

Combinations of Job Demands and Job Control and Future Trajectories of Sickness Absence and Disability Pension An 11-year Follow-up of Two Million Employees in Sweden

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Objective: The aim of this study was to examine the association between combinations of job demands/control and future sickness absence (SA) and disability pension (DP) trajectories over 11 years. **Methods:** A population-based prospective cohort study of female ($n = 1,079,631$) and male ($n = 1,107,999$) employees in 2001. With group-based trajectory analysis, we modeled the trajectories of annual mean SA/DP days in 2002 to 2012. We predicted trajectory memberships for job demands/control using multinomial regression. **Results:** We found three SA/DP trajectories for women (low stable, medium stable, and high increasing) and two for men (low stable and high increasing). Low demands/low control in women [odds ratio (OR) 1.42; 95% confidence interval (95% CI) 1.38 to 1.45], and low demands and medium/high control in men (equal OR of 1.23; 95% CI 1.18 to 1.28) were strongly associated with high increasing trajectory. **Conclusion:** The associations between job demands/control varied between SA/DP trajectories and between sexes.

Keywords: disability pension, job control, job demands, sickness absence, trajectory

As work disability is a major cause for an early exit from the labor market in Europe, it is crucial to understand the factors leading to work disability. Previous research has identified multiple factors associated with work disability,¹ including working conditions.² Especially psychosocial working conditions are becoming increasingly important, as physically straining jobs are diminishing

Learning Objectives

- Summarize previous findings on associations of job demand and control with risk of sickness absence (SA) and disability pension (DP).
- Discuss the new findings on long-term trajectories of SA/DP in the Swedish working population.
- Identify combinations of job demands and control associated with SA/DP trajectories, including differences between women and men.

at least in Sweden.³ The relationship between working conditions and work disability and related benefits is complex. Poor working environment can contribute to sickness absence (SA) and disability pension (DP) either by causing poor health or nonhealth-related absence from work (such as experience of bullying at work⁴). In addition, individuals with health problems might select into occupations with a poor work environment.

The Job Demands-Control (JDC) model by Karasek and Theorell⁵ is widely used in describing the association between job demands and job control and employee wellbeing. Although the theoretical model has shown to be very effective, according to recent reviews, empirical research has had several shortcomings.^{6,7} There is a need for more research with a longitudinal setting, using measures of job demands and job control that are not self-reported, using more fine-tuned combinations of demands and control for further insight how these two components work together. In this study, we aim to fill all these gaps. Previous studies have shown a clear association between combinations of job demands and job control and SA and DP.^{2,8–11} Most of these studies have used four specific occupational characteristics: active (high demands and high control), high strain (high demands and low control), passive (low demands and low control), and low strain (low demands and high control). Especially high strain jobs^{2,12–17} and passive jobs^{12,14,16–18} are associated with a high risk of SA and DP. However, the “quadrant” model does not differentiate between those who are located very near or far from the median of the different job demand-control combinations. A division of job demands and control into tertiles provides a reference group in the “middle” of this combination, and more detailed insight on its association with health outcomes.

We have previously examined associations between tertile-based demand-control combination and risk of SA and DP in both cross-sectional¹⁹ and longitudinal analyses²⁰ in the Swedish workforce. In the present paper, we examine in the same cohort, the association between tertile-based demand-control combinations and trajectories of SA and DP. To our knowledge, only one study has examined the association between job demands and job control and SA trajectories among Finnish female kitchen workers.²¹ Moreover, studies examining work disability trajectories have mainly analyzed socioeconomic and health-related factors.^{21–25} Only one study has examined the contribution of physically demanding work to the

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Low levels of job demands, independently of job control, and low levels of job control, independently of job demands, were associated with adverse sickness absence and disability pension trajectories in women and men. However, more nuanced associations between job demands/control and the trajectories were also discovered in both sexes.

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SA trajectories.²⁶ However, no studies have used the combined measure of job demands and job control as exposure to the SA/DP trajectories.

The main research question of this study was: how are different combinations of job demands and job control measured by job-exposure matrix (JEM) associated with subsequent SA/DP trajectories among paid Swedish employees? The analyses were divided in two main parts. First, we examined what kind of SA/DP trajectories are formed in the study population. Second, we investigated how different combinations of job demands and job control from the surveys were associated with these trajectories. As the labor market in Sweden is gender segregated²⁷ and the gender differences are also clear in SA²⁸ and DP,²⁹ we conducted all analyses separately for women and men.

METHODS

Data

We used data from a nationwide register, linked at an individual level by use of the personal identification number. Data on age, sex, country of birth, type of living area, family composition, education, and net days with SA and DP benefits from the Social Insurance Agency per year derived from the Longitudinal Integration Database for Health Insurance and Labour Market Studies (LISA by Swedish acronym) held by Statistics Sweden.

Study Population

All individuals who were living in Sweden, aged 30 to 54 years, in paid work with an annual income from work and benefits at least 8856 SEK (approximately 957 euros, exchange rate in 2001) and had a registered occupation according to the Swedish Standard for Occupational Classification (SSYK by Swedish acronym) in 2001 were included in this study. The income limit is used to exclude those ineligible for SA benefits from the Swedish Social Insurance Agency (SIA). Those with full-time SA in 2000 and 2001 or full-time DP in 2001 were excluded. To include enough time points for trajectory construction, we included individuals with at least 4 years of follow-up in the study. This yielded a study population of 2,187,630 individuals.

Sickness Insurance in Sweden

The public sickness benefit insurance covers all over 15 years old Swedes, living in Sweden with an income from work (including self-employed) or unemployment benefits. Sickness benefit can be received after a reduced work capacity due to disease or injury. Medical certification is required after 7 days of self-certification. The first 14 days of SA are covered by the employer, after which sickness benefit is paid by the SIA. All Swedish residents aged 19 to 64 years whose work capacity is permanently reduced due to diseases or injury can receive a DP from the SIA. Sickness benefits amount to 80% of lost income, DP to 65%, and they can be for full-time or part-time (25%, 50%, or 75%) of ordinary working hours.

INDEPENDENT VARIABLES

Job Demands and Job Control

For assessing job demands and job control, we used a previously published JEM.^{19,30} The data for the JEM derive from the Swedish Work Environment Surveys from 1989 to 1997 ($N = 48,894$). Answers to questions considering job demands and job control were grouped using factor analysis (see questions in Supplementary Digital Content 3, <http://links.lww.com/JOM/A767>). From these, separate estimates of demands and control were given for each age and sex-adjusted 320 occupations separated into gender and age. Occupational categories were based on the Nordic Classification of Occupations (NYK by Swedish acronym).³¹ A more

detailed description of how the occupational classes in the JEM were coded according to NYK and SSYK is found in study from Norberg et al.¹⁹ In line with studies from Norberg et al.¹⁹ and Farrants et al.,²⁰ we divided the mean values into tertiles: high, medium, and low job demands and control, and combined them into a nine-category matrix.

Covariates

We adjusted for several demographic variables measured at baseline in 2001. These consisted of age, country of birth, education, type of living area, and family composition (see Table 1). Further, we adjusted for previous work disability benefits, that is, having part-time SA in 2000 or 2001, full-time DP in 2000, and part-time DP in 2001.

DEPENDENT VARIABLE

Sickness Absence and Disability Pension

The outcome variable was measured as the total number of net days of SA and DP per year. For the calculation of net days, part-time SA/DP was combined, for example, 2 days of 50% absence were combined to one day.

Statistical Analysis

To analyze SA/DP trajectories, we utilized a group-based trajectory analysis (GBTAs), which is an application of a mixture modeling that identifies distinct groups of the study population with approximately similar trajectories on a selected time or age-varying outcome.³² The annual number of work disability days was used as a repeated outcome. The number of optimal trajectory groups and shapes were assessed using the Bayesian information criteria (BIC). Individuals were assigned to the group they had the highest probability of belonging to. The final model was the one with decreasing BIC value, at least 5% of the study population in each group, and at least 0.70 average probability of belonging to the group in all groups. We used a normal distribution to model the outcome variable. The composition of the work disability trajectory groups was initially examined with cross-tabulations and Chi-square tests.

The individual probabilities of belonging to a particular group were estimated using a multinomial logit function. In the full models, we adjusted the models for all the confounders described previously. Coefficients were log-transformed to odds ratios (ORs) with their 95% confidence intervals (95% CIs) reported. We use a contour plot to visualize of the kernel density estimates for the JEM by each trajectory group for women and men. Statistical analyses were conducted using SAS v. 9.4 and Stata v. 15.

Sensitivity Analysis

To control for individuals with poor health selecting out during the follow-up period, we conducted the trajectory analysis with different restrictions to follow-up. However, as around 94% of the study population had full 11 years of follow-up, the results did not change significantly with different follow-up times.

RESULTS

Descriptive Results

In total, there were 1,079,631 women and 1,107,999 men in this study. In general, a majority of women and men were born in Sweden, had 10 to 12 years of education, lived in urban areas, were married or cohabiting with children and did not have SA in 2000 (Table 1). No large differences between women and men were found in demographic characteristics, except for the family composition, as a lower rate of women lived without children than men. A higher rate of women than men had previous SA and DP.

Women worked more often in occupations with low job demands and low job control, and men in occupations with high

TABLE 1. Descriptive Characteristics of the Population in 2001

	Women		Men	
	N	%	N	%
Age groups, years				
30–34	214,654	19.9	240,641	21.7
35–40	233,147	21.7	251,594	22.7
41–44	218,969	20.3	219,790	19.8
45–50	223,601	20.8	206,747	18.7
51–53	185,410	17.3	179,227	16.2
Country of birth				
Sweden	952,450	88.5	991,044	89.5
Outside Sweden	123,331	11.5	116,682	10.5
Education, years				
Elementary (≤9)	116,606	10.9	543,117	26.0
Secondary (10–12)	546,721	50.8	917,720	43.9
Tertiary (>12)	412,454	38.4	631,323	30.2
Type of living area				
Urban (Stockholm, Gothenburg, Malmö)	398,683	37.2	398,138	35.9
Medium-sized town (>90,000 inhabitants)	373,975	34.7	389,870	35.2
Rural or small town (<90,000 inhabitants)	303,123	28.2	319,991	28.9
Family composition				
Married/cohabiting w/o children	608,757	56.5	613,210	54.4
Married/cohabiting with children	111,284	10.4	84,195	7.5
Single/divorced/separated/widowed w/o children	156,556	14.6	40,042	3.5
Single/divorced/separated/widowed with children	199,184	18.6	390,552	34.6
Previous work disability				
Sickness absence in 2000	198,238	18.4	102,821	9.3
Sickness absence in 2001	229,007	21.3	118,673	10.7
Disability pension in 2000	7,496	0.7	4,427	0.4
Disability pension in 2001	8,093	0.8	2,264	0.2
Total	1,075,781	100	1,107,999	100

Job Exposure Matrix	Job Control (%)			Job Control (%)		
	Low	Medium	High	Low	Medium	High
Low	24.81	6.38	2.44	16.08	11.83	5.15
Medium	8.91	18.58	3.57	7.8	9.73	18.66
High	6.30	15.44	13.55	3.55	4.97	22.89

job demands and high job control (Table 1 and Fig. 1A). Women also had higher job demands in relation to job control, whereas in men, this association was reversed. More detailed results on the JEM distribution across the population are reported in a previous study of Norberg et al¹⁹ (Table 2 and Fig. 2A,B).

SA/DP Trajectories

In trajectory analysis, a three-group model with cubic shapes had the best fit to the data in women, and a two-group model with cubic shapes had the best fit in men (Fig. 2 and Supplementary Digital Content 1, <http://links.lww.com/JOM/A765>). Among women, the three groups were low stable, with 71.9% of the study population, medium stable with 19.7%, and high increasing with 8.4%. Among men, the two groups were low stable with 90.6% and high increasing with 9.4%.

Those in low stable SA/DP trajectory were on average younger, more often born in Sweden, had a higher education, lived in an urban area, were more often married or cohabiting without children, and had less often previous SA and DP than those in the other trajectories (Table 2). Those in the high increasing trajectory were on average older, more often born outside Sweden, had on average lower education, lived in rural areas or in a small town, were more often married or cohabiting without children at home, and had SA and DP more often than those in other trajectories. In its demographic characteristics, the medium trajectory was somewhere in between, but more similar to the low trajectory.

Distribution of Job Demands and Control Across SA/DP Trajectories

In women, the JEM distribution in low stable trajectory was much like in the total population (Fig. 1A,B). In the medium stable trajectory, many occupations were characterized by low and medium job demands or control. Those in the high increasing trajectory were even more often in occupations with low demands and low control. In men, the results were similar. The occupations were less concentrated in the high increasing trajectory; however, most men were in occupations with low demands and low to medium control (Fig. 1C).

Associations with JEM and SA/DP Trajectories

Figure 3A and B show in general, high job demands with medium or high job control was associated with low stable SA/DP trajectory. Further, low job demands, independently of job control, and low job control independently of job demands, were associated of belonging to the medium stable or high increasing trajectory instead of low stable trajectory. In women, there were three exceptions. First, a combination of low job demands and high job control was associated with low stable SA/DP trajectory. Second, high job demands with low job control was associated with adverse SA/DP trajectories. Third, the ORs between medium stable and high increasing trajectories were very small, and only the combination of low job demands and low job control had an increased risk of belonging to the high increasing trajectory, while other combinations decreased the risk.

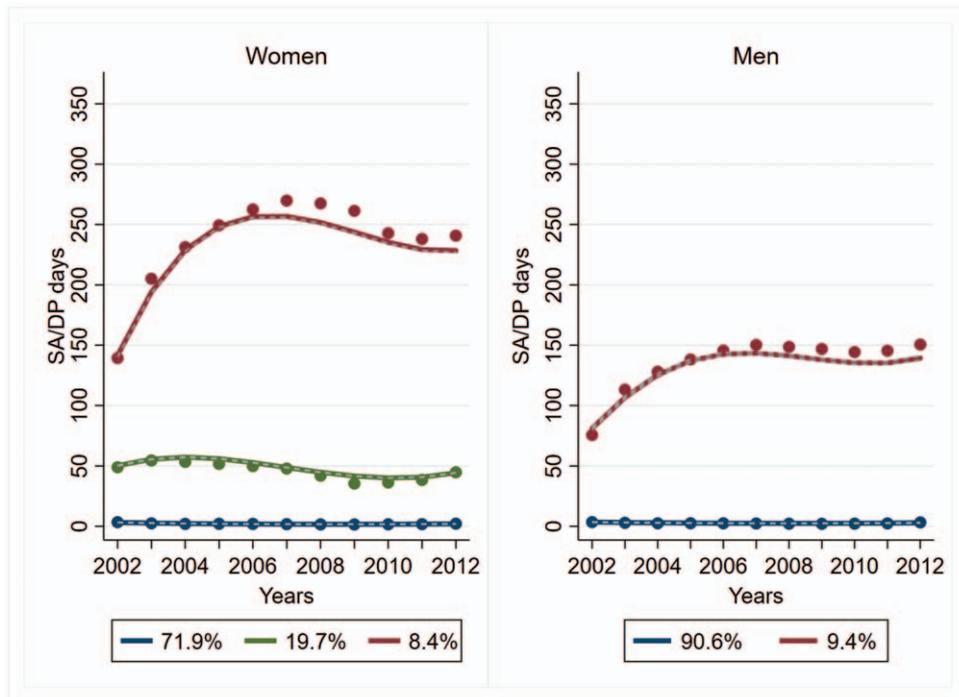


FIGURE 1. SA/DP trajectories calculated with a censored normal model. Estimated SA/DP trajectories (solid lines) and observed group means at each time point (dotted line) with smoothed estimates and 95% confidence intervals and estimated group percentages. Women on the left, men on the right.

Compared with the combination of medium job demands and medium job control, women working in occupations with low job demands and low job control had the highest risk of belonging to high increasing trajectory (OR 1.42, 95% CI 1.38 to 1.45) or to medium stable trajectory (OR 1.33, 95% CI 1.31 to 1.35) than to low stable trajectory, and to high increasing trajectory (OR 1.08, 95% CI 1.05 to 1.11) than to the medium stable trajectory. In men, the combination of low job demands and medium job control (OR 1.23, 95% CI 1.19 to 1.27) and low job demands and high job control (OR 1.23, 95% CI 1.18 to 1.28) had the highest risk of belonging to the high increasing trajectory.

In both women and men, those who were older, living in an urban area, born in Sweden, other than unmarried without children, had higher education and had previous SA or DP had a higher odds of belonging to medium stable or high increasing trajectory both in women and men (Supplementary Digital Content 2, <http://links.lww.com/JOM/A766>).

DISCUSSION

Main Results

This study of two million Swedish 30 to 54 years old employees showed how different combinations of job demands and control are associated with future SA/DP trajectories in women and men. We found three trajectories for women: low stable, medium stable, and high increasing, and two for men: low stable and high increasing. In women, low stable and medium stable trajectories consisted largely of occupations with higher levels of job demands in relation to job control, and the high increasing trajectory of occupations with low job demands and low job control. In men, the low stable trajectory consisted mostly of occupations with medium or high job demands and high job control, and the high increasing trajectory of occupations with low or medium job demands and medium or low job control.

Comparison with Previous Studies

The only previous study on job demands and job control and SA trajectories found no association between them.²¹ In this study,

we found multiple associations with the three SA/DP trajectories. However, the previous study focused on a specific group of Finnish municipal kitchen workers with musculoskeletal pain, whereas our study included the whole Swedish workforce. Perhaps within one specific occupation, the variation between the levels of job demand and control is too small to be associated with significant variation in SA. Due to the lack of previous studies on job demands and control and SA/DP trajectories, we can only compare our results with studies measuring SA or DP outcomes at single time points. The results should be compared with caution, as many previous studies have used different classification of job demands and job control and reported relative risks.

Our results showed that the combination of low job demands, independently of levels of job control, and low job control, independently of job demands were associated with adverse SA/DP trajectory instead of low stable trajectory in women and men. Similar findings have been made in studies using different measures of job demands and control and SA/DP outcomes.^{2,8–11,13,15–17} As an exception, in women, low job demands and high job control (“low strain jobs”) were associated with low stable SA/DP trajectory. Surprisingly in men, a combination of low job demands and medium or high job control had the strongest association with an adverse SA/DP trajectory. Previous studies, using quadrant division, have found high job demands and low job control (“passive jobs”) to be protective against adverse SA or DP outcomes.^{12–14,17,18} In women, the strongest associations were between low job demands and low job control and adverse SA/DP trajectories compared with low stable SA/DP trajectory. Previous studies, again using the quadrant division, have similarly found an association between this combination and adverse SA and DP outcomes.^{12,14,16–18} Occupations with low job demands and low job control largely consist of low-wage and manual work jobs that typically have a higher prevalence of SA¹⁶ and DP.^{8,35} However, our results suggest that at least in women, a combination low job demands and low job control only differentiates between low stable and more adverse SA/DP trajectories, but not between medium stable and high increasing SA/DP trajectories.

TABLE 2. Proportion (%) of Sociodemographic Characteristics in Each of the Three Sickness Absence and Disability Pension (SA/DP) Trajectories in Women and Two SA/DP Trajectories in Men

	Women			Men	
	Low Stable	Medium Stable	High Increasing	Low Stable	High Increasing
Group N	763,734	215,484	96,563	999,941	102,632
Age groups, years					
30–34	21.2	20.0	9.8	22.7	12.4
35–40	22.6	21.5	15.7	23.3	17.4
41–44	20.5	20.2	19.7	19.9	19.3
45–50	20.0	21.0	26.2	19.1	24.4
51–53	15.7	17.4	29.1	15.1	26.5
Country of birth					
Sweden	89.6	87.5	82.6	90.2	83.1
Outside Sweden	10.4	12.5	17.4	9.8	16.9
Education, years					
Elementary (≤9)	9.2	12.5	20.2	15.2	25.9
Secondary (10–12)	49.4	53.7	55.5	50.5	55.3
Tertiary (>12)	41.4	33.8	24.4	34.4	18.8
Type of living area					
Urban (Stockholm, Gothenburg, Malmö)	37.9	35.6	31.4	36.2	33.0
Medium-sized town (>90,000 inhabitants)	34.8	34.1	36.2	35.2	34.9
Rural or small town (<90,000 inhabitants)	27.3	29.4	32.4	28.6	32.1
Family composition					
Married/cohabiting without children	59.1	52.9	44.8	56.3	46.7
Married/cohabiting with children	9.7	10.3	15.8	7.3	10.1
Single/divorced/separated/widowed without children	13.1	18.3	18.0	3.5	4.7
Single/divorced/separated/widowed with children	18.1	18.6	21.4	32.9	38.4
Total (%)	100	100	100	100	100
Previous work disability					
Sickness absence in 2000	11.6	28.2	50.4	7.4	29.9
Sickness absence in 2001	12.5	34.6	60.9	7.8	38.5
Disability pension in 2000	0.2	0.6	4.9	0.3	1.8
Disability pension in 2001	0.0	0.6	6.8	0.0	2.0
Total (%)	100	100	100	100	100

Further, we were unable to confirm previous findings on high job demands and low job control (“high strain job”) being the strongest predictor of adverse SA/DP outcomes.^{2,12–14,16–18} We found that this combination had a strong, but not the strongest association with high increasing SA/DP trajectory. In women, this combination was not significant in differentiating between belonging to the medium stable and high increasing SA/DP trajectories. This indicates that the association between high job demands and low job control, and health outcomes is associated with the severity of the outcome. In our previous study, we also did not find evidence for high job strain being a particularly strong predictor of SA.¹⁹ It is difficult to state whether these contradicting results stem from the differences in the study population, in the measures of job strain, SA/DP, or something else.

High job demands with medium or high job control (“active jobs”) were associated with beneficial SA/DP trajectories. Also previous studies, again using slightly different classification of job demands and job control, have found similar results with SA and DP outcomes.¹⁹ As an exception, in women, this combination did not differentiate between low stable and medium stable SA/DP trajectories, implying that this demands-control combination may be protective only against high levels of SA or DP. High job demands and high job control are typically found to protect against health risks by increasing performance, learning, and motivation.⁵ In general, we are unable to show whether these associations are due to the effect of work environment or due to health selection, for example, that persons with poorer health would more likely to select into occupations with low levels of job demands and job control.

Our results on the demographic differences between trajectories support previous findings^{19,22} showing that on average younger, those

born in Sweden, who had a higher education, lived in an urban area, were married or cohabiting without children, and did not have previous SA or DP were more likely to belong to low rather than to medium or high increasing SA/DP trajectory, and to medium trajectory rather than high increasing SA/DP trajectory.

Strengths and Limitations

A strength of this study is that the whole population in paid work in Sweden was included, instead of a specific diagnostic or occupational group, as in most previous studies. Other strengths are that we have used data from a large, high-quality administrative register for outcome and covariates that allows adjusting for several important factors with no loss of data due to non-response. Another strength is the use of a JEM to measure job demands and job control, as this decreases the reporting bias of the exposure, one of the key concerns in research on psychosocial work environment and health.^{34,35} Finally, we believe that it is a strength that we combined demands and control not by the median split, as previous studies have done,^{17,36,37} but that we instead used a nine combinations approach, as this resulted in a more detailed categorization of job demands and job control. Use of trajectories can help to recognize vulnerable groups in terms of SA/DP. Perhaps the two largest limitations of the study are that, first, with the JEM methodology we are unable to distinguish between-individual variation in job demands and job control in the same occupation. Second, we are unable to identify the mechanisms between psychosocial work environment and subsequent SA/DP. Individuals with poor health might be prone to select into occupations with lower demands, or to switch to occupations with lower job demands. These individuals are in turn more prone to transit to SA or DP. Further, values at a

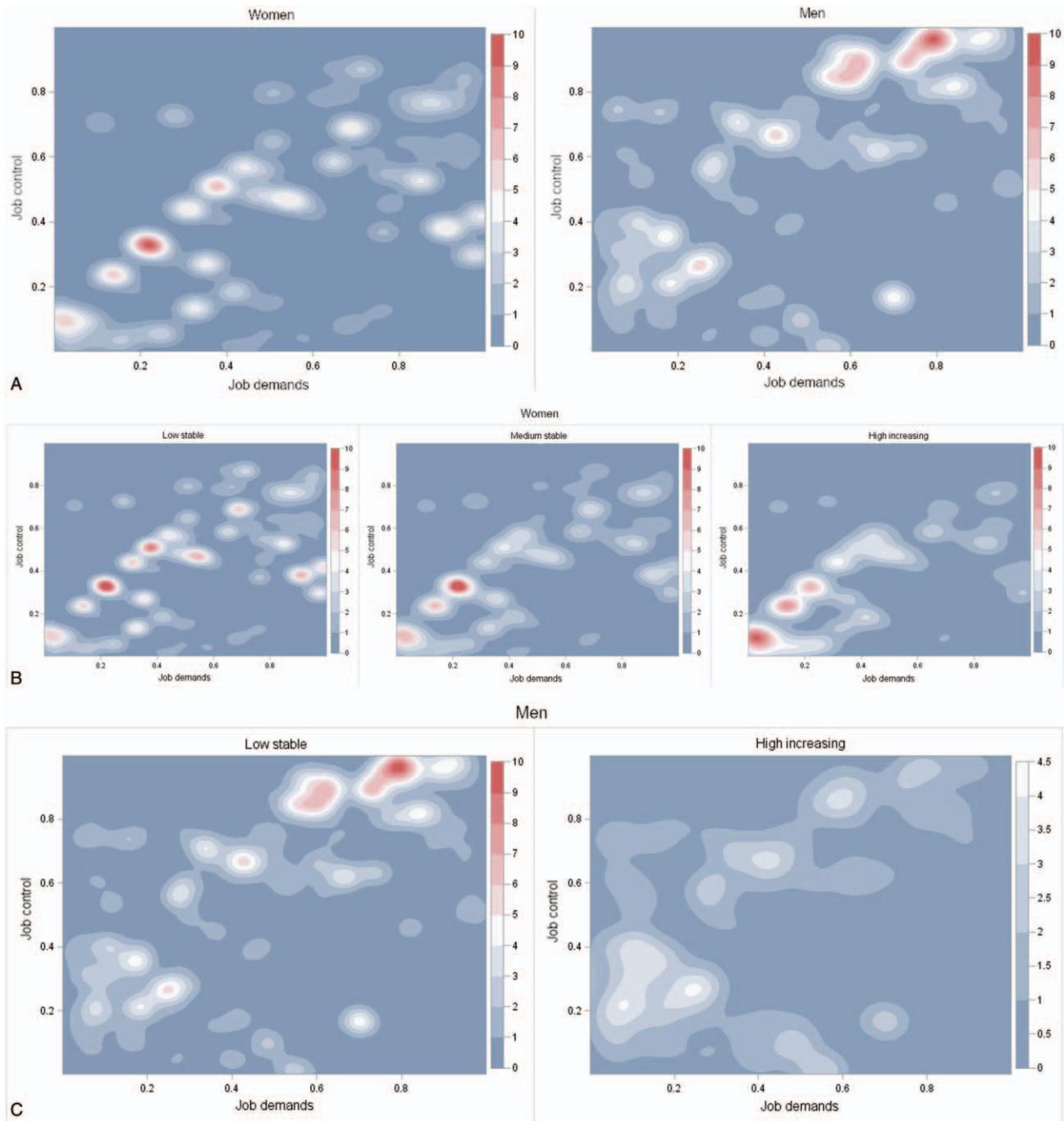


FIGURE 2. (A) Kernel density plots of the concentration of combinations of job demands and control among people in paid work in Sweden in men and women. (B) Kernel density plots in women according to SA/DP trajectory groups. Low trajectory group on the left, medium trajectory group in the middle, high increasing trajectory group on the right. (C) Kernel density plots in men according to SA/DP trajectory groups. Low trajectory group on the left, high increasing trajectory group on the right.

detailed level were not available for all occupations, and that information on occupation was only measured once and not updated in LISA for all individuals every year. More research should be conducted on the changes in JEM during an individual’s life-course and how these possible changes interact with work ability.

CONCLUSION

The results of this study suggest that the combination of job demands and job control is associated with subsequent SA/

DP trajectories and this association varies between women and men. In women, low job demands and in men low job demands and low job control are independently associated with adverse SA/DP trajectories. Low job demands and low job control in women, and low job demands with medium or high job control were at risk of belonging to medium stable or high increasing SA/DP trajectory, instead of low stable trajectory. Further research should be conducted to assess whether job demands and job control cause health problems, or whether individuals with poor

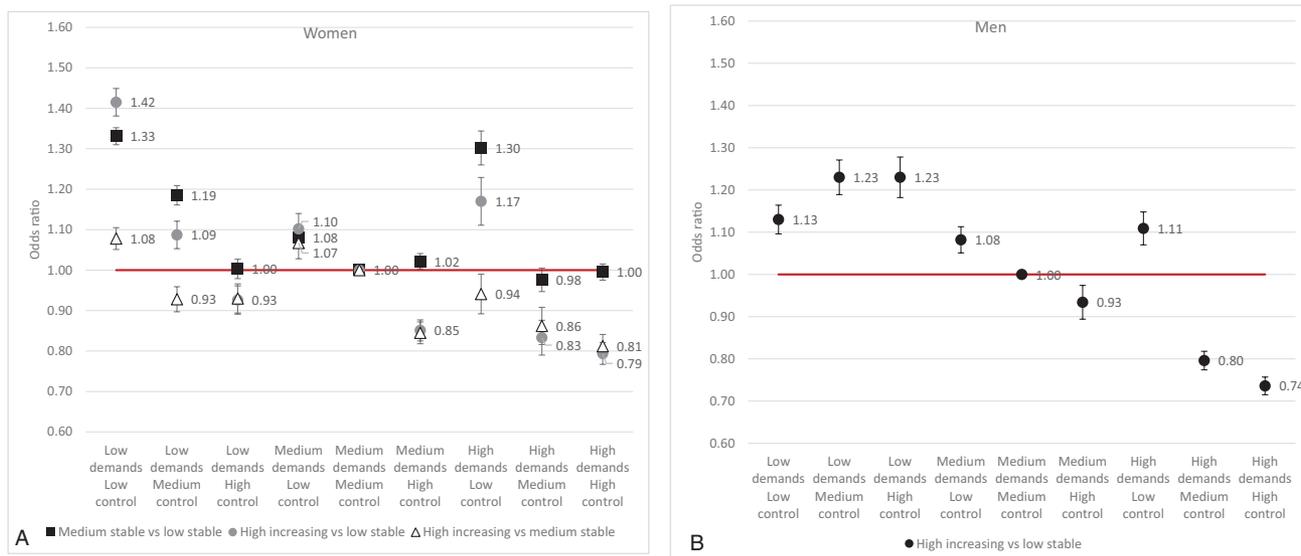


FIGURE 3. (A) Odds ratios with 95% confidence intervals for each of the nine job strain categories for belonging to different SA/DP trajectories in women. Adjusted for age group, country of birth, education, type of living area, family composition, and previous work disability. (B) Odds ratios with 95% confidence intervals for each of the nine job strain categories for belonging to different SA/DP trajectories in men. Adjusted for age group, country of birth, education, type of living area, family composition, and previous work disability.

health are selected into occupations with low job demands and job control.

REFERENCES

- Duijts SFA, Kant I, Swaen GMH, van den Brandt PA, Zeegers MPA. A meta-analysis of observational studies identifies predictors of sickness absence. *J Clin Epidemiol.* 2007;60:1105–1115.
- Knardahl S, Johannessen HA, Sterud T, et al. The contribution from psychological, social, and organizational work factors to risk of disability retirement: a systematic review with meta-analyses. *BMC Public Health.* 2017;17.
- Cerdas S, Härenstam A, Johansson G, Nyberg A. Development of job demands, decision authority and social support in industries with different gender composition: Sweden, 1991-2013. *BMC Public Health.* 2019;19:758.
- Voss M, Floderus B, Diderichsen F. How do job characteristics, family situation, domestic work, and lifestyle factors relate to sickness absence? A study based on Sweden post. *J Occup Environ Med.* 2004;46:1134–1143.
- Karasek R, Theorell T. *Healthy Work: Stress, Productivity, and the Reconstruction of Working Life.* New York: Basic Books; 1990.
- Fila MJ. The job demands, control, support model: where are we now? *Int J Res Manag.* 2016;1:15–44.
- Kain K, Jex S. Karasek's (1979) job demands-control model: a summary of current issues and recommendations for future research. In: Perrewe PL, Ganster DC, editors. *New Developments in Theoretical and Conceptual Approaches to Job Stress.* Bingley, UK: Emerald Group Publishing Limited; 2010. p. 237–268.
- Aagestad C, Johannessen HA, Tynes T, Gravseth HM, Sterud T. Work-related psychosocial risk factors for long-term sick leave: a prospective study of the general working population in Norway. *J Occup Environ Med.* 2014;56:787–793.
- Clausen T, Burr H, Borg V. Do psychosocial work conditions predict risk of disability pensioning? An analysis of register-based outcomes using pooled data on 40,554 observations. *Scand J Public Health.* 2014;42:377–384.
- Laaksonen M, Pitkaniemi J, Rahkonen O, Lahelma E. Work arrangements, physical working conditions, and psychosocial working conditions as risk factors for sickness absence: Bayesian analysis of prospective data. *Ann Epidemiol.* 2010;20:332–338.
- Lund T, Labriola M, Christensen KB, Bültmann U, Villadsen E, Burr H. Psychosocial work environment exposures as risk factors for long-term sickness absence among Danish employees: results from DWECS/DREAM. *J Occup Environ Med.* 2005;47:1141–1147.
- Blank N, Diderichsen F. Short-term and long-term sick-leave in Sweden: relationships with social circumstances, working conditions and gender. *Scand J Soc Med.* 1995;23:265–272.
- Canivet C, Choi B, Karasek R, et al. Can high psychological job demands, low decision latitude, and high job strain predict disability pensions? A 12-year follow-up of middle-aged Swedish workers. *Int Arch Occup Environ Health.* 2013;86:307–319.
- Mutambudzi M, Theorell T, Li J. Job strain and long-term sickness absence from work: a ten-year prospective study in German working population. *J Occup Environ Med.* 2019;6:278–284.
- Sundstrup E, Hansen ÅM, Mortensen EL, et al. Retrospectively assessed psychosocial working conditions as predictors of prospectively assessed sickness absence and disability pension among older workers. *BMC Public Health.* 2018;18:149.
- Gimeno D. Psychosocial factors and work related sickness absence among permanent and non-permanent employees. *J Epidemiol Community Health.* 2004;58:870–876.
- Ropponen A, Samuelsson Å, Alexanderson K, Svedberg P. Register-based data of psychosocial working conditions and occupational groups as predictors of disability pension due to musculoskeletal diagnoses: a prospective cohort study of 24 543 Swedish twins. *BMC Musculoskelet Disord.* 2013;14:268.
- Clumeck N, Kempnaers C, Godin I, et al. Working conditions predict incidence of long-term spells of sick leave due to depression: results from the Belstress I prospective study. *J Epidemiol Community Health.* 2009;63:286–292.
- Norberg J, Alexanderson K, Framke E, Rugulies R, Farrants K. Job demands and control and sickness absence, disability pension and unemployment among 2,194,692 individuals in Sweden. *Scand J Public Health.* 2020;48:125–133.
- Farrants K, Norberg J, Framke E, Rugulies R, Alexanderson K. Job demands and job control and future labor market situation: an 11-year prospective study of 2.2 million employees. *J Occup Environ Med.* 2020.
- Haukka E, Kaila-Kangas L, Luukkonen R, Takala E-P, Viikari-Juntura E, Leino-Arjas P. Predictors of sickness absence related to musculoskeletal pain: a two-year follow-up study of workers in municipal kitchens. *Scand J Work Environ Health.* 2014;40:278–286.
- Björkenstam C, Alexanderson K, Wiberg M, Hillert J, Tinghög P. Heterogeneity of sickness absence and disability pension trajectories among individuals with MS. *Mult Scler J Exp Transl Clin.* 2015;1:205521731559563.
- Farrants K, Friberg E, Sjölund S, Alexanderson K. Work disability trajectories among individuals with a sick-leave spell due to depressive episode ≥ 21

- days: a prospective cohort study with 13-month follow up. *J Occup Rehabil*. 2018;28:678–690.
24. Hiilamo A, Shiri R, Kouvonen A, et al. Common mental disorders and trajectories of work disability among midlife public sector employees: a 10-year follow-up study. *J Affect Disord*. 2019;247:66–72.
 25. Virtanen M, Kivimäki M, Zins M, et al. Lifestyle-related risk factors and trajectories of work disability over 5 years in employees with diabetes: findings from two prospective cohort studies. *Diabet Med*. 2015;32:1335–1341.
 26. Lallukka T, Kaila-Kangas L, Mänty M, et al. Work-related exposures and sickness absence trajectories: a nationally representative follow-up study among Finnish working-aged people. *Int J Environ Res Public Health*. 2019;16:2099.
 27. Gonäs L, Tyrkkö A. Changing structures and women's role as labor force. *Nord J Work Life Stud*. 2015;5:89.
 28. Melsom AM, Mastekaasa A. Gender, occupational gender segregation and sickness absence: longitudinal evidence. *Acta Sociol*. 2017;61:227–245.
 29. Karlsson NE, Carstensen JM, Gjesdal S, Alexanderson K. Risk factors for disability pension in a population-based cohort of men and women on long-term sick leave in Sweden. *Eur J Public Health*. 2008;18:224–231.
 30. Fredlund P, Hallqvist J, Diderichsen F. Psychosocial Occupational Exposure Matrix. One Updating of a Classification System for Occupational Psychosocial Exposures. Stockholm: Institute for Working Life; 2000. Available at: <https://core.ac.uk/download/pdf/16312321.pdf>
 31. SCB. Yrkesklassificeringar i Fob 85. Stockholm, Sweden: Statistiska centralbyrån; 1982.
 32. Nagin DS, Jones BL, Passos VL, Tremblay R. Group-based multi-trajectory modeling. *Stat Methods Med Res*. 2018;27:2015–2023.
 33. Albertsen K, Lund T, Christensen KB, Kristensen TS, Villadsen E. Predictors of disability pension over a 10-year period for men and women. *Scand J Public Health*. 2007;35:78–85.
 34. Kolstad HA, Hansen AM, Kaergaard A, et al. Job strain and the risk of depression: is reporting biased? *Am J Epidemiol*. 2011;173:94–102.
 35. Rugulies R. Studying the effect of the psychosocial work environment on risk of ill-health: towards a more comprehensive assessment of working conditions. *Scand J Work Environ Health*. 2012;38:187–192.
 36. 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;380:1491–1497. doi:10.1016/S0140-6736(12)60994-5.
 37. Virtanen M, Vahtera J, Pentti J, Honkonen T, Elovainio M, Kivimäki M. Job strain and psychologic distress. *Am J Prev Med*. 2007;33:182–187.