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Chronic conditions as predictors of later life disability employment exit: a gendered analysis

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ABSTRACT

Objectives

Increasing life expectancy has led governments to implement reforms aimed at delaying retirement. Chronic conditions are an important barrier to this given their association with pain, functional limitations, depression and ultimately lower life expectancy. Chronic diseases are gendered in terms of these characteristics, as well as their population prevalence. I examined the extent to which gender moderates the extent to which different chronic conditions lead to disability employment exit, the proportion of exits they account for, and key mediators in this process.

Methods

Data from waves 1-8 of the English Longitudinal Study of Ageing were analysed. I followed employees aged 50-70 until they experienced disability employment exit, or were censored. I analysed the influence of chronic conditions, functional limitations, pain, depressive symptoms and subjective life expectancy using discrete time survival analysis. All analyses were carried out separately by gender if a significant interaction was found. The mediation analysis was carried out using the Karlson/Holm/Breen method.

Results

No significant gender interactions were found for the risk of chronic conditions on disability employment exit. Lung disease (OR 4.1; 95% CI 2.8-5.9), cancer (OR 2.9; 95% CI 2.1-4.0) and arthritis (OR 2.6; 95% CI 2.1-3.3) were the strongest determinants. Depressive symptoms (OR 3.2; 95% CI 2.5-4.1) were also a strong determinant, and along with arthritis, explained a greater proportion of women than men's exits given differences in prevalence. Pain and various types of functional limitations were important mediators of exit as well as determinants in their own right.

Conclusion

The results suggest that gender differences in the prevalence of different chronic conditions result in differences in the proportion of disability employment exits they account for in the population. Targeted and tailored interventions e.g. in the workplace might take this into account.

KEY MESSAGES

What is already known?

- Chronic conditions are risk factors for disability employment exit.
- This is partly explained by their association with functional limitations, pain and depression.
- There are gender differences in the prevalence of different chronic conditions, as well as the experience of limitations, pain and depression.
- Given these differences, gender inequalities in the relationship between chronic conditions and employment exit is under researched.

What are the new findings?

- Arthritis accounts for more disability employment exits than any other chronic condition, especially for women.
- Depression accounts for more exits for women than men.
- Mobility limitations are a bigger risk factor for men.

How might this impact on policy or clinical practice in the foreseeable future?

- Targeting and tailoring interventions e.g. at the workplace according to gender and chronic condition may reduce disability employment exits and their gender inequalities.

INTRODUCTION

Increasing life expectancy poses a significant challenge to the financial sustainability of public pensions. The issue of extending working lives (EWL) is therefore high on the research and policy agenda. Recent systematic reviews have identified health as the most frequently cited factor inhibiting EWL[1], and chronic conditions as strongly implicated[2]. This is unsurprising given these conditions most commonly develop when people are 10 to 15 years from retirement age[3]. Chronic conditions are often treated as a homogenous category, yet different diseases have different symptoms and cause different functional limitations, and therefore require different interventions to reduce their impact on EWL. Crucially, they also vary in prevalence and therefore account for different levels of disability associated employment exit (DEE) in the population.

Gender differences in chronic disease prevalence means that different conditions might account for different proportions of DEE for men and women. Further, gender differences in symptoms and complications might explain why chronic conditions differentially lead to DEE for men and women. For example, depression is often co-morbid with chronic conditions, is higher in women[4], and is a risk factor for employment exit[5]. Similarly, qualitative work has suggested health subjectivities and expectations might mediate the relationship between health conditions and labour market participation, especially in terms of pessimism about future health[6]. An important mechanism might be that chronic conditions reduce subjective life expectancy i.e. how long people expect to live, which influences retirement intentions, including when controlling for self-rated health[7]. Given these arguments, as well as increasing attention to gender and later life employment in policies circles[8], a gendered analysis on this topic is highly warranted.

As noted by Leijten et al., the relationship between health and early retirement is often complex. Just as illness can 'push' people out of the labour market, health can also 'pull' people from it, as healthy people may leave work to enjoy retirement in good health[9]. However, recent findings based on the English Longitudinal Study of Ageing (ELSA) found that poor self-reported health was a much stronger predictor of involuntary retirement than good health was a predictor of voluntary retirement, suggesting chronic conditions are more relevant as 'push' factors. This is especially the case for DEE implies functional limitation. However, the pathways involved for different chronic conditions is unknown.

In considering which factors might protect workers with chronic conditions from work exit, existing studies have tended to focus on workplace or job characteristics such as autonomy, skills, or social support[9–11]. There has been much less focus on illness characteristics. Existing studies have also tended to conceive of functional limitations narrowly as activities of daily living, but as I go onto show, other types of limitations are more relevant for DEE, especially those related to mobility. Pain is also key and often over looked. These are important determinants in themselves and affect those without a diagnosed (or an undiagnosed) condition.

The gendered approach to focussing on specific conditions, as well as the factors that mediate their relationship with DEE, suggests how workplace and other types of interventions might be targeted and tailored by gender and condition.

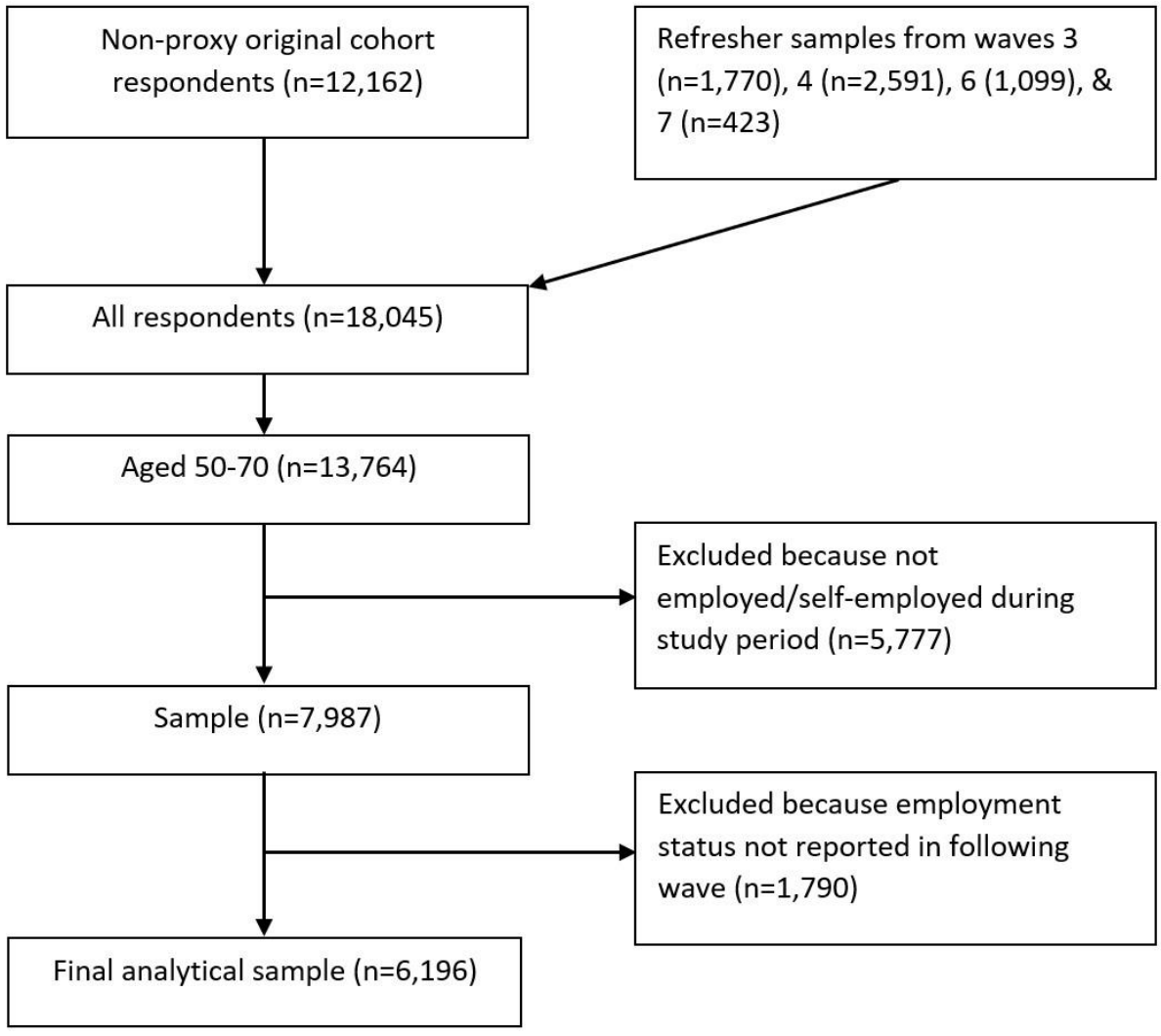
METHODS

Study design

Data from ELSA waves 1-8 (2002/3 – 2016/7) are analysed. ELSA is a biennial panel study of adults aged 50+ living in England[12]. The initial inclusion criterion for the study sample was non-proxy

respondents reporting labour market situation as being 'employed' or 'self-employed' in any wave and reporting on labour market situation in at least the following wave. Those who transitioned from employed/self-employed to permanently sick or disabled, or who transitioned to retired, unemployed or looking after home or family while newly claiming any disability benefit were classified as experiencing DEE. DEE therefore captures disability-associated employment exit. Those not experiencing DEE were censored when exiting employment or when lost to follow up. The following were classed as disability benefits: incapacity benefit, severe disability allowance, attendance allowance, disability living allowance, industrial injuries disablement benefit, other health benefit, and in waves 7 and 8 personal independence payment and employment support allowance. I followed respondents from age 50 to age 70 given the interest in later life employment exit. This resulted in a study sample of 6196 participants (Figure 1).

Figure 1 Flowchart of study population



Chronic conditions

Respondents were asked if they had ever been told by a doctor they had: diabetes or high blood sugar, cancer or a malignant tumour (excluding minor skin cancers), chronic lung disease such as chronic bronchitis or emphysema, heart problems (any of the following: angina, a heart attack (including myocardial infarction or coronary thrombosis), congestive heart failure, a heart murmur, an abnormal heart rhythm, or any other heart trouble, arthritis (including osteoarthritis or rheumatism), or asthma. Respondents were asked about other conditions but these were not analysed either because they did

not pertain to a chronic condition as such (high blood pressure), or because the numbers were too small (e.g. Parkinson's disease).

Depressive symptoms

Depressive symptoms were measured using the short 8 item version of the Center for Epidemiologic Studies Depression scale (CES-D 8)[4]. A score of 4 to 8 indicates depressive symptoms.

Pain

Respondents were asked 'are you often troubled be pain?' (yes/no). This question is harmonised with the Health and Retirement Study, and respondents answering yes are considered to be experiencing chronic pain[13].

Functional limitations

Functional limitations were measured according to whether respondents reported 'some difficulty' with various activities. Different indices were constructed according to whether the activities pertained to large, gross, or fine muscle/motor use, mobility, or activities of daily living (ADL). These indices are harmonised with the Health and Retirement Study; full details can be found in Phillips et al.[14]. If a respondent reported some difficulty with any of the activities they were coded as experiencing functional limitations for the corresponding index. There is overlap between these indices because different activities require different combinations of muscle groups or have different implications for mobility or daily living. The activities for each group were as follows: large muscle use (sitting for 2 hrs, getting up from a chair, stooping, kneeling or crouching, and pushing or pulling large objects); gross muscle use (walking 100 yards, walking across a room, climbing one flight of stairs, getting in or out of bed, and bathing); fine muscle use (picking up a 5p coin, eating, and dressing); mobility (walking 100 yards, walking across a room, climbing one flight of stairs, and climbing several flights of stairs); activities of daily living (bathing, dressing, eating, getting in or out of bed, walking across a room).

Subjective life expectancy

Respondents were asked to rate their chances of living until age x or more, with x being 75 if the participant was age 65 or under, and 80 if the respondent was 66-69. I followed the method of Kobayashi et al.[15] in defining those who rated their chances as 0-49% as having low subjective life expectancy given the tendency of many respondents to give a modal focal response of 50%.

Missing data

Missing data in the study sample were negligible, with a maximum of 0.85% (by observation). Therefore complete case analysis was used. Response rate to the initial baseline survey was 67%[12].

Number of events per variable

Unreliable confidence interval coverage, error and bias are likely with any less than 5-9 events per variable (EPV)[16]. The lowest number of EPV was 15 for female diabetes and male lung disease, and 19 for male cancer. Following the suggestion of Vittinghoff and McCulloch[16], I conducted a sensitivity analysis removing the weakest confounder (year of birth) for each of the affected models to increase the number of EPV. For the PAF models, results were virtually identical. For the mediation models, results varied by a maximum of 1-2%. The lowest number of EPV for interaction models was 34 for lung disease and 36 for diabetes suggesting the models were powered to detect an interaction of the same magnitude as the main effect, requiring four times the sample size[17]. Multiple tests increase the chance of falsely finding an interaction, however interaction tests typically have 'high false-negative risks'[18] thus the tests for interaction are overall conservative and cannot be considered

conclusive. Mediation interaction effects were tested but likely lacked power; nonetheless combined models were sufficiently powered.

Statistical analysis

Given the panel design, discrete time survival analysis was used, and odds ratios and their 95% confidence intervals are reported. These can be interpreted as hazard ratios from Cox models when the outcome is rare[19] as with the current analysis. The logit transformation of the hazard was used to estimate time to exit from baseline, calculated as the summation of the hazard probabilities of all person-periods for the predictors of interest[20]. The time metric is years in study from when respondents enter the study to either when they experience DEE, which was assumed to occur at midpoint between the previous two waves, or when lost to follow up. Time in study ranged from 0.5-14 years with an average of 5.13, and was very similar for men (5.26) and women (5.01). Age at study entry was included in the adjusted models following best practice[21], as well as year of birth since respondents could enter the study at different times. All predictors were first measured when the respondent entered the study and all available follow-up measurements were used, and last measured at the wave before censoring/employment exit. All confounders were time invariant.

To test whether gender modified the effect of predictors, I tested for additive interaction using the relative excess risk due to interaction (RERI), which estimates the proportion of the total effect that is due to interaction. For example, a significant gender interaction for gender and diabetes might suggest that the number of DEEs is larger for women with diabetes than would be expected by considering the hazards associated with gender and diabetes separately[22]. RERI was tested based on odds ratios estimates and calculated as OR (predictor and female))−(OR (predictor and male))−(OR (no predictor and female))+1. RERI was calculated using adjusted data.

We calculated the population attributable fraction (PAF) for the predictors by gender to account for differences in their prevalence in the wider population. For example, although a certain health condition might carry an equal risk of DEE for men and women, if women have double the prevalence it will account for double the proportion of women's exits, all else being equal. The PAF estimates the log of the mean rate ratio between the baseline scenario as observed in the data and the scenario where the exposure variables are assumed to be zero. PAFs were calculated using adjusted data with the punafcc plug in in Stata which accounts for survival data[24]. To test whether PAFs were significantly different by gender I fit separate logistic models for men and women and computed confidence intervals for the ratio of the PAFs.

To test whether depressive symptoms, pain, functional limitations and subjective life expectancy mediated the relationship between chronic conditions and employment exit, I calculated their indirect effect by comparing models with and without these variables (controlling for confounders). This strategy is problematic with logit models because they are rescaled depending on included variables. I therefore used the Karlson/Holm/Breen method which solves this problem by analysing residuals[25]. I tested whether indirect effects were significantly different by gender by running pooled t-tests on the indirect effect coefficients, calculating 95% confidence intervals by bootstrapping the standard errors with 1,000 replications.

For all analyses, if there was a significant gender interaction I stratified models by gender or ran combined models as is best practice[23].

All analyses were conducted in Stata 14.0.

RESULTS

Sample characteristics

Characteristics of the sample at study entry are shown in Table 1. The average age was 55.5 for men and 54.4 for women. Arthritis was most prevalent, followed by asthma and heart disease. Cancer, lung disease, arthritis and asthma were more prevalent in women, and diabetes and heart disease more prevalent in men. Depressive symptoms were twice as prevalent in women – around 14%. Functional limitations except fine muscle limitations were more prevalent in women. Low subjective life expectancy was slightly more common in men. Overall, 190 (3.6%) of men and 183 (5.7%) of women experienced DEE over the study period.

Table 1 Sample characteristics at study entry (n=6196)

	Men (n=3007)	Women (n=3189)
Socio-demographics		
Age at entry - mean (SD)	55.5 (4.3)	54.4 (3.9)
Year of birth - median	1949	1951
Diagnosed chronic conditions		
Diabetes - n (%)	171 (5.7)	70 (2.2)
Cancer - n (%)	72 (2.4)	160 (5.0)
Lung disease - n (%)	57 (1.9)	63 (2.0)
Heart disease - n (%)	246 (8.2)	241 (7.6)
Arthritis - n (%)	396 (13.2)	629 (19.7)
Asthma - n (%)	254 (8.5)	375 (11.8)
Depressive symptoms		
CES-D 8 (cut off ≥4) - n (%)	232 (7.7)	449 (14.1)
Pain		
Often troubled with pain - n (%)	824 (27.4)	1020 (32.0)
Functional limitations (≥1)		
Large muscle limitations - n (%)	693 (23.1)	974 (30.5)
Gross motor limitations - n (%)	111 (3.7)	192 (6.0)
Fine motor limitations - n (%)	189 (6.3)	149 (4.6)
Mobility	324 (10.8)	674 (21.1)
Activities of daily living - n (%)	39 (1.3)	66 (2.1)
Subjective life expectancy		
Medium or low - n (%)	999 (33.2)	895 (28.1)
Outcome event		
Disability employment exit - n (%)	190 (3.6)	183 (5.7)

Determinants of disability employment exit and population attributable fractions

Table 2 shows the results of the survival and PAF analyses. No significant gender interactions were found for the risk of chronic conditions on DEE. Lung disease (OR 4.1; 95% CI 2.8-5.9), cancer (OR 2.9; 95% CI 2.1-4.0), arthritis (OR 2.6; 95% CI 2.1-3.3) and diabetes (OR 2.1; 95% CI 1.5-3.0) were the conditions with the strongest risk factors, whilst asthma (OR 1.6; 95% CI 1.2-2.1) and heart disease (OR 1.6; 95% CI 1.2-2.1) were lower risk. Significant gender differences in PAFs were observed in lung disease and arthritis. The former accounted for 8.1% (95% CI 7.0-9.2%) of women's DEEs, but 5.7% (95% CI 4.5-6.9%) of men's exits, while arthritis accounted for 30.7% (95% CI 25.3-35.7%) of women's DEEs compared with 20.3% (95% CI 16.1-24.4%) of men's. Depressive symptoms showed a clear gender difference in PAFs, accounting for 18.6% (95% CI 15.4-21.7%) of women's DEEs compared with 13.8% (95% CI 11.8-15.9%) of men's.

Pain and functional limitations were strong determinants of DEE. Gender differences were seen in risk for of functional limitations, with gross muscle limitations a bigger risk factor for men (OR 10.3; 95% CI 7.3-14.4) than women (OR 6.8; 95% CI 4.9-9.3), as with mobility limitations (male OR 5.9; 95% CI 4.4-8.0; female OR 3.3; 95% CI 2.5-4.5). Overall, pain, large muscle limitations, gross muscle limitations and mobility limitations account for substantial proportions of DEEs (around 25-40%). PAF differences were small.

Finally, low subjective life expectancy is less of a risk factor than depressive symptoms, though accounts for a greater proportion of employment exits (24.3%; 95% CI 19.6-28.7%) given its prevalence – around three times that of depressive symptoms (Table 1).

Table 2 Relationship between health/illness factors and disability employment exit and population attributable fractions

	OR (95%CI)[a]		Population Attributable Fraction (%)[a]	
	Men	Women	Men	Women
Diagnosed chronic conditions				
Diabetes	2.1 (1.5-3.0)		5.4 (3.8-7.1)	
Cancer	2.9 (2.1-4.0)		7.7 (6.3-9.0)	
Lung disease	4.1 (2.8-5.9)		5.7 (4.5-6.9)	8.1 (7.0-9.2)
Heart disease	1.6 (1.2-2.1)		5.3 (2.6-7.9)	
Arthritis	2.6 (2.1-3.3)		20.3 (16.1-24.4)	30.7 (25.3-35.7)
Asthma	1.6 (1.2-2.1)		6.1 (3.3-8.9)	
Depressive symptoms				
RCES-D 8 (cut off ≥4)	3.2 (2.5-4.1)		13.8 (11.8-15.9)	18.6 (15.4-21.7)
Pain				
Often troubled with pain	3.4 (2.7-4.1)		40.6 (36.9-44.1)	
Functional limitations (≥1)				
Large muscle limitations	3.4 (2.8-4.2)		39.8 (36.3-43.2)	
Gross motor limitations	10.3 (7.3-14.4)	6.8 (4.9-9.3)	24.7 (23.8-25.6)	27.0 (25.5-28.5)
Fine motor limitations	5.6 (4.3-7.2)		17.8 (16.1-19.5)	20.9 (19.6-22.2)
Mobility	5.9 (4.4-8.0)	3.3 (2.5-4.5)	34.5 (32.3-36.6)	
Activities of daily living	10.9 (7.9-15.1)		12.7 (12.3-13.1)	
Subjective life expectancy				
Medium or low	2.1 (1.7-2.6)		24.3 (19.6-28.7)	

a Separate ORs and PAFs are reported for men and women when significant interaction present.

For each model the comparison groups are those without the condition, limitation etc.

Analyses adjusted for year of birth, age at baseline (and gender if no significant interaction).

n 6162-6196 (combined models); 2998-3006 (men); 3178-3189 (women).

Mediators of disability employment exit

The mediation analysis suggests that different chronic diseases lead to DEE for different reasons. First, regardless of disease or gender, pain, large and gross muscle limitations and mobility are key mediators. Depressive symptoms, fine muscle limitations, ADL and subjective life expectancy are less important. Mediation varied according to disease. Pain mediated a large proportion of the relationship between arthritis and DEE (18.6%; 95% CI 11.3-26.0%). Muscle limitations were important mediators for arthritis, especially pertaining to large (36.0%; 95% CI 28.4-43.6%) and gross (23.9%; 95% CI 19.6-28.2%) muscles, and to a lesser extent, heart disease and lung disease. Subjective life expectancy was an important mediator for diabetes (12.2%; 95% CI 7.4-17.0%) and heart disease (10.5%; 95% CI 5.6-15.4%). The measures explained hardly any of the effects of cancer on DEE.

Few significant gender differences are apparent, though the sample size likely limited detection. Large muscle limitations were a strong mediator for women than men for diabetes (women 21.8%; 95% CI 13.2-30.4%; men 16.0%; 95% CI 7.6-24.4%) as were gross muscle limitations (women 24.9%; 95% CI 14.2-35.7%; men 15.2%; 95% CI 5.8-24.7%). Subjective life expectancy was a significant mediator for women with asthma (11.0%; 95% CI 4.7-17.4%) but not for men.

Table 3 Mediation of the relationship between chronic diseases and disability employment exit

		Diabetes	Cancer	Lung disease	Heart disease	Arthritis	Asthma
Depressive symptoms	Men	5.2% (1.8-8.7%)	0.8% (-1.6-3.2%)	4.9% (1.8-7.9%)	5.6% (1.2-9.9%)	5.6% (3.6%-7.5%)	8.8% (4.2-13.3%)
	Women						
Pain	Men	12.8% (7.3-18.2%)	2.6% (-1.2-6.5%)	15.2% (10.4-19.9%)	18.6% (11.3-26.0%)	35.7% (27.8-43.6%)	12.7% (6.5-18.9%)
	Women						
Large muscle limitations	Men	16.0% (7.6-24.4%)	-2.1% (-7.0-2.8%)	14.7% (9.9-19.4%)	18.2% (11.0-25.4%)	36.0% (28.4-43.6%)	17.6% (11.3-23.8%)
	Women	21.8% (13.2-30.4%)	7.3% (1.5-13.1%)				
Gross muscle limitations	Men	15.2% (5.8-24.7%)	1.8% (-1.8-5.3%)	21.3% (14.8-27.9%)	18.9% (11.1-26.8%)	23.9% (19.6-28.2%)	12.6% (6.4-18.7%)
	Women	24.9% (14.2-35.7%)					
Fine muscle limitations	Men	9.2% (4.4-13.9%)	-1.6% (-3.9%-0.8%)	9.6% (5.3%-14.0%)	4.0% (-0.7-8.7%)	18.5% (14.5-22.5%)	5.9% (1.5-10.2%)
	Women						
Mobility	Men	24.3% (17.2-31.3%)	6.2% (1.9-10.5%)	30.0% (23.1-37.0%)	34.8% (25.5-44.1%)	24.3% (19.4-29.1%)	42.7% (33.2-52.2%)
	Women						
ADL	Men	7.5% (3.2-11.7%)	-1.1% (-3.0-0.8%)	5.2% (1.6-8.8%)	6.4% (1.7-11.2%)	9.8% (7.5-12.1%)	2.1% (-1.3-5.5%)
	Women						
Subjective life expectancy	Men	12.2% (7.4-17.0%)	4.6% (1.8-7.4%)	7.9% (4.4-11.4%)	10.5% (5.6-15.4%)	4.3% (2.4-6.1%)	2.4% (-3.9-8.8%)
	Women						11.0% (4.7-17.4%)

Separate percentages reported for men and women when significant interaction present.

Percentages express percentage change in the OR for each chronic condition controlling for each of the potential mediators in turn, indicating the extent to which these account for the effect of chronic conditions on disability employment exit - obtained via Karlson/Holm/Breen method (2011).

Analyses adjusted for year of birth and age at baseline.

n 6162-6195 (combined models); n 2992-3006 (men); 3170-3189 (women).

DISCUSSION

Chronic conditions varied in terms of the risk they pose for DEE, that is, employment exit associated with disability. This measure includes those who leave employment and became permanently sick or disabled even if not newly claiming disability benefits, and hence captures more disability associated exits. Chronic conditions also varied in the proportion of DEEs they account for in the population, and the health- and functional-related reasons they led to DEE. There were no significant gender differences in terms of risk, which may be because the interactions were too small to detect given the sample. I did find significant differences in PAFs, which can help inform targeted/tailored approaches. Edge et al. suggest that the workplace should be a priority setting for health promotion and policy measures should include primary, secondary and tertiary prevention[1].

Arthritis should be a priority for such measures. Other work that suggests early retirement due to rheumatic diseases accounts for 0.5% of lost GDP in Portugal[26] and 0.7% in Australia[27]. Pain, muscle use and mobility are key to why arthritis leads to DEE, and interventions and policies should take this into account. A recent review of interventions to reduce early retirement due to rheumatic diseases suggested that effective non-pharmacologic interventions included job assessment and adjustment, vocational counselling and guidance, and patient education[28]. Another recent review suggested that for upper extremity musculoskeletal disorders and symptoms evidence is strongest for workplace interventions including resistance training, followed by stretching, mouse use feedback, and forearms supports[29].

As well as being a mediator with respect to various chronic conditions, depressive symptoms are an important determinant of DEE themselves, especially for women, accounting for 19% of women's exits and 14% of men's DEEs. A recent study found that depression accounts for a high proportion of disability benefit exits in Europe[5] (it did not however find gender differences, likely due to the different setting and measures used). The analysis of subjective life expectancy supports previous work suggesting that health subjectivities and expectancies moderate the influence of illness on labour market participation[6]. This was especially the case for diabetes and heart disease, and asthma for women. A review of workplace interventions for depression suggests that the most effective approaches combine internal therapy focussed on depression and external therapy focussed the work environment, working relationships, coping with stressors and drawing on skills[30].

Pain and functional limitations account for a substantial proportion of DEEs in the presence of chronic conditions, but should also be considered in their own right, since not everyone who experiences them will have a condition or be diagnosed. In addition, multimorbidity is common[3], and these symptoms are shared across multiple conditions. Thus workplaces for example could make adjustments irrespective of diagnosis. In comparison with analysing activities of daily living as is common in retirement research, the findings strongly suggests that a more nuanced consideration of functional limitations in terms muscle groups is warranted. The mediation analysis detected few gendered effects however, and further work would be useful here with larger samples.

Gendered interventions might consider the finding that gross muscle limitations and mobility are more of a risk factor for men, which might reflect the gendered nature of work. This potentially suggests occupation-based interventions. Existing studies have shown work characteristics influence employment exit, such as skill discretion, social support, and autonomy[9–11]. Pain and limitations differentially impact different types of work e.g. manual versus clerical. Lastly, it is important to bear in mind that macro factors such as labour market opportunities and conditions, social care policies, and inequalities in lifetime earnings and pensions also help to explain gender differences in the effect of chronic conditions on DEE, which might be explored alongside health in further work.

STRENTHS AND LIMITATIONS

Caution is required in interpreting the gender interactions given the limited sample size and further studies should investigate these differences. Strengths of the current analysis include long follow up, low amount of missing data, consideration of prevalence, and analysis of separate chronic conditions and of relevant mediators using statistically appropriate methods. Limitations of the data meant that I could only consider prevalence and not incidence; left censoring means that I cannot be sure that respondents had not already left employment due to illness. The sample is therefore likely to be health selected. However, the onset of most chronic conditions is typically aged 50-70, in line with the age of the study sample[3], so this effect is likely minimal. This is not true for depressive symptoms however. In any case, this will lead to underestimated effect sizes. The mediation analysis lacked power to detect gender interactions. Further work might consider the influence of multimorbidity of conditions which is now the new norm in those aged 65+[3]. The measure of pain used has not been formally validated, though has been widely analysed including in work disability research[31], and prevalence estimates based on this question match closely with several validated measures[13]. Chronic conditions were self-reported doctor diagnosed rather based on administrative data.

CONCLUSIONS

Chronic conditions vary in the risk they pose for DEE and their prevalence in the population and therefore the proportion of employment exits they account for. They also lead to DEE for different reasons, though pain and functional limitations are key mediators, especially mobility and non-fine muscle functions. These processes appear gendered mainly in terms of PAFs, though further research with larger samples is required. Taking these nuances into account is on potential way forward for workplace interventions to extend working life, which may also offer opportunities to redress gender inequalities in the later life labour market.

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