (n = 128,710)
* Interaction between health of a place and major occupation (baseline group: managerial occupation and healthiest area level self-rated health in 2001); adjusted for age, sex, individual self-rated health, hours of caring, highest qualification level, and area level unemployment rate.

association varied by occupation and was stronger for people in three of the SOC major occupation groups: skilled trades; process, plant and machine operatives; and elementary occupations. In these occupations, the gap between the healthiest and unhealthiest areas in terms of relative risk of not being in paid work ten years later was more marked than for the other occupational groups (Fig. 1). Corresponding results from a model with economic activity as the outcome also indicated an interaction between health in a place and occupational group although confidence intervals were wide (Supplementary Fig. 1a-1c).

3.2. SOC minor groups

We ran similar analyses with the more detailed SOC minor occupation groupings restricting analyses to those minor occupations with more than 200 people. First, we fitted a model with a random intercept for minor occupation which confirmed that there was significant occupational variation in likelihood of not being in paid work after adjustment for area health and other covariates. This is illustrated in Supplementary Figure 2a which shows random intercepts for each minor occupation ranked (caterpillar plot) by lowest to highest likelihood of being in paid work in 2011. We used different colours for minor occupations within each major occupation group to show the extent of variation between minor occupation group within a particular major grouping. This shows differences in employment rates by minor occupation even with the same major occupation grouping, for example, within the SOC major groupings 'Elementary' (blue bars) and 'Managers and senior officials' (red bars). Next, to assess whether health in a place modified these minor occupational differences in employment outcomes, we fitted a model including a random slope for area health. Supplementary Figure 2b illustrates results from this model and shows random slopes for each minor occupation ranked by the difference in the likelihood of not being in paid work between the unhealthiest areas and the healthiest areas.

3.3. Results for men and women

We repeated analyses stratified by sex (Supplementary Tables 2 and 3). The association of area health with not being in paid work 10 years later was slightly stronger for men than women (fully adjusted RRR 1·28 for men, 1·22 for women). There were also some differences in associations for occupation, notably for the 'Administrative and secretarial' and 'Elementary' occupations, where stronger associations were observed in men and for the 'Sales and customer service' and 'Process, plant and machine operatives' occupations where stronger associations were observed in women. This most likely reflects gender differences in specific occupations within the major SOC groups. An interaction between area health and occupation was observed in both men and women (Supplementary Fig. 3a and 3b).

To illustrate these findings for occupational group, we calculated predicted probabilities by single years of age for men and women separately, from analyses stratified for age before and after State Pension age which was 65 for men and 60 in women in 2011 (Fig. 2a–d). Inequalities were larger at younger ages and in the years before State Pension age. The figures also illustrate the jump in employment rates around State Pension age.

3.4. Sensitivity analyses

We conducted three sensitivity analyses. First, we re-ran analyses with additional adjustment for the following two covariates: whether self-employed or not and whether in part-time or full-time work in 2001. Respondents were only asked for information on these two additional covariates if they were currently in work in 2001 so this analysis was conducted for a reduced sample size of 106,950 people. We obtained similar results for area health before and after adjustment for these two additional covariates. Associations of occupational group with employment outcome were slightly attenuated after this additional

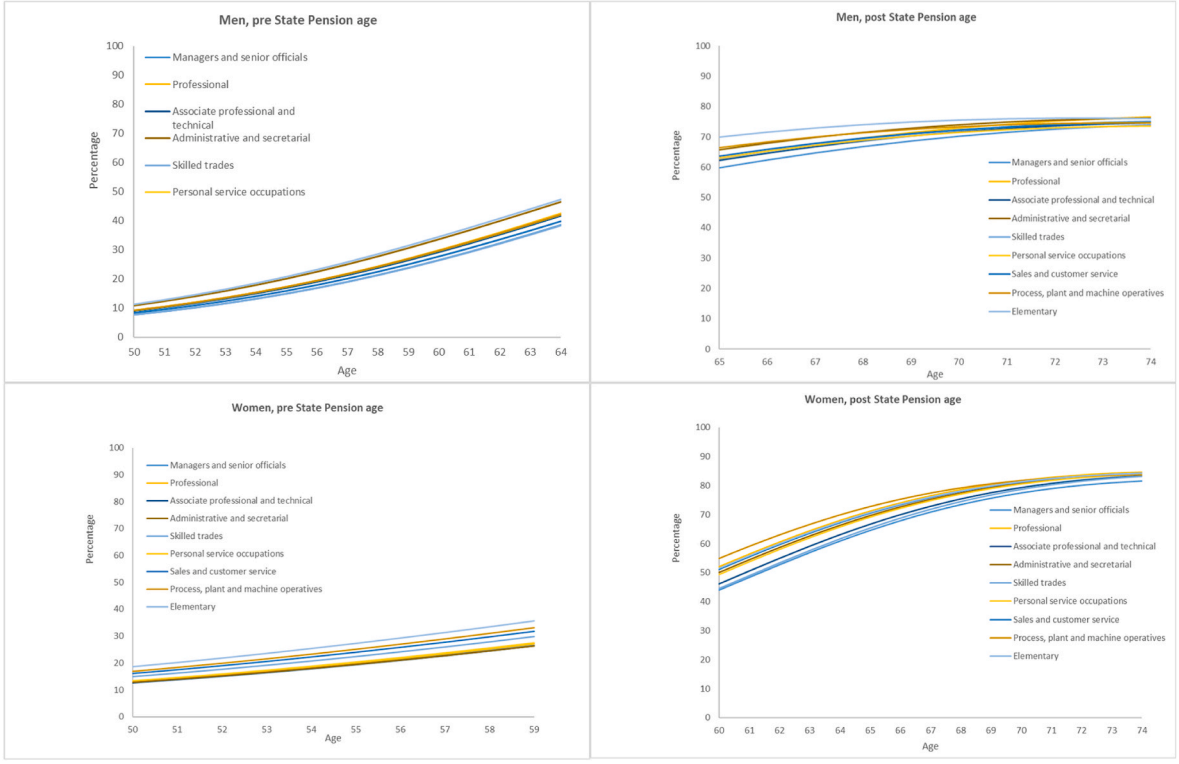


Fig. 2a–d. Predicted probability (%) of not being in paid work by age in 2011 for major occupation in 2001. Probabilities from models stratified by gender and age before and after State pension age, with adjustment for individual self-rated health, hours of caring, highest qualification level, and area level unemployment. ONS Longitudinal Study (n = 128,710).

adjustment (Supplementary Table 4).

Second, we re-ran analyses using an alternative measure of area health, namely disability-free life expectancy in 2001. Results using this alternative measure were very similar to those obtained with our main measure of health in a place (adjusted RRRs for unhealthiest vs healthiest area: 1·27 for area DFLE, 1·25 for area SRH). Results for occupational group were almost identical (Supplementary Table 5). As before, there was an interaction between the health in a place measured by DFLE and occupational group such that the strength of association of area health with employment outcomes varied by occupation and was stronger for people in major occupation groups such as skilled trades; process, plant and machine operatives; and elementary occupations (Supplementary figure 4).

Third, as it is possible that area deprivation may account for some of the associations of area level health with employment outcomes, we checked that adjustment for area level Townsend deprivation score (instead of unemployment rate as the two are correlated) gave similar results (Supplementary Table 6).

4. Discussion

Using a large, nationally representative sample of the resident population of England and Wales, we found that both the health of local older working age populations and occupation in 2001 are associated with employment rates ten years later in 2011. Furthermore, we found that the health of the local population modifies occupational differences in employment rates of older workers. Our results show that the gap between the healthiest and unhealthiest local authority areas in terms of relative risk of not being in paid work ten years later was most marked for the following major occupation groups: skilled trades; process, plant and machine operatives; and elementary occupations. There was less of a gap for the managerial group, although there were differences between the healthiest and unhealthiest areas for all the major occupation groups. Further examination of occupational differences in employment outcomes by type of economic inactivity (unemployed, retired, sick/disabled, other) compared to the reference employed group showed that differences were most marked for the sick/disabled category and that the extent of these occupational differences in inactivity outcomes was larger in the less healthy areas. Associations of health in a place with employment outcomes were slightly stronger for men than women. There were also some differences in associations of occupation with employment outcomes, which may reflect gender differences in specific occupations within the major SOC groups.

Our findings make an important contribution to existing literature as most previous evidence is from ecological or cross-sectional data and, to our knowledge, no previous longitudinal studies have examined the interaction between the health of local populations where people live and their occupation in relation to future employment outcomes.

It is well established that there are area differences in both employment rates and the health of local populations and that there is overlap in those local areas with high unemployment rates and unhealthy populations (The Health Foundation, 2019). Our finding that there is area-level variation in employment outcomes for older people is consistent with other studies that have shown area-level variations in disability pension (Macpherson et al., 2023; Reime and Claussen, 2013). There is a substantial amount of evidence showing that the health of individuals predicts employment outcomes (Burdorf et al., 2023; van Rijn et al., 2014) but to our knowledge, fewer studies have examined associations between place-based measures of health and employment outcomes. Our finding that health in a place in 2001 is associated with subsequent employment outcomes in 2011 is consistent with an earlier study that found cross-sectional associations between several place-based measures of health and employment outcomes, after adjustment for individual measure of health (Murray et al., 2022a). That paper also found that living in the unhealthiest areas was associated with all four types of economic activity, including unemployment and retirement. Of note, is that our results show similar associations with unemployment and retirement after adjustment for individual level covariates including individual self-rated health. However, further adjustment for local unemployment rates largely explained associations with unemployment whereas associations with retirement became slightly more marked.

Our study adds to previous research that found occupational differences in employment outcomes (Syddall et al., 2020) by being able to analyse more detailed occupational groupings. The physical demands of occupations may partially account for some of the occupational differences in employment outcomes that we observed as several studies have shown that physical workload is related to eg early retirement (Halonen et al., 2020; Karpansalo et al., 2002; Pedersen et al., 2020; Schram et al., 2021; Syddall et al., 2020).

Strengths of our study include the large representative sample for England and Wales that allowed us to analyse detailed occupation groupings and local area measures of health. We showed that the health of local areas modifies occupational differences in employment outcomes after adjustment for individual-level health and taking account of clustering of individuals with potentially similar characteristics within local areas. Sensitivity analyses using an alternative measure of area health (DFLE) showed similar findings.

There were some limitations to our study. Information on employment was only available every 10 years, so our analysis did not take account of time in and out of work in between the two censuses. Our sample included people who were in work in the five years preceding the 2001 Census, but we will have missed some people from former occupations who were not in work in those five years. Additionally, there may be unmeasured confounders at both individual and area levels. Although we adjusted for individual self-rated health (which may include physical and mental health), we were not able to adjust for poor mental health specifically which is one of the major reasons for early exit from the labour market. Other individual level factors that are known to be associated with employment rates of older workers include access to private pensions, wealth and income (Cribb, 2023), but these were not available in our data. Although the detailed occupational groupings we used capture some aspects of socioeconomic circumstances, we were not able to adjust for individual level poverty. It is possible that other area-level factors, such as local house prices, may be important. Our analysis did not take account of mobility between areas. Our study was limited to two time points, so we were not able to examine long-term trajectories between different employment states such as employed, long-term sick, retired, and unemployed as has been done in some countries where it was possible to examine the association of region with employment trajectories using national register data (Pedersen et al., 2012; Ropponen et al., 2023). We focused on employment outcomes at ages 50–74 but future research could study younger populations as well as investigate both occupation and area influences on employment trajectories throughout mid and later life. Our measure of the 'health in a place' was at local authority level but other geographic scales may be important, such as travel to work areas.

Our findings are descriptive, and we cannot infer causal associations from our results. The link between work and health is complex and bi-directional. Nevertheless, the large, representative sample gives confidence that our findings are robust and generalisable to the population of England and Wales.

Our research was carried out using data collected prior to the Covid-19 pandemic. Studies have shown that the pandemic amplified existing health and socioeconomic inequalities (McGowan and Bambra, 2022; Munford et al., 2022), so it is possible that the inequalities we describe have widened since the onset of the pandemic. More recent data from the 2021 Census show that inequalities in the health of local populations persist (Office for National Statistics (ONS), 2023), and employment rates among people aged 50 and over in have not yet returned to pre-pandemic levels. Furthermore, long term sickness accounts for an increasing proportion of economic inactivity among people aged 50–74

(Department for Work and Pensions, 2023). When data from the 2021 Census is linked for LS members and made available to the research community, it will be possible to update analyses on how the health in a place modifies occupational differences in employment outcomes. However, the persistence of area inequalities in health point to the need to and potential benefit of improving the health of local populations.

Our findings are important as they relate to ongoing policy debates around local economies, ageing societies, and the 'levelling up' agenda of recent UK government administrations. The effectiveness of reforms that increase the State Pension age rely on individuals maintaining their health and/or ability to work in line with such increases. Our research highlights that there are variations in the likelihood of remaining in paid work across occupations, and that this is moderated by the health in a place. These findings suggest that, since State Pension age increases are applied universally across the UK, inequalities in the labour force participation of older workers that emerge from occupational and place-based variation will only grow with existing legislated increases in age eligibility to 67 in 2026–2028 and to 68 in 2044–2046 (Hobson, Frank, n.d.). In other words, our research has shown that the ability to remain in paid work up to State Pension age is linked to the type of occupation worked as well as the overall health of the local area in which one finds oneself.

Recent years have seen local authority councils face significant and immense pressures on their budgets, which include provision of health-related services like adult social care. Central government funding to local authorities has been significantly cut or eliminated since 2010, an approach designed in part to stimulate greater revenues generated by the economies of local authorities themselves. The capacity for local authorities to replace this government funding through business rates and council taxes has proven inadequate to cover shortfalls in the budget; there was an overall average 15% decline between 2009/10 and 2020/21 in local authority spending power in England ("Local government funding in England | Institute for Government," 2020). The cuts to central government grants also hit more deprived local authorities disproportionately, as initial cuts were a uniform percentage and central grants made up a larger proportion of funding in more deprived local authorities ("Local government funding in England | Institute for Government," 2020). Our research provides insight into the implications for these cuts, the area-based inequalities to which they contribute, and the substantial link between local area health and employment outcomes.

5. Conclusion

There were differences in employment outcomes by both occupation and health in a place after taking account of individual level health. The link between health in a place and employment outcomes for older people is only partly explained by occupation, with living in an 'unhealthy' area exacerbating occupational inequalities in employment rates of older workers. Strategies to level up the health of places may be important for sustaining employment of older workers.

CRediT authorship contribution statement

Jenny Head: Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Paul Norman:** Writing – review & editing, Data curation, Conceptualization. **Nicola Shelton:** Writing – review & editing, Conceptualization. **Brian Beach:** Writing – review & editing. **Emily T. Murray:** Writing – review & editing, Funding acquisition, Formal analysis, Conceptualization.

Role of the funding source

The funders had no role in the study design, data collection, analysis, decision to publish or preparation of the manuscript.

Ethics approval

This paper is based on an analysis of secondary data that cannot be traced back to specific individuals and did not require us to obtain informed consent.

Note

This work contains statistical data from ONS, which is Crown Copyright. The use of the ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. This work uses research datasets, which may not exactly reproduce National Statistics aggregates.

Funding

This work was funded by the Health Foundation (R-000002350). The funders had no role in the study design, data collection, analysis, decision to publish, or preparation of the manuscript.

Declaration of competing interest

We declare no competing interests.

Acknowledgements

The permission of the Office for National Statistics to use the Longitudinal Study is gratefully acknowledged, as is the help provided by staff of the Centre for Longitudinal Study Information & User Support (CeLSIUS). CeLSIUS is funded by the ESRC under project ES/V003488/1. The authors alone are responsible for the interpretation of the data.

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.healthplace.2024.103376.

References

Burdorf, A., Fernandes, R.C.P., Robroek, S.J.W., 2023. Health and inclusive labour force participation. Lancet Lond. Engl. 402, 1382–1392. https://doi.org/10.1016/S0140-6736(23)00868-1.

Carr, E., Fleischmann, M., Goldberg, M., Kuh, D., Murray, E.T., Stafford, M., Stansfeld, S., Vahtera, J., Xue, B., Zaninotto, P., Zins, M., Head, J., 2018. Occupational and educational inequalities in exit from employment at older ages: evidence from seven prospective cohorts. Occup. Environ. Med. 75, 369–377. https://doi.org/10.1136/oemed-2017-104619.

CeLSIUS data dictionary [WWW Document], n.d. URL https://www.ucl.ac.uk/infostudies/silva-php-resources/researchProjects/celsius/standalone/index.php (accessed 8. February.2024).

Clark, C., Smuk, M., Lain, D., Stansfeld, S.A., Carr, E., Head, J., Vickerstaff, S., 2017. Impact of childhood and adulthood psychological health on labour force participation and exit in later life. Psychol. Med. 47, 1597–1608. https://doi.org/10.1017/S0033291717000010.

Cribb, J., 2023. Understanding retirement in the UK. The IFS. https://doi.org/10.1920/re.ifs.2023.0284.

Department for Work and Pensions, 2023. Economic labour market status of individuals aged 50 and over, trends over time: September 2023 [WWW Document]. URL. https://www.gov.uk/government/statistics/economic-labour-market-status-of-individuals-aged-50-and-over-trends-over-time-september-2023/economic-labour-market-status-of-individuals-aged-50-and-over-trends-over-time-september-2023#:~:text=5.-,Employment,ye.

Farrants, K., Head, J., Alexanderson, K., 2023. Trends in associations between sickness absence before the age of 65 and being in paid work after the age of 65: prospective study of three total population cohorts. J. Aging Soc. Pol. 35, 197–220. https://doi.org/10.1080/08959420.2021.2022950.

Halonen, J.I., Mänty, M., Pietiläinen, O., Kujanpää, T., Kanerva, N., Lahti, J., Lahelma, E., Rahkonen, O., Lallukka, T., 2020. Physical working conditions and subsequent disability retirement due to any cause, mental disorders and musculoskeletal diseases: does the risk vary by common mental disorders? Soc. Psychiatr. Psychiatr. Epidemiol. 55, 1021–1029. https://doi.org/10.1007/s00127-019-01823-6.

Harber-Aschan, L., Chen, W.-H., McAllister, A., Koitzsch Jensen, N., Thielen, K., Andersen, I., Diderichsen, F., Barr, B., Burström, B., 2020. The impact of

longstanding illness and common mental disorder on competing employment exits routes in older working age: a longitudinal data-linkage study in Sweden. PLoS One 15, e0229221. https://doi.org/10.1371/journal.pone.0229221.
HM Government, 2022. Levelling up the United Kingdom, CP 604. Stationary Office, London.
Hobson, Frank, 2023. State Pension Age Review. n.d.. Research Briefing, House of Commons Library https://researchbriefings.files.parliament.uk/documents/SN06546/SN06546.pdf. (Accessed 30 March 2024).
Karpansalo, M., Manninen, P., Lakka, T.A., Kauhanen, J., Rauramaa, R., Salonen, J.T., 2002. Physical workload and risk of early retirement: prospective population-based study among middle-aged men. J. Occup. Environ. Med. 44, 930–939. https://doi.org/10.1097/00043764-200210000-00012.
Local government funding in England, 2020. Institute for government [WWW Document]. https://www.instituteforgovernment.org.uk/explainer/local-government-funding-england. (Accessed 4 April 2024).
Macpherson, R.A., Amick, B.C., Collie, A., Koehoorn, M., Smith, P.M., McLeod, C.B., 2023. Do regional labor market conditions matter for temporary work disability duration? A multilevel analysis of workers' compensation claims in five Canadian provinces. Am. J. Ind. Med. 66, 637–654. https://doi.org/10.1002/ajim.23489.
Marshall, L., Finch, D., Cairncross, L., Bibby, J., 2018. The nation's health as an asset: Building evidence on the social and economic value of health. The Health Foundation,London. https://www.health.org.uk/publications/the-nations-health-as-an-asset.
McGowan, V.J., Bambra, C., 2022. COVID-19 mortality and deprivation: pandemic, syndemic, and endemic health inequalities. Lancet Public Health 7, e966–e975. https://doi.org/10.1016/S2468-2667(22)00223-7.
Munford, L., Khavandi, S., Bambra, C., 2022. COVID-19 and deprivation amplification: an ecological study of geographical inequalities in mortality in England. Health Place 78, 102933. https://doi.org/10.1016/j.healthplace.2022.102933.
Murray, E.T., Head, J., Shelton, N., Beach, B., Norman, P., 2022a. Does it matter how we measure the health of older people in places for associations with labour market outcomes? A cross-sectional study. BMC Publ. Health 22, 2252. https://doi.org/10.1186/s12889-022-14661-0.
Murray, E.T., Shelton, N., Norman, P., Head, J., 2022b. Measuring the health of people in places: a scoping review of OECD member countries. Health Place 73, 102731. https://doi.org/10.1016/j.healthplace.2021.102731.
Norman, P., Exeter, D., Shelton, N., Head, J., Murray, E., 2022. (Un-) healthy ageing: geographic inequalities in disability-free life expectancy in England and Wales. Health Place 76, 102820. https://doi.org/10.1016/j.healthplace.2022.102820.
Office for National Statistics (ONS), 2023. General health, England and Wales: census 2021 [WWW Document]. URL. https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandwellbeing/bulletins/generalhealthenglandandwales/census2021.
Pedersen, J., Bjorner, J.B., Burr, H., Christensen, K.B., 2012. Transitions between sickness absence, work, unemployment, and disability in Denmark 2004-2008. Scand. J. Work. Environ. Health 38, 516–526. https://doi.org/10.5271/sjweh.3293.
Pedersen, J., Schultz, B.B., Madsen, I.E.H., Solovieva, S., Andersen, L.L., 2020. High physical work demands and working life expectancy in Denmark. Occup. Environ. Med. 77, 576–582. https://doi.org/10.1136/oemed-2019-106359.
Reime, L.J., Claussen, B., 2013. Municipal unemployment and municipal typologies as predictors of disability pensioning in Norway: a multilevel analysis. Scand. J. Publ. Health 41, 158–165. https://doi.org/10.1177/1403494812472004.
Ropponen, A., Wang, M., Alaie, I., Narusyte, J., Svedberg, P., 2023. Concurrent trajectories of residential region in relation to a sustainable working life among Swedish twins. Eur. J. Publ. Health 33, 596–600. https://doi.org/10.1093/eurpub/ckad053.
Schram, J.L., Solovieva, S., Leinonen, T., Viikari-Juntura, E., Burdorf, A., Robroek, S.J., 2021. The influence of occupational class and physical workload on working life expectancy among older employees. Scand. J. Work. Environ. Health 47, 5–14. https://doi.org/10.5271/sjweh.3919.
Shelton, N., Marshall, C.E., Stuchbury, R., Grundy, E., Dennett, A., Tomlinson, J., Duke-Williams, O., Staff, O.N.S., Xun, W., 2019. Cohort profile: the Office for national Statistics longitudinal study (The LS). Int. J. Epidemiol. 48, 383–384g. https://doi.org/10.1093/ije/dyy243.
SOC, 2000. Office for national Statistics [WWW Document], n.d. URL. https://www.ons.gov.uk/methodology/classificationsandstandards/standardoccupationalclassificationsoc/socarchive. (Accessed 4 April 2024).
Syddall, H.E., D'Angelo, S., Ntani, G., Stevens, M., Harris, E.C., Linaker, C.H., Walker-Bone, K., 2020. Work participation and risk factors for health-related job loss among older workers in the Health and Employment after Fifty (HEAF) study: evidence from a 2-year follow-up period. PLoS One 15, e0239383. https://doi.org/10.1371/journal.pone.0239383.
The Health Foundation, 2019. Healthy Life Expectancy at Birth by Decile of Deprivation and Employment Rate, England: 2015–2017 (Years of Life Lost).
van Rijn, R.M., Robroek, S.J.W., Brouwer, S., Burdorf, A., 2014. Influence of poor health on exit from paid employment: a systematic review. Occup. Environ. Med. 71, 295–301. https://doi.org/10.1136/oemed-2013-101591.