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Higher effort–reward imbalance and lower job control predict exit from the labour market at the age of 61 years or younger: evidence from the English Longitudinal Study of Ageing

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ABSTRACT

Background We examined whether higher effort–reward imbalance (ERI) and lower job control are associated with exit from the labour market.

Methods There were 1263 participants aged 50–74 years from the English Longitudinal Study on Ageing with data on working status and work-related psychosocial factors at baseline (wave 2; 2004–2005), and working status at follow-up (wave 5; 2010–2011). Psychosocial factors at work were assessed using a short validated version of ERI and job control. An allostatic load index was formed using 13 biological parameters. Depressive symptoms were measured using the Center for Epidemiologic Studies Depression Scale. Exit from the labour market was defined as not working in the labour market when 61 years old or younger in 2010–2011.

Results Higher ERI OR=1.62 (95% CI 1.01 to 2.61, p=0.048) predicted exit from the labour market independent of age, sex, education, occupational class, allostatic load and depression. Job control OR=0.60 (95% CI 0.42 to 0.85, p=0.004) was associated with exit from the labour market independent of age, sex, education, occupation and depression. The association of higher effort OR=1.32 (95% CI 1.01 to 1.73, p=0.045) with exit from the labour market was independent of age, sex and depression but attenuated to non-significance when additionally controlling for socioeconomic measures. Reward was not related to exit from the labour market.

Conclusions Stressful work conditions can be a risk for exiting the labour market before the age of 61 years. Neither socioeconomic position nor allostatic load and depressive symptoms seem to explain this association.

INTRODUCTION

The proportion of older employees is rapidly increasing, and the estimations suggest that this trend will continue.¹ To keep the working population balanced, one of the most important current strategic *aims* is to extend *work careers* and prevent early exit from the labour market; it is an important societal requirement. In the UK, in 2011, the average age of withdrawal from the labour market was approximately 62.8 years for women and 64.5 years for men.² The present study focuses on exit from the labour market at the age of 61 years or younger at wave 5 (2010–2011).

In previous studies, a stressful psychosocial work environment has been linked to intentions to retire early.^{3–6} A stressful psychosocial work environment may have far-reaching negative effects on

individuals' work ability from midlife to old age⁷ and it may also decrease job satisfaction. A previous study in the Whitehall II cohort showed that if employees are dissatisfied with their job, the probability of retiring early is twofold compared with that of satisfied employees.⁸ Although some evidence on psychosocial predictors of early retirement or early work exit exists,^{3 8 9} evidence on how stressful psychosocial work is related to exit from the labour market is scarce.

Exposure to a stressful psychosocial work environment is typically measured by two established theoretical models: the demand–control^{10 11} and effort–reward imbalance (ERI) models.^{12 13} In the demand–control model, job control denotes the employees' authority to make decisions concerning their own activities and using their skills at work, while job demands refer to time pressures and workload.¹¹ A combination of high job demands with low job control is assumed to be stressful.¹¹ The ERI model focuses on the work contract and emphasises social reciprocity.¹³ Rewards received in return for efforts spent at work include money, esteem and career opportunities such as promotion prospects and job security.¹³ The lack of reciprocity (high effort in combination with low rewards) is assumed to generate negative emotions and psychobiological stress responses with adverse long-term effects on health.¹³ Both models have been extensively studied in relation to health and they have been repeatedly linked to adverse health outcomes, especially heart disease.^{14–16}

Further, there are consistent findings indicating that a perceived stressful psychosocial work environment is related to depression.¹⁷ Depression may have an impact on occupational function,¹⁸ and it can lead to early exit from work due to disability pension.¹⁹ Higher job demands, lower job control and higher job strain were associated with a 12-month prevalence of depressive disorder among 3366 participants from a representative sample of the Finnish working population.²⁰ A systematic review of the epidemiological evidence about psychosocial factors at work and risk of depression concluded that a stressful psychosocial work environment increases the risk for depression.¹⁷ In a study including 17 European countries, it was found that depressive symptoms are higher among older employees experiencing high psychosocial stress compared with those with low or no stress.²¹ Similarly, in another study, work-related psychosocial factors were associated with an elevated risk

of prospective depressive symptoms among older employees from 13 European countries.²² Moreover, symptomatic depression predicted early work exit (OR=1.52, 95% CI from 1.07 to 2.18) in a representative sample of older English adults.²³

In addition to that work-related psychosocial factors are linked to elevated levels of depression, they may be related to physiological strain. The term allostasis refers to the adaptive physiological responses organisms activate when homeostasis is disrupted.²⁴ In acute stress, the sympathetic-adrenal-medullary axis releases catecholamines, and the hypothalamic-pituitary-adrenal axis secretes glucocorticoids in order to mobilise energy necessary for fight-or-flight responses.²⁵ If these systems are chronically activated, for example, in the case of chronic exposure to a stressful psychosocial work environment, allostatic mechanisms may become physiologically taxing. This is called allostatic load and represents the physiological strain experienced when allostasis is repeatedly activated.^{24 25} Increased allostatic load has been previously associated with increased depressive symptoms and a stressful psychosocial work environment.^{26 27}

The aim of the present study was to examine whether ERI and job control are associated with exit from the labour market at the age of 61 years or younger. A further aim was to examine whether the potential association of ERI and job control with and exit from the labour market is influenced by age, sex, education, occupational class, depressive symptoms and allostatic load.

METHODS

Participants

The data were derived from the English Longitudinal Study of Ageing (ELSA), which is a prospective observational study of people aged 50 and older living in England, designed to be nationally representative. Details of the study design are given elsewhere.²⁸ There were 6682 core member participants who were aged between 50 and 74 years at wave 2 (2004–2005). There were 2274 participants who were working and reported the psychosocial characteristics of their work. Of those 2274 participants who had reported the psychosocial characteristics of their work, 2039 had reported their working status at waves 2 and 5 (2010–2011). The criteria for being classified into the category of ‘exit from the labour market’ were (1) working at wave 2 and (2) an age of 61 years or younger and not working at wave 5. The formation of the analytic sample is described in more detail in figure 1. In the final sample, there were 1263 participants aged 56.5 years on average (SD 3.7, range 52–74 years) who reported active working status and work characteristics at wave 2, and their working status at wave 5.

Attrition analysis comparing the included participants with the excluded showed that the included participants were younger than the excluded individuals (mean age at baseline 56.5 vs 60.4 years, $p<0.001$). There was no difference in the proportion of women and men between the included and excluded groups. Among the participants there was a smaller proportion of those who had no educational qualification compared with the excluded (37.6% vs 64%, $p<0.001$). There was a smaller proportion of participants in the routine/manual labour category compared with the excluded group (participants 40.8% vs excluded 59.2%, $p<0.001$).

Measures

Exit from the labour market

The participants were classified into two categories based on their age and working status at wave 5. As described above, the

participants who were aged 61 years or younger and were not working at wave 5 were included in the ‘exit from the labour market’ category. The reasons for not working at wave 5 were early retirement (approximately 73%), unemployment (approximately 8%), sick leave (approximately 6%) or other/undefined (approximately 13%). In the exit from the labour market group, there was a larger proportion of women than men (61.9 vs 38.1, $p<0.001$).

Stressful psychosocial work environment

Stressful psychosocial work environment characteristics were assessed at wave 2 by a short battery of items derived from the Job Content Questionnaire measuring job control and the ERI questionnaire,¹³ which have been shown to be valid measures of stressful working conditions.^{29–31} Work characteristics were effort (eg, “I am under constant time pressure due to a heavy workload”); reward (eg, “I receive the recognition I deserve for my work”)^{13 29 32} and job control (eg, “I have very little freedom to decide how I do my work,” reversed).^{29 32} Psychosocial work characteristics were calculated as means and ERI was calculated as a ratio of effort/reward.

Socioeconomic measures

Education at wave 2 was categorised as A-level or higher degree (including university degree, other higher or postsecondary education and “A-level” education or equivalent), secondary (Certificate of Secondary Education or equivalent) and no qualification (including all people with lower than secondary education or no educational qualifications), as done previously in ELSA data.³³ Occupational class at wave 2 was categorised according to the primary social classification in the UK, that is, National Statistics Socio-Economic Classification as three categories of occupations: (1) routine/manual, (2) intermediate occupations and (3) professional occupations.

Depressive symptoms

Depressive symptoms were measured at wave 2 using an eight-item version of the Center for Epidemiologic Studies Depression Scale (CES-D).³⁴ This tool has been validated against the full CES-D³⁵ and used in community settings to predict health.³⁶ A cut off point of ≥ 4 , which has been previously reported to indicate clinically relevant depressive symptoms,³⁷ was used when depressive symptoms were classified as no depressive symptoms=0 and depressive symptoms=1.

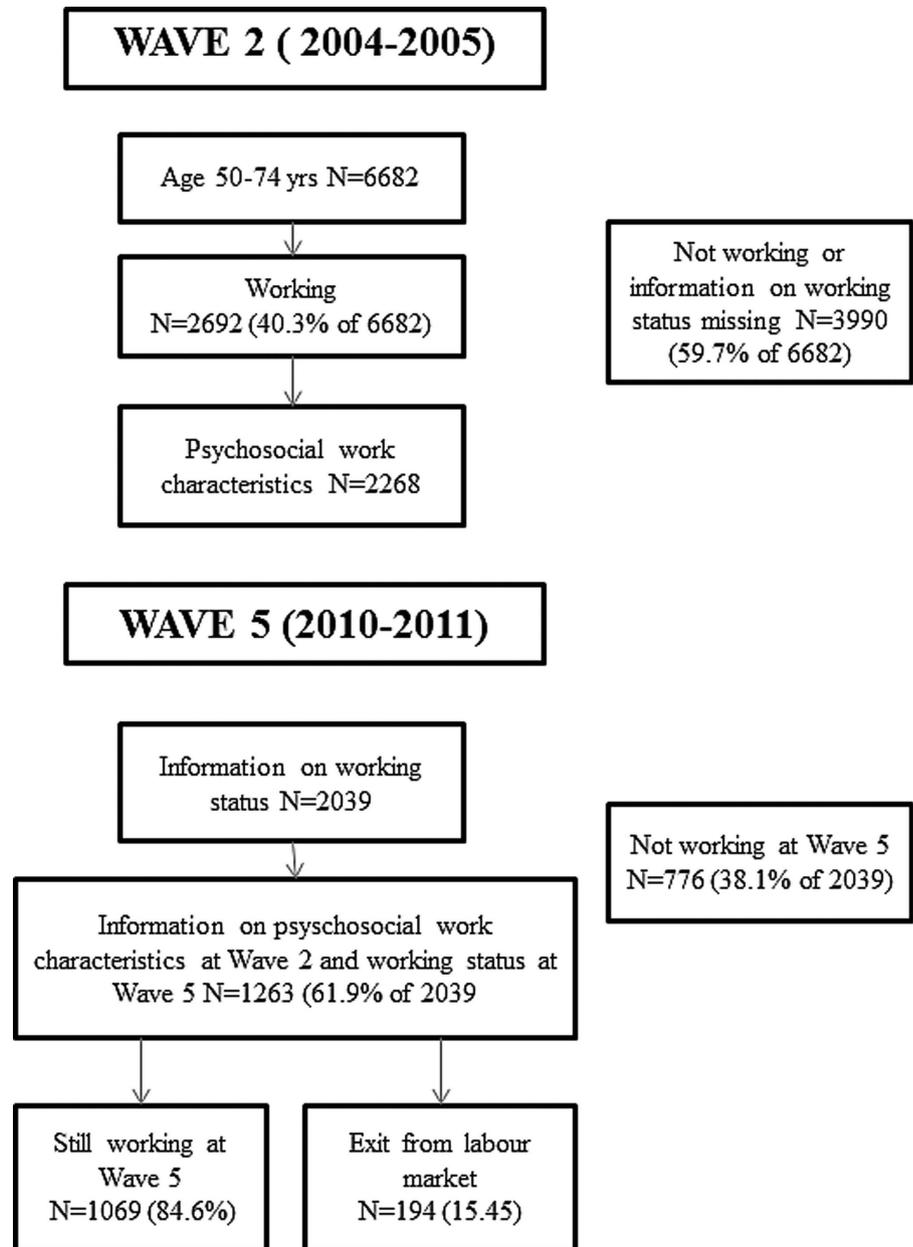
Allostatic load

A variable indicating allostatic load at wave 2 was formed from 13 biomarkers.^{38 39} The cut off points for obtaining a value of 1 (=higher risk) in allostatic load were defined as suggested in previous literature.³⁸ The cut off points used in our analyses to identify people at higher risk are the following: systolic blood pressure (>140 mm Hg) and diastolic blood pressure (>90 mm Hg), fibrinogen (>3 g/L), total cholesterol (>6.0 mmol/L), high-density lipoprotein and low-density lipoprotein cholesterol (<1.0 and >4 mmol/L, respectively), triglycerides (>2 mmol/L), C reactive protein (>3 mg/L), glycosylated haemoglobin ($>6\%$), peak flow (>410 L/min), body mass index (>30 kg/m²), sex-adjusted waist-hip ratio (0.9 for men and 0.8 for women) and sex-adjusted waist circumference (90 cm for women and 100 cm for men).

Statistical analyses

The associations between ERI and exit from the labour market were studied using logistic regression analysis. Multiple imputation models were used to account for missing information on

Figure 1 Description of data formation.



cohort members using Stata's 'mi' suite of commands. Variables were assumed to be missing at random. All variables included in the analytical models were included in the imputation model estimation. There were 30 imputed data sets for analysis. Visual inspection showed the distribution of imputed values varied randomly without any 'trending', suggesting the imputation process was stable. The associations between effort, reward, job control and exit from the labour market were studied using logistic regression analysis only in the complete cases data set.

RESULTS

The descriptive statistics of the sample are shown in table 1. There were 194 (15%) participants who had exited from the labour market at follow-up. At baseline, the mean age of the still working at follow-up group (n=1069, 483 women/45.2%) was 56.5 years (range 52–74 years) and 54.2 years (range 52–56) in the exit from labour market at follow-up group. In the still working at follow-up group, 503 participants (47.1%) and 104 participants (53.6%) in the exit from the labour market at follow-up group had A-level degree.

The relationships of age, sex, education, occupational class, depression and allostatic load with effort, reward, job control and ERI are shown in table 2. In the still working at follow-up group, younger age, lower occupational class and higher depression were related to higher ERI ($p < 0.05$). In the exit from labour market group at follow-up, higher depression was related to ERI ($p < 0.001$).

The results of the binary logistic regression analyses showed an age-adjusted and sex-adjusted association between higher ERI OR=1.68 (95% CI 1.07 to 2.66, $p=0.025$) and exit from the labour market (table 3). When controlling for education, occupation, depressive symptoms and allostatic load, in addition to age and sex, we found an attenuation of 8.8% in the association between higher ERI OR=1.62 (95% CI 1.01 to 2.61, $p=0.048$) and exit from the labour market (table 3). The results were not quite similar in the complete cases data set. Higher ERI was associated with exit from the labour market independent of age, sex, education and occupational class OR=1.65 (95% CI 1.03 to 2.62, $p=0.036$, $n=1108$). When controlling for depressive symptoms and allostatic load, in

Table 1 Descriptive characteristics of the sample

	Still working at follow-up				Exit from the labour market at follow-up			
	N	Per cent	Mean (SD)	Range	N	Per cent	Mean (SD)	Range
Age (2004–2005)	1069	84.6	56.5 (3.7)	52–74	194	15.4	54.2 (0.97)	52–56
Sex								
Male	586	54.8			74	38.1		
Female	483	45.2			120	61.9		
Education								
A-level or higher degree	503	47.1			104	53.6		
Secondary education	345	32.3			55	28.4		
No qualification	221	20.7			35	18.0		
Occupational class								
Professional	411	38.4			91	46.9		
Intermediate	296	27.7			42	21.6		
Routine/manual	362	33.9			61	31.4		
Effort–reward imbalance	934		0.94 (0.35)	0.25–3.33	174		1.02 (0.34)	0.26–2.50
Effort	936		2.47 (0.65)	1.00–4.00	174		2.65 (0.61)	1.00–4.00
Reward	936		2.75 (0.50)	1.00–4.00	174		2.70 (0.47)	1.60–4.00
Job control	937		2.92 (0.54)	1.00–4.00	174		2.79 (0.47)	1.00–4.00
Allostatic load	839		4.42 (2.30)	0.00–11.00	154		3.88 (2.24)	0.00–9.00
Depressive symptoms	1059							
No	959	90.6			163	84.9		
Yes	100	9.4			29	15.1		

addition to age and sex, the association was not significant (n=885, OR=1.61, p>0.05).

In addition, we conducted binary logistic regression analyses in the complete cases data set (max n) on effort, reward and job control. The results showed that job control was related to exit from labour market OR=0.60 (95% CI 0.42 to 0.85, p=0.004) independent of age, sex, education, occupational class and depression (table 4). In a similar way, after adjustment for age, sex, education, occupation and allostatic load, results showed that job control was associated with exit from the labour market OR=0.58 (95% CI 0.39 to 0.85, p=0.006). Controlling for all covariates reduced the effect of lower job control on exit from the labour market by 6.3% (age, sex, education, occupational class and depression) and by 7.9% (age, sex, education, occupational class and allostatic load) compared with age-adjusted and

sex-adjusted models (table 4). Effort was not related to exit from the labour market, except for in the analysis controlling for age, sex and depression OR=1.32 (95% CI from 1.01 to 1.73, p value 0.045). Reward was not associated with exit from the labour market (p>0.05, results not shown).

DISCUSSION

We examined whether stressful psychosocial work environment defined as ERI was related to exit from the labour market 6 years later. We found that higher ERI was associated with exit from the labour market independent of age, sex, education, occupational class, depression and allostatic load. In addition, we examined whether effort, reward and job control were related to exit from the labour market. Job control was associated with decreased likelihood of exit from the labour market.

Table 2 The association between background factors and stressful work characteristics

Predictor	Still working at follow-up								Exit from the labour market at follow-up							
	ERI		Effort		Reward		Control		ERI		Effort		Reward		Control	
	β	p Value	β	p Value	β	p Value	β	p Value	β	p Value	β	p Value	β	p Value	β	p Value
Age	-0.08	0.01	-0.13	<0.001	0.01	0.704	0.02	0.502	0.08	0.313	0.01	0.905	-0.12	0.119	-0.17	0.029
Sex M_W	-0.05	0.126	-0.00	0.904	0.07	0.026	0.00	0.970	-0.03	0.742	-0.01	0.875	0.02	0.798	-0.03	0.664
Education																
L3_L1	0.06	0.080	0.05	0.160	-0.05	0.121	-0.13	<0.001	-0.04	0.626	-0.08	0.330	-0.08	0.344	-0.11	0.154
L3_L2	-0.05	0.167	-0.09	0.009	-0.05	0.176	-0.14	<0.001	-0.02	0.839	-0.06	0.459	-0.06	0.424	-0.01	0.868
Occupation																
L3_L1	0.14	<0.001	-0.01	0.813	-0.25	<0.001	-0.25	<0.001	0.04	0.637	-0.07	0.422	-0.16	0.046	-0.16	0.053
L3_L2	0.03	0.474	-0.03	0.364	-0.09	0.014	-0.06	0.109	0.05	0.525	-0.09	0.254	-0.17	0.038	-0.11	0.161
Depression																
LO_L1	0.19	<0.001	0.11	0.001	-0.20	<0.001	-0.21	<0.001	0.27	<0.001	0.18	0.019	-0.26	0.001	-0.09	0.218
Allostatic load	0.01	0.702	0.02	0.542	-0.01	0.863	0.04	0.252	0.09	0.279	0.07	0.430	-0.08	0.333	0.02	0.861

Education and occupation: for example, L3_L1=level 1 (lowest) compared with level 3 (highest). Depression LO_L1: depression=L1 compared with no depression=L0; control=job control. Sex: M_W=men compared to women. ERI, effort–reward imbalance.

Table 3 The association between effort–reward imbalance (ERI) and early exit from the labour market in imputed data and complete cases data set

	ERI			N	ERI		
	OR	95% CI	p Value		OR	95% CI	p Value
Model 1	1.00			934	1.00		
	1.68	1.07 to 2.66	0.025	174	1.58	1.00 to 2.50	0.052
Model 2	1.00			930	1.00		
	1.57	0.98 to 2.51	0.058	174	1.50	0.94 to 2.40	0.092
Model 3	1.00			743	1.00		
	1.68	1.06 to 2.66	0.027	144	1.57	0.93 to 2.64	0.093
Model 4	1.00			934	1.00		
	1.73	1.09 to 2.75	0.020	174	1.65	1.03 to 2.62	0.036
Model 5	1.00			741	1.00		
	1.62	1.01 to 2.61	0.048	144	1.61	0.93 to 2.78	0.088

Left side imputed data set n=1263, right side complete cases data set (maximum n).
 Model 1: age and sex, models 2–4 in addition to age and sex.
 Model 2: depression.
 Model 3: allostatic load.
 Model 4: education and occupation.
 Model 5: all.

Higher effort was related to exit from the labour market independent of age, sex and depression, but this association attenuated to non-significant when education and occupational class were taken into account. Reward was not related to exit from the labour market.

We found that people exposed to higher ERI had an increased risk of having exited the labour market 6 years later. This finding is in line with previous results. Among London-based civil servants aged younger than 60 years, it was reported that if an employee is dissatisfied with the job, the probability of retiring early is twofold compared with satisfied employees.⁸ Dissatisfaction with work may increase the likelihood of perceiving characteristics at work as stressful, which, in turn, have been shown to increase intentions to retire early.⁴ Stressful psychosocial work environment may contribute to intentions to

exit from the labour market more among the older than among the younger employees. Furthermore, older employees may perceive their workload as more stressful and threatening than younger employees do.⁴⁰

Further, we found that job control decreased the likelihood of exit from the labour market. This is in accordance with previous findings reporting that lower job control is associated with increased early-retirement intentions.^{4 5} The association between lower job control and intentions to retire early were independent of age, sex, education and self-rated health, and the association was stronger among people aged 45 years or older compared with the whole sample.⁴ The effect size of job control on intentions to retire early was similar compared with the effect of lower job control on exit from the labour market in the present study.⁴ In a previous study, 24% of women and 26% of men with low job control were reported to have strong intentions to retire early.⁵ In a study among working men and women of early old age comprising 11 European countries, it has been shown that low job control exerts significant effects on general disability.²⁹ Low job control may also increase feelings of exhaustion⁴¹ and thus endanger ability to work.

Effort was related to exit from the labour market independent of age, sex and depression. It has been reported that employees in psychosocially demanding jobs tend to retire early more often compared with their colleagues in less psychosocially demanding jobs.⁸ Higher effort may increase job dissatisfaction that has been related to an increased risk of early retirement.^{8 42} However, taking education and occupational class into account attenuated the association between effort and work exit to non-significant. This finding is not in line with a study across six European countries reporting that higher job demands are related to early exit from work independent of education and employment opportunities.⁴³ The type of work may be reflected more in demands and effort than the other characteristics of work such as job control. Heavy physical workloads have been shown to predict early retirement.^{44 45} Working in a repetitive job has been shown to be linked with early exit from the labour market.⁴⁶

Table 4 The associations between work characteristics and early exit from the labour market in the complete cases data set

	Effort				Job control			
	N	OR	95% CI	p Value	N	OR	95% CI	p Value
Model 1a	932	1.00			933	1.00		
	174	1.35	1.03 to 1.76	0.030	174	0.64	0.46 to 0.89	0.008
Model 2a		1.00				1.00		
		1.32	1.01 to 1.73	0.045		0.66	0.47 to 0.92	0.015
Model 3a		1.00				1.00		
		1.27	0.96 to 1.66	0.094		0.58	0.42 to 0.82	0.002
Model 4a		1.00				1.00		
		1.23	0.93 to 1.63	0.138		0.60	0.42 to 0.85	0.004
Model 1b	742	1.00			743	1.00		
	144	1.24	0.92 to 1.68	0.152	144	0.63	0.43 to 0.91	0.014
Model 2b		1.00				1.00		
		1.24	0.92 to 1.67	0.156		0.64	0.44 to 0.92	0.016
Model 3b		1.00				1.00		
		1.15	0.85 to 1.56	0.371		0.57	0.39 to 0.84	0.004
Model 4b		1.00				1.00		
		1.15	0.84 to 1.56	0.385		0.58	0.39 to 0.85	0.006

Complete cases in listed variables. Model 1a: age and sex, 2a: age, sex, depression, 3a: age, sex, oc, 4a: all.
 Complete cases in listed variables. Model 1b: age and sex, 2b: age, sex, allostatic load, 3a: age, sex, oc, 4a: all.
 Models 1a–4a: n=932 (effort) and n=933 (job control) working as a reference group, n=174=work exit.
 Models 1b–4b: n=742 (effort) and n=743 (job control) working as a reference group, n=144=work exit.
 oc, occupational class.

The results of the present study should be interpreted considering some limitations. First, we assessed stressful work characteristics with abbreviated scales, which may increase the risk of underestimating their effects on work exit. However, abbreviated measures of stressful work characteristics have been validated in European cohort studies.^{29 31 32} Second, there are sex differences in the average age of withdrawal from the labour market. In 2011, this was approximately 62.8 years for women and 64.5 years for men.² Indeed, in our data there were more women among those who had exited the labour market. Yet, we found that there was an attrition according to occupational class and education (ie, a smaller proportion of participants with no educational qualification and in routine/manual occupations compared with the excluded), which may slightly influence the results. Another limitation is using self-reported labour market situation.

Further, in the present study the main reason for having exited from the labour market was early retirement, but there were some other reasons such as unemployment and sick leave. Including these is an unlikely reason for major bias in the present study because unemployed participants (8%) or people on sick leave (6%) did not comprise of very large proportions. However, we cannot be sure of whether they have definitively exited from the labour market. It has been shown that once becoming unemployed, older employees remain unemployed for longer,⁴⁷ which may decrease intentions and also hinder opportunities to return to work. Among older employees, being absent from the labour market for longer periods can decrease probability of re-employment and increase the risk of total exclusion from the labour market.⁴⁸ It is suggested that unemployment rate would be good to consider in future studies. Finally, we did not consider type of work, that is, physically active or sedentary work, in the present study. It has been previously shown in the ELSA cohort that activity level of work is not related to early retirement.²³ In addition, our results showed that work stress was related to work exit independent of occupational class. However, activity level of work could still be taken into account in future studies on exit from the labour market.

The strengths of our study were the use of a representative sample of older community-dwelling English adults and the ability to control for a number of covariates such as age, sex, education, occupational class, allostatic load and depression. Importantly, our study shows that depression and allostatic load have relatively little influence on labour market exit among older employees. Exit from the labour market does not occur only among those whose physical and mental health is affected by stress, stressful work environment appears to affect all employees. We yielded new information on the potential influence of stressful work conditions on work exit that can be utilised in efforts of extending work career and prevention of untimely exit from the labour market.

In conclusion, we showed that a stressful psychosocial work environment, indicated by ERI and lower job control, is associated with early exit from the labour market among older employees. The laws that regulate occupational healthcare (eg, The Health and Safety at Work, etc, Act 1974)⁴⁹ oblige employers to make sure that the health risks in the work environment are minimised or prevented whenever possible. A stressful psychosocial work environment has been shown to be a health risk and in the present study we showed that it is also predictive of exit from the labour market at the age of 61 years or younger. Thus, policies that invest in creating less stressful work environments would be a relevant starting point for maintaining work ability of older employees and extending working lives.

What is already known on this subject?

In previous studies, a stressful psychosocial work environment has been linked to intentions to retire early. Although some evidence on psychosocial predictors of early retirement exists, evidence on how stressful psychosocial work is related to early exit from the labour market is scarce. In addition, it is not yet known whether these potential associations are independent of age, sex, socioeconomic measures, depressive symptoms and allostatic load.

What this study adds?

Higher effort–reward imbalance predicts increased likelihood of exit from the labour market at the age of 61 years or younger, independent of age, sex, education, occupational class, depression and allostatic load. Job control is related to decreased likelihood of exit from the labour market. Policies that invest in creating less stressful work environments would be a relevant starting point for maintaining work ability of older employees and extending working lives.

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Contributors TH is responsible for all parts of the study (acquiring funding, planning the study design and analyses, and writing the text); AK and MM participated in planning the study, commented on the text and helped with the analyses. MM ran the imputed analyses. PD participated in planning the study, provided his expertise in interpreting ELSA data and commented on all parts of the manuscript. MJ provided expertise in statistical methods and helped in summarising the results. ME provided his expertise in psychosocial characteristics of the work and commented on the text.

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REFERENCES

- Whiting E. The labour market participation of older people. *Labour Market Trends* 2005;112.
- Government UK. <https://www.Gov.Uk/.../equality-data-table6-13.xls>
- Laine S, Gimeno D, Virtanen M, et al. Job strain as a predictor of disability pension: the Finnish Public Sector Study. *J Epid Comm Health* 2009;63:24–30.
- Elovainio M, Forma P, Kivimäki M, et al. Job demands and job control as correlates of early retirement thoughts in Finnish social and health care employees. *Work Stress* 2005;19:84–92.

- 5 Harkonmäki K, Rahkonen O, Martikainen P, *et al.* Associations of SF-36 mental health functioning and work and family related factors with intentions to retire early among employees. *Occup Environ Med* 2006;63:558–63.
- 6 Siegrist J, Wahrendorf M, von dem Knesebeck O, *et al.* Quality of work, well-being, and intended early retirement of older employees: baseline results from the SHARE Study. *Eur J Public Health* 2007;17:62–8.
- 7 von Bonsdorff M, Kokko K, Seitsamo J, *et al.* Work strain in midlife and 28-year work ability trajectories. *Scand J Work Environ Health* 2011;37:455–63.
- 8 Mein G, Martikainen P, Stansfeld SA, *et al.* Predictors of early retirement in British civil servants. *Age Ageing* 2000;29:529–36.
- 9 Amick BC III, McDonough P, Chang H, *et al.* Relationship between all-cause mortality and cumulative working life course psychosocial and physical exposures in the united states labor market from 1968 to 1992. *Psychosom Med* 2002;64:370–81.
- 10 Karasek RA. Job demands, job decision latitude, and mental strain: implications for job redesign. *Admin Sci Q* 1979;24:285–308.
- 11 Karasek RA, Theorell T. *Healthy work: stress, productivity and the reconstruction of working life*. New York: Basic Books, 1990.
- 12 Siegrist J. Adverse health effects of high-effort/low-reward conditions. *J Occup Health Psychol* 1996;1:27–41.
- 13 Siegrist J, Starke D, Chandola T, *et al.* The measurement of effort-reward imbalance at work: European comparisons. *Soc Sci Med* 2004;58:1483–99.
- 14 Belkic KL, Landsbergis PA, Schnall PL, *et al.* Is job strain a major source of cardiovascular disease risk? *Scand J Work Environ Health* 2004;30:85–128.
- 15 van Vegchel N, de Jonge J, Bosma H, *et al.* Reviewing the effort-reward imbalance model: drawing up the balance of 45 empirical studies. *Soc Sci Med* 2005;60:1117–31.
- 16 Kivimäki M, Nyberg ST, Batty GD, *et al.* Job strain as a risk factor for coronary heart disease: a collaborative meta-analysis of individual participant data. *Lancet* 2012;380:1491–7.
- 17 Bonde J. Psychosocial factors at work and risk of depression: a systematic review of the epidemiological evidence. *Occup Environ Med* 2008;65:438–45.
- 18 Adler D, McLaughlin T, Rogers W, *et al.* Job performance deficits due to depression. *Am J Psychiatry* 2006;163:1569–76.
- 19 Mittendorfer-Rutz E, Härkänen T, Tiihonen J, *et al.* Association of socio-demographic factors, sick-leave and health care patterns with the risk of being granted a disability pension among psychiatric outpatients with depression. *PLoS ONE* 2014;9:e99869.
- 20 Virtanen M, Honkonen T, Kivimäki M, *et al.* Work stress, mental health and antidepressant medication findings from the health 2000 study. *J Affect Disord* 2007;98:189–97.
- 21 Siegrist J, Lunau T, Wahrendorf M, *et al.* Depressive symptoms and psychosocial stress at work among older employees in three continents. *Global Health* 2012;8:27.
- 22 Lunau T, Wahrendorf M, Dragano N, *et al.* Work stress and depressive symptoms in older employees: impact of national labour and social policies. *BMC Public Health* 2013;13:1086.
- 23 Rice NE, Lang IA, Henley W, *et al.* Common health predictors of early retirement: findings from the English Longitudinal Study of Ageing. *Age Ageing* 2011;40:54–61.
- 24 McEwen BS. Stress, adaptation, and disease. Allostasis and allostatic load. *Ann N Y Acad Sci* 1998;840:33–44.
- 25 Sapolsky RM, Romero LM, Munck AU. How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative actions. *Endocr Rev* 2000;21:55–89.
- 26 Juster RP, Moskowitz DS, Lavoie J, *et al.* Sex-specific interaction effects of age, occupational status, and workplace stress on psychiatric symptoms and allostatic load among healthy montreal workers. *Stress* 2013;16:616–29.
- 27 Juster RP, Marin MF, Sindi S, *et al.* Allostatic load associations to acute, 3-year and 6-year prospective depressive symptoms in healthy older adults. *Physiol Behav* 2011;104:360–4.
- 28 Steptoe A, Breeze E, Banks J, *et al.* Cohort profile: the English Longitudinal Study of Ageing. *Int J Epidemiol* 2013;42:1640–8.
- 29 Reinhardt JD, Wahrendorf M, Siegrist J. Socioeconomic position, psychosocial work environment and disability in an ageing workforce: a longitudinal analysis of SHARE data from 11 European countries. *Occup Environ Med* 2013;70:156–63.
- 30 Leineweber C, Wege N, Westerlund H, *et al.* How valid is a short measure of effort-reward imbalance at work? A replication study from Sweden. *Occup Environ Med* 2010;67:526–31.
- 31 Wahrendorf M, Dragano N, Siegrist J. Social position, work stress, and retirement intentions: a study with older employees from 11 European countries. *Eur Social Res* 2013;29:792–802.
- 32 Siegrist J, Dragano N, Nyberg ST, *et al.* Validating abbreviated measures of effort-reward imbalance at work in European cohort studies: the IPD-Work Consortium. *Int Arch Occup Environ Health* 2014;87:249–56.
- 33 Demakakos P, Marmot M, Steptoe A. Socioeconomic position and the incidence of type 2 diabetes: the ELSA study. *Eur J Epidemiol* 2012;27:367–78.
- 34 Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. *Appl Psychol Meas* 1977;1:385–401.
- 35 Turvey CL, Wallace RB, Herzog R. A revised CES-D measure of depressive symptoms and a DSM-based measure of major depressive episodes in the elderly. *Int Psychogeriatr* 1999;11:139–48.
- 36 Turvey CL, Schultz SK, Beglinger L, *et al.* A longitudinal community-based study of chronic illness, cognitive and physical function, and depression. *Am J Geriatr Psychiatry* 2009;17:632–41.
- 37 Demakakos P, Pierce MB, Hardy R. Depressive symptoms and risk of type 2 diabetes in a national sample of middle-aged and older adults. *Diabetes Care* 2010;33:792–7.
- 38 Juster RP, McEwen BS, Lupien SJ. Allostatic load biomarkers of chronic stress and impact on health and cognition. *Neurosci Biobehav Rev* 2010;35:2–16.
- 39 Seeman TE, McEwen BS, Rowe JW, *et al.* Allostatic load as a marker of cumulative biological risk: MacArthur studies of successful aging. *Proc Natl Acad Sci USA* 2001;98:4770–5.
- 40 Wang M, Shultz KS. Employee retirement: a review and recommendations for future investigation. *J Manag* 2010;36:172–206.
- 41 De Lange AH, Taris TW, Kompier MAJ, *et al.* “The very best millenium”: longitudinal research and the demand-control-(support) model. *J Occup Health Psychology* 2003;8:282–305.
- 42 Kubicek B, Korunka C, Hoonakker P, *et al.* Work and family characteristics as predictors of early retirement in married men and women. *Res Aging* 2010;32:467–98.
- 43 Widerszal-Bazyl M, Piotr Radkiewicz P, Hasselhorn H-M, *et al.* The demand-control-support model and intent to leave across six European countries: the role of employment opportunities. *Work Stress* 2008;22:166–84.
- 44 Salonen JT, Arola H, Nygård C-H, *et al.* Factors associated with premature departure from working life among ageing food industry employees. *Occup Med* 2003;53:65–8.
- 45 Blekesaune M, Solem P. Working conditions and early retirement—a prospective study of retirement behavior. *Res Aging* 2005;27:3–30.
- 46 Reitzes DC, Mutran EJ, Fernandez ME. The decision to retire: a career perspective. *Soc Sci Q* 1998;79:607–19.
- 47 Lascko F, Phillipson C. *Changing work and retirement*. Milton Keynes Open University Press, 1991.
- 48 Henkens K, Sprengers M, Tazelaar F. Unemployment and the older worker in the Netherlands: re-entry into the labour force or resignation. *Ageing Soc* 1996;16:561–78.
- 49 <http://www.hse.gov.uk/legislation/hswa.htm>