Psychosocial working conditions and trajectories of sickness absence and disability pension days – An 11-year follow up of 2.1 million employees in Sweden

Laura Salonen[1], Kristina Alexanderson[2], Reiner Rugulies[3], Elisabeth Framke[3], Mikko Niemelä[1], Kristin Farrants[2]

1 University of Turku, Finland
2 Division of Insurance Medicine, Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden
3 National Research Centre for the Working Environment, Copenhagen, Denmark

ABSTRACT

Psychosocial working conditions such as job demands and job control are associated with employee well-being. However, studies on the associations between working conditions and sickness absence (SA) and disability pension (DP) and especially on their development over time are scarce. We examined the association between psychosocial working conditions and subsequent SA/DP trajectories over 11 years in the workforce in Sweden. Using a prospective cohort study with microdata we explored SA/DP trajectories among women (n=1,076,042) and men (n=1,102,721) in paid work, respectively, aged 30–53 years in 2001 in Sweden. Group-based trajectory analysis was used to model annual mean SA/DP net days in 2002–2012. Based on a Swedish Job Exposure Matrix (JEM), individuals were assigned an age-, sex- and occupation-specific mean score for demands and control, respectively. Mean scores were categorized into tertiles and categorised into 3x3 combinations of exposure categories. Using multinomial regression we predicted trajectory group memberships for the JEM and demographic characteristics. Three SA/DP trajectories were found for women (low stable, medium stable & high increasing) and two for men (low stable & high increasing). In fully adjusted models, low job demands and control were associated with the highest risk of belonging to the high increasing trajectory in women (OR 1.38 95% CI 1.35-1.42) and high demands and low control in men (OR 1.18 95% CI 1.13-1.24) compared to medium demands and control. In general, low demands was independently of the level of control associated with an increased odds of belonging to medium stable and high increasing trajectory.

INTRODUCTION

Sickness absence and disability pension are the most common causes of an early exit from the labour market in many European countries. In addition to poor health, working conditions are potentially important risk factors for sickness absence and disability pension. Especially psychosocial working conditions have become more demanding (Cerdas et al. 2019). Previous studies have discovered that especially psychosocial working conditions, such as job demands and job control, are associated with subsequent sickness absence and disability pension (Aagestad et al. 2014; Albertsen et al. 2007; Clausen, Burr, & Borg 2014; Laaksonen et al. 2010; Labriola et al. 2011; Lund et al. 2005). The Job Demands-Control (JDC) –model developed by Karasek and Theorell (1990) has been widely used in studies on the association between psychosocial working environment and employee wellbeing. Although the model has proven to be very effective, empirical research has had several shortcomings, for example, use of subjective measures for job demands and control and lack of longitudinal settings and

population level study sample. Reviews (Fila 2016; Kain & Jex 2010) have emphasised a need for more research with a longitudinal setting, using well validated and objective rather than subjective measures of job demands and control, and further development and broadening the measure of job demands and control. In addition, since prior studies are conducted on specific occupations or workplaces (Haukka et al. 2013; Canivet et al. 2013; Sundstrup et al. 2018), the comparison between studies is difficult. This raises a need for studies covering the whole workforce.

Most studies have emphasised four specific occupational characteristics: active (high demands and high job control), job strain (high demands and low job control), passive (low demands and low job control), and low strain (low demands and high job control). Especially high strain jobs, i.e. jobs characterized by high demands and low control (Blank & Diderichsen 1995; Canivet et al. 2013; Knardahl et al. 2017; Mutambudzi, Theorell, & Li 2019; Sundstrup et al. 2018) and passive jobs, i.e. jobs with low demands and low control are associated with a higher risk of sickness absence and disability pension. However, this 'quadrant' model is not sensitive enough to accurately distinguish different compositions of job demands and control, since it does not differentiate between those who are located very near or far from the median (Norberg et al. 2019). As a solution, we introduced a three-level measure of job demands and control and created a nine-categorical matrix from their combination.

Many previous studies use self-reported measures of job demands and control. This makes it difficult to distinguish between a causational relationship (work characteristics predict sickness absence or disability pension) and a reversed relationship, i.e. persons with poor health may be more prone to overestimate their job demands and underestimate their level of job control (De Lange et al. 2004; Kolstad et al. 2011; Rugulies 2012). One way of avoiding self-reporting bias is to use socio-demographically adjusted average exposure values of job demands and job control. Job Exposure Matrix (JEM) method is one well-established model for this. In short, JEM is built on multiple self-reported job demands and control surveys that were collected in Sweden across multiple years. Job exposure values are then adjusted for age group, sex group and occupational group, and the mean value is then assigned to individuals of the same age and sex in the same occupational group. Further, by using a JEM in national registers, it is possible to analyse associations between working conditions and sickness absence and disability pension in a whole national workforce.

Studies on the association between psychosocial working conditions and sickness absence or disability pension have mainly measured them only at one time point or within a short time period and there is a lack of longitudinal studies. Even longitudinal studies have often measured sickness absence or disability at one time point. However, job demands and control may affect how work ability develops over time. To our knowledge, only one study has examined this association with a trajectory analysis among Finnish female kitchen workers (Haukka et al. 2013). Moreover, studies on work disability that have used trajectory modelling approach have mainly taken into account socio-economic and health-related factors (Björkenstam et al. 2015; Farrants et al. 2018; Haukka et al. 2013, 2014; Hiilamo et al. 2019; Virtanen et al. 2015). Studies on work-related factors in this field are scarce and to our knowledge, only one study

has examined the contribution of physically demanding work to the sickness absence trajectories (Lallukka et al. 2019).

In this study, we examine, first, the trajectories of sickness absence and disability pension (SA/DP) among paid Swedish employees. Second, we examine how job demands and job control measured with JEMs are associated with the subsequent SA/DP trajectories. Since the labour market in Sweden is highly segregated and the gender differences are also clear in sickness absence and disability pensions, we analyse the associations between psychosocial working conditions and sickness absence and disability pension 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 situation, education, and net days with sickness absence and disability pension 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 30–54, in paid work with an annual income from work and benefits ≥8856 SEK (1002,80 € 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 who would not be eligible for sickness absence benefits from the Swedish Social Insurance Agency. Those with full-time SA in both 2000 and 2001 or full-time disability individuals in 2001 were excluded. Also, persons who had less than four years of follow-up were excluded. This yielded a study population of 2 194 694 individuals.

Work disability insurance in Sweden

The public sickness benefit insurance covers all Swedish aged over 16 years, living in Sweden with an income from work 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 work incapacity are covered by the employer, after which sickness benefit is paid by the Social Insurance Agency. Social Insurance Agency pays all sickness benefits for self-employed and unemployed. All Swedish residents aged 19–64 whose work capacity is permanently reduced due to diseases or injury, can receive a disability pension from the Social Insurance Agency. Sickness benefits amount to 80 % of lost income, disability pension to 65 %. Sickness absence and disability pension can be for full-time or part-time (25, 50 or 75 %) of ordinary working hours.

DEPENDENT VARIABLE

Sickness absence and disability pension

The outcome variable was measured as the total number of net days of sick leave and disability pension per year. For the calculation of net days, part-time work disability was combined, e.g., 2 days of 50 % absence were combined to one day.

INDEPENDENT VARIABLES

Job demands and job control

For assessing the psychosocial workplace exposure, we used a previously published job-exposure matrix (JEM) (Norberg et al. 2019). The current Swedish JEM was developed in 2000, based on data from annual questioners from Swedish Work Environment Survey 1989–1997 (N=48,894). From the data, questions measuring psychosocial job demands and control were identified and grouped by factor analysis. From these, separate estimates of demand 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) (SCB 1982).

Since occupational codes in the JEM were coded according to NYK, and the occupational codes of the study population were coded according to SSYK, we translated SSYK occupational codes into NYK. We used two keys – one from Statistics Sweden from NYK to SSYK. There were no SSYK occupations that did not translate to at least one NYK occupation. For those SSYK occupations that had more than one possible corresponding occupation in NYK we constructed a second key by firstly using the information on branch of industry to distinguish the different occupations in NYK, or, if that was not possible, the most common NYK occupation was used.

For this study, we divided the estimated values into tertiles; high, medium and low job demands and control, and combined them into a nine-category matrix.

Demographic variables

All the demographic variables were measured at the baseline year of 2001. These consisted of sex, age group, country of birth, education, type of living area and family composition (see Table 1). Previous sickness absence was measured as having or not having sickness absence in the year 2000.

In total there were 1,076,042 women and 1,102,721 men in this study. Around 90 % of the women and men were born in Sweden, had 10–12 years of education, lived in urban areas, were married or cohabiting with children and did not have sickness absence in 2000 (Table 1). No large differences between women and men were found in demographic characteristics, except for the family composition, since women lived less often without children than men. Women also had previous sickness absence more often than men.

Women were more often in occupations with high job demands or low job control and men in occupations with high job demands and control (Figure 2A). In general, there was more variation across the JEM in women than men. Women also had relatively higher job demands relative 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 al. (2019), Table II and Figures 1A-1B).

Table 1. Descriptive characteristics of the population in 2001.

	Women		Men	
	N	%	N	%
Age groups				
30–34	214,330	20.0	239,218	21.7
35–40	233,012	21.6	250,349	22.7
41-44	218,998	20.3	218,886	19.8
45-50	223,864	20.8	215,886	19.6
51-53	185,838	17.3	178,382	16.2
Country of birth				
Sweden	952,502	88.4	987,016	89.4
Outside Sweden	123,540	11.6	115,705	10.6
Education (years)				
Elementary (<= 9)	116,827	10.9	178,544	16.2
Secondary (10–12)	547,047	50.8	562,343	50.9
Tertiary (>12)	412,168	38.4	361,834	32.9
Type of living area				
Urban (Stockholm, Gothenburg, Malmö)	398,516	37.1	395,274	36.0
Medium-sized town (>90,000 inhabitants)	374,187	34.7	388,396	35.2
Rural or small town (<90,000 inhabitants)	303,339	28.1	319,051	28.9
Family composition				
Married/cohabiting w/o children	608,709	10.4	610,884	7.6
Married/cohabiting with children	111,458	56.5	83,726	55.3
Single/divorced/separated/widowed w/o children	156,682	18.6	39,895	33.5
Single/divorced/separated/widowed with children	199,193	14.6	368,216	3.6
Sickness absence in 2000				
Yes	246,328	22.8	131,395	11.9
No	829,714	77.2	971,326	81.9
Total	1,076,042	49.3	1,102,721	50.7

Job Exposure Matrix (JEM) (%)	*Job demands*			*Job demands*		
Job control	%			%		
%	Low	Medium	High	Low	Medium	High
Low	24.8	8.9	6.3	16.1	7.2	3.6
Medium	6.4	18.6	15.4	11.8	9.2	4.9
High	2.4	3.6	13.6	5.1	18.7	22.9

Statistical analysis

A group-based trajectory analysis (GBTA) was used to analyse work disability trajectories. GBTA is an application of a mixture modelling that identifies distinct groups of the study population with approximately similar trajectories on a selected time or age-varying outcome (Nagin et al. 2018). 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 a ≥ 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 chi2 tests. The individual probabilities of belonging to a particular group were estimated using a multinomial logit function. Coefficients were log-transformed to odds ratios (ORs) with their 95 % confidence intervals 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.

RESULTS

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 (Figure 1). Among women the three groups were low stable 76.9 %, medium stable 15.0 % and high increasing 8.0 %. Among men, the two groups were low stable 93.2 % and high increasing 6.8 %.

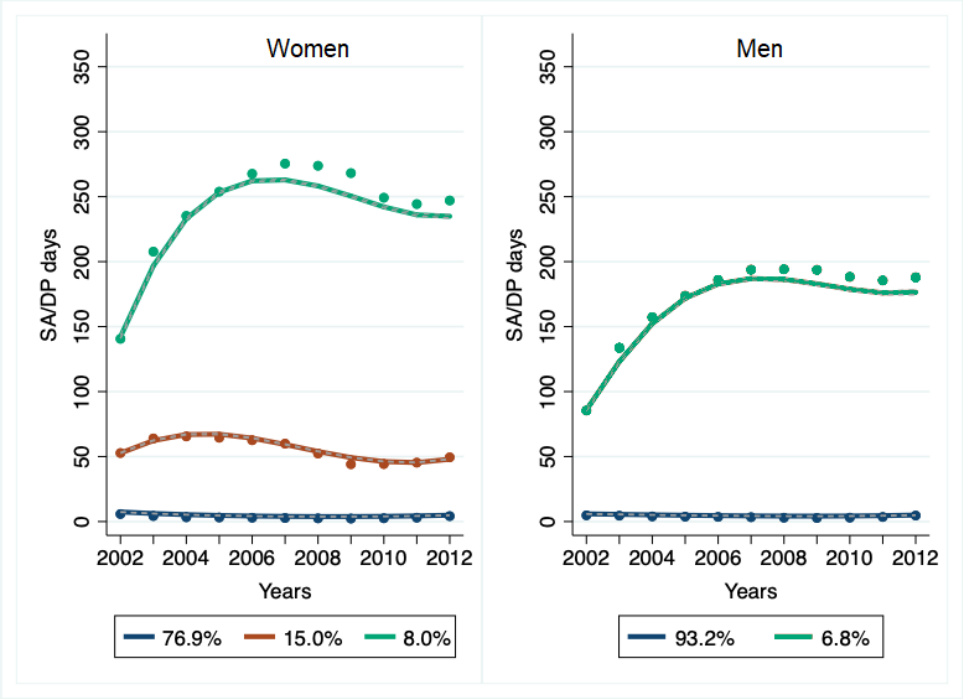

Figure 1. SA/DP trajectories calculated with censored normal model. Estimated SA/DP trajectories (solid lines) and observed group means at each time point (dotted line) with smoothed estimates and 95 % confidence intervals and estimated group percentages. Women on the left, men on the right

Those in low stable trajectory were on average younger, were 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 sickness absence than those in the other trajectories (Table 2). On the contrary, those in 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 other than married or cohabiting without children and have had previous sickness absence than the other trajectories. In terms of demographic characteristics, those in the medium stable trajectory were between the low and high increasing trajectory, although they were more similar to the low stable trajectory.

Table 2. Proportion (%) of sociodemographic characteristics in each of the two SA/DP trajectories in men and three SA/DP trajectories in women.

	Women			**Men**	
	Low stable	**Medium stable**	**High increasing**	**Low stable**	**High increasing**
Group N	834,260	155,393	86,389	1,027,785	74,936
Age groups					
30–34	21.2	19.0	9.7	22.5	10.7
35–40	22.5	21.0	14.9	23.2	16.1
41-44	20.4	20.4	19.6	19.9	18.9
45-50	20.1	21.5	26.2	19.2	25.4
51-53	15.8	18.1	29.6	15.2	29.0

Country of birth					
Sweden	89.5	87.0	82.0	90.1	82.0
Outside Sweden	10.5	13.0	18.0	9.9	18.0
Education (years)					
Elementary (<= 9)	9.4	13.1	21.1	15.4	27.1
Secondary (10–12)	49.6	54.6	55.8	50.7	54.7
Tertiary (>12)	41.0	32.3	23.1	33.9	18.2
Type of living area					
Urban (Stockholm, Gothenburg, Malmö)	37.9	35.6	31.5	36.1	32.7
Medium-sized town (>90,000 inhabitants)	34.7	34.5	36.1	35.2	35.0
Rural or small town (<90,000 inhabitants)	27.4	29.9	32.4	28.7	32.4
Family composition					
Married/cohabiting without children	58.8	51.4	44.2	56.2	44.9
Married/cohabiting with children	9.7	10.6	16.1	7.4	10.8
Single/divorced/separated/widowed without children	13.3	19.2	18.0	3.5	4.9
Single/divorced/separated/widowed with children	18.1	18.8	21.7	33.0	39.4
Previous sickness absence					
No	86.9	49.6	32.0	91.1	47.0
Yes	13.1	50.4	68.1	8.9	53.1
Total (%)	100	100	100	100	100

Distribution of job demands and control across SA/DP trajectories

We used kernel density plots to illustrate the relationship between job demands and control within each SA/DP trajectory. In women, the JEM distribution in low stable trajectory was very much like in the total population (Figure 2B). In the medium stable trajectory, many occupations were concentrated in the low to medium demands or control. Those in the high increasing trajectory were even more concentrated in the low demands and control. In men, the results were similar. The occupations were less concentrated in general in the high increasing trajectory, however, most were in occupations with low demands and low to medium control (Figure 2C).

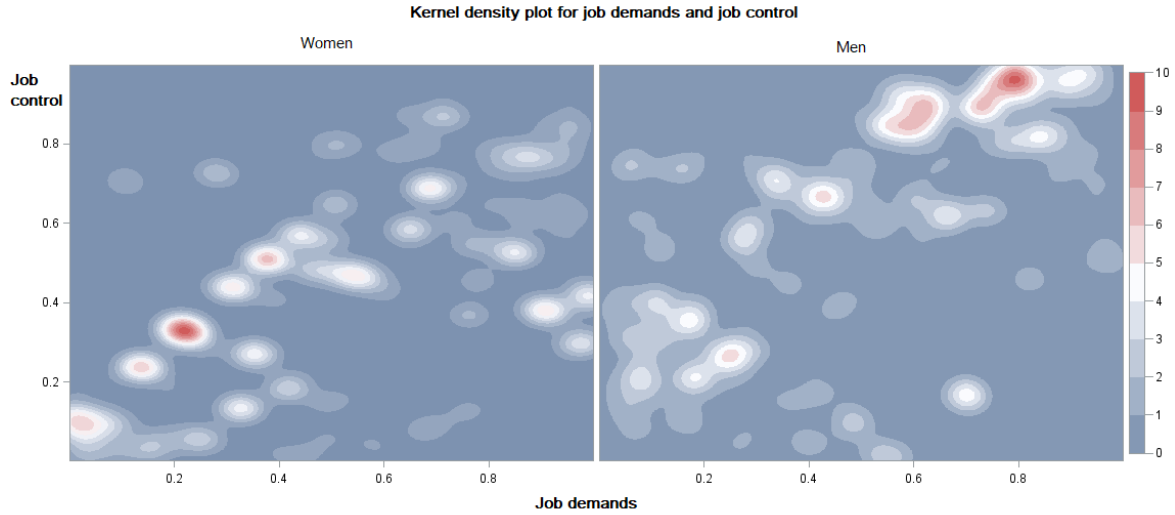

Figure 2A. Kernel density plots of the concentration of combinations of job demands and control among people in paid work in Sweden in men and women.

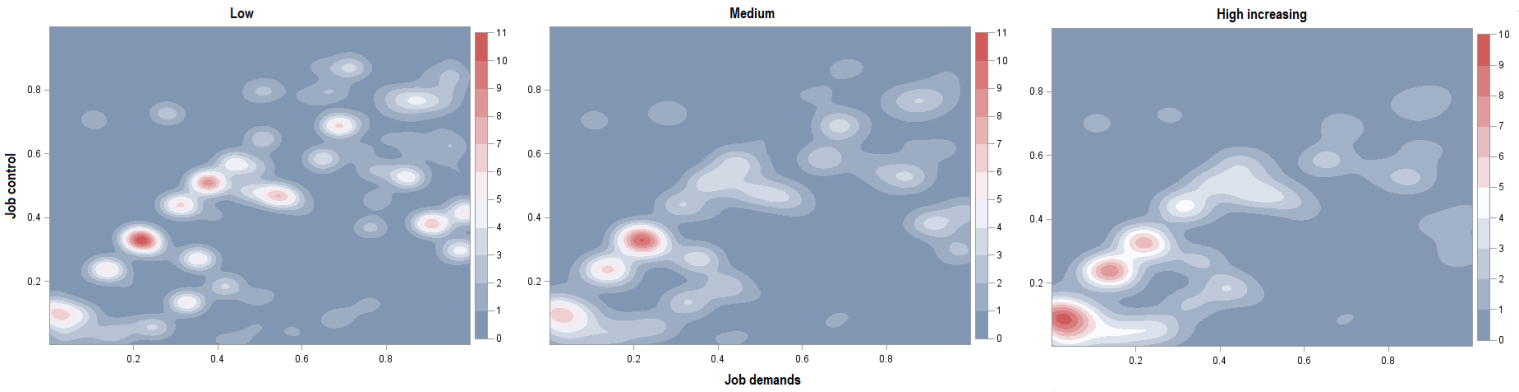

Figure 2B. Kernel density plots in women according to SA/DP trajectory groups. Low stable trajectory group on the left, medium stable trajectory group in the middle, high increasing trajectory group on the right.

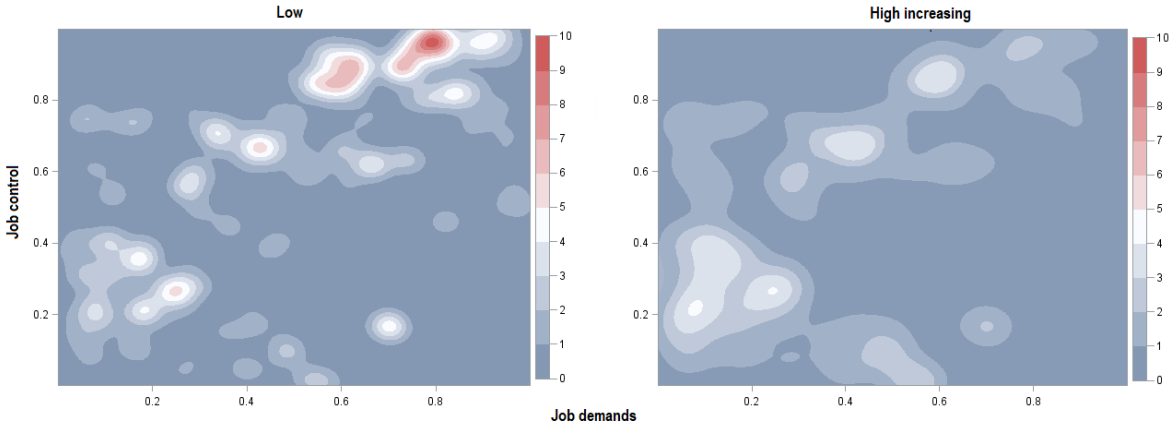

Figure 2C. Kernel density plots in men according to SA/DP trajectory groups. Low stable trajectory group on the left, high increasing trajectory group on the right.

Associations with JEM and SA/DP trajectories

Lastly, we conducted multinomial logistic regression for women and men to calculate the OR of belonging to each trajectory (Figures 3A & 3B). In general, low demands regardless of the level of control were associated with a higher risk of belonging to high increasing trajectory than to medium or low stable trajectory. Similarly, high demands were associated with a lower risk of belonging to medium stable or high increasing trajectory, regardless of the level of control than to medium or low stable trajectory. These associations were more consistent in men. In general, those with high demands and control were least likely to belong to medium stable or high increasing trajectory rather than low stable trajectory. However, in all of these associations, there were differences between women and men.

Women with low demands and low control had the highest risk of belonging to the high increasing trajectory (OR 1.38, 95% CI 1.35-1.42). Those with low to medium demands, despite the level of control, were more likely to belong to medium or high trajectory compared to those with medium demands and control. Those in occupation with medium to high demands, despite the level of control, were less likely to belong to high increasing trajectory than to medium stable trajectory compared to the reference group. Lastly, when comparing medium and high increasing trajectories, the differences in the ORs between JEM groups were small. Only those with low demands and low to medium control were more likely in high increasing trajectory, and all other JEM categories more likely belonged to medium stable trajectory.

In men, low demands the level of control and low control the level of demands were independently more likely to belong to high increasing trajectory than to low stable trajectory, with one exception. Those with high demands and low control had the highest OR for belonging to high increasing trajectory (OR 1.18, 95 % CI 1.13-1.24).

Supplementary Table 2 shows ORs for different trajectories for the covariates. In both women and men, the older, living in urban area and those born in Sweden, who were other than unmarried without children, who had a higher education and who had sickness absence in 2000 had a higher odds of belonging to medium or increasing high trajectory instead of low or medium stable trajectory both in women and men.

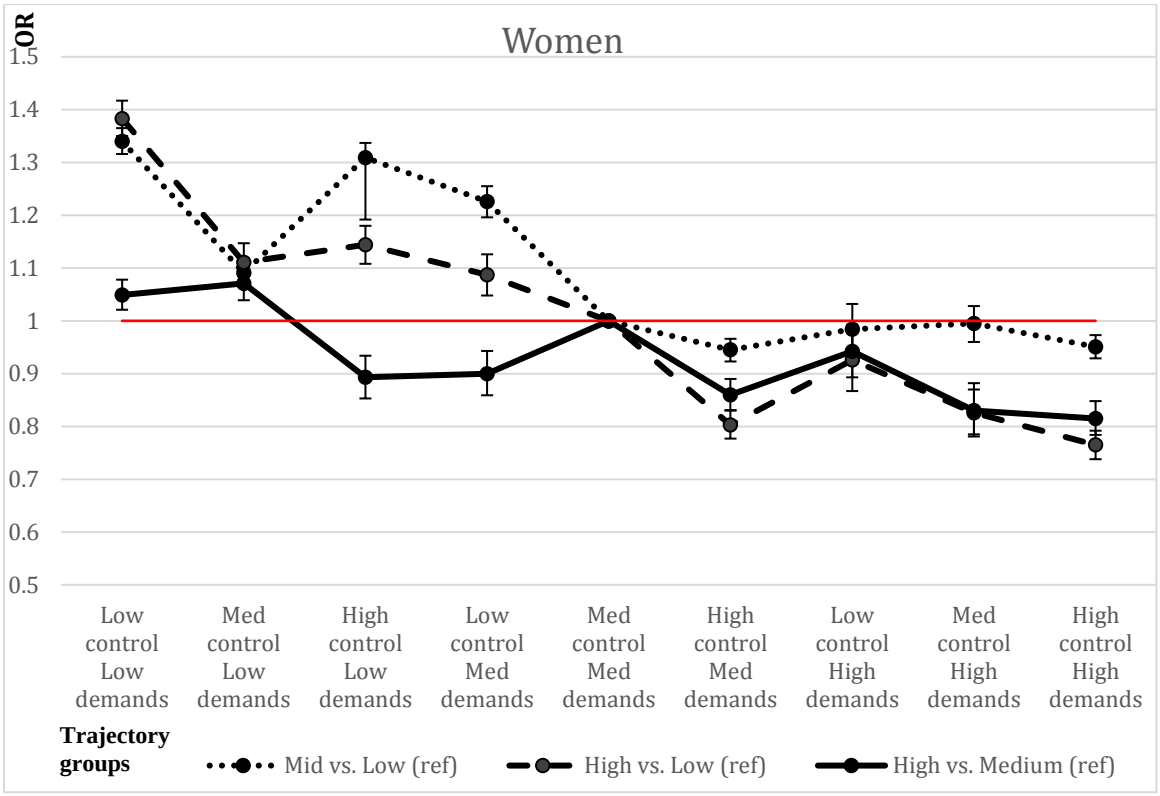

Figure 3A. Fully adjusted odds ratios with 95 % confidence intervals for each JEM tertiles for belonging to different SA/DP trajectories in women.

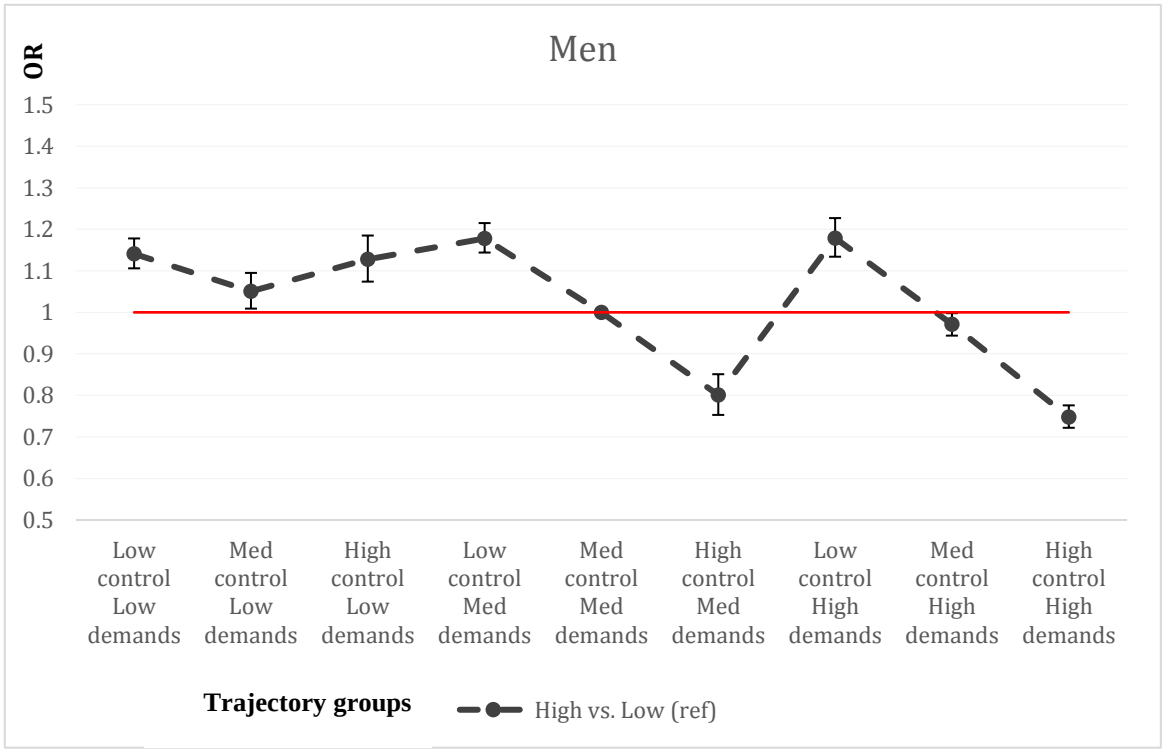

Figure 3B. Fully adjusted odds ratios with 95 % confidence intervals for each JEM tertiles for belonging to different SA/DP trajectories in men.

DISCUSSION

Main results

This study of 2.1 million Swedish 30 to 53 years old employees showed that job demands and control are associated with future SA/DP trajectories. We found three trajectories for women: low stable, medium stable and high increasing, and two for men: low and high increasing. The JEM profiles varied across the trajectories: in women, low and medium trajectories consisted mostly of occupations with low to medium demands and control and the high increasing group consisted of occupations with low demands and control. In men, low stable trajectory had occupations with medium to high demands and high control while the high increasing trajectory consisted mostly of occupations with low to medium demands and medium to high control.

The association between job demands and control with SA/DP trajectories both agree and disagree with previous findings. The only previous study on the association between psychosocial working conditions and sickness absence trajectories found that high psychosocial workload, a combination of job demands and control, was not associated with any sickness absence trajectory (Haukka et al. 2013). In contrast, we found multiple associations with the three SA/DP trajectories. The differences in our results can derive from that the previous study was conducted on a very specific group of Finnish municipal kitchen workers with musculoskeletal pain whereas our study included the whole population with all-cause SA/DP. It is likely that within one, very specific occupation, the variation between the levels of job demand and control is very small.

We found that passive jobs (low demands and low control) were associated with a higher risk of belonging to medium stable or high increasing trajectory. This association was also the strongest and the most consistent. Passive jobs largely consist of low-wage and manual work jobs. However, further research should be conducted to investigate if this association is due to the work environment or due to health selection, e.g. that persons with poorer health would more likely to select into a passive job. Contradictory to previous findings (Blank & Diderichsen 1995; Canivet et al. 2013), low strain jobs (low demands and high control) were associated with a relatively high risk of belonging to high increasing trajectory in women and men. However, in women, this group was more likely to belong to medium stable trajectory instead of high increasing trajectory. Previous studies have usually used this as a reference group, finding it to have the lowest risk of sickness absence or disability pension.

Evidence for high job strain, i.e. that high demands and low control would excessively increase the risk of SA/DP (Blank & Diderichsen 1995; Broubonnais & Mondor 2001; Canivet et al. 2013; Mutambudzi et al. 2019; North et al. 1996), was only found in men. In women, no clear associations were found. In men, those in occupations with medium or high demands and low control had the highest risk of belonging to the high increasing trajectory. A study that also measured job demands and control as tertiles also did not find evidence for high job strain being a particularly strong predictor of sickness absence (Norberg et al. 2019). It is difficult to state whether the contradicting results between our study and previous studies stem from the differences in the study population, in the measures of psychosocial working environment, SA/DP or something else.

In this study, high demands and high control were associated with a low risk of belonging to medium stable or high increasing SA/DP trajectory, which is in line with previous findings (Norberg et al. 2019). According to the hypothesis by Karasek and Theorell, active jobs (high demands and high control) protect against health risks by increasing performance, learning and motivation (Karasek 1979; Karasek & Theorell 1990). Medium demands with low control were associated with a higher risk and medium demands with high control with a lower risk of belonging to high increasing trajectory versus low stable trajectory in women and men. Further, they were more likely to belong to medium stable trajectory instead of high increasing trajectory in women, although the ORs were relatively small when comparing medium stable and high increasing trajectories. These results indicate that those in occupations with low demands and low to medium control are particularly vulnerable to have an increasing amount of SA/DP.

Our results on the demographic differences between trajectory groups support previous findings (Björkenstam et al. 2015) 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 sickness absence were more likely to belong to low rather than to medium or high increasing trajectory, and to medium stable trajectory rather than high increasing trajectory. The risks were similar in both women and men.

Strengths and limitations

A strength of this exploratory study is that the whole population in paid work in Sweden was included, not a sample or specific occupations as in most previous studies. Other strengths are that we have used data from a high-quality administrative register for outcome and covariates and further there was no loss of data due to non-response. Due to the large study population, we could adjust for several factors of importance (Allebeck & Mastekaasa 2004; White et al. 2013). Another strength is the use of a JEM to measure job demands and job control, as this eliminated reporting bias of the exposure, one of the key concerns in research on psychosocial work environment and health (Kolstad et al. 2011; Rugulies 2012). Finally, we believe that it is a strength that we combined demands and control not by the median split, as many previous studies have done (Kivimäki et al. 2012; Ropponen et al. 2013; Virtanen et al. 2007), but that we instead constructed nine combinations based on tertiles. This gave a more detailed categorisation of job demands and job control, rather than simply dividing into high/low, whilst our approach still maintained the distinction between high demands and high control, and low demands and low control. Limitations are that values at a 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 health and work ability. A limitation of the JEM methodology is that we were unable to distinguish differences in job demands and job control between individuals in the same occupation.

REFERENCES

Aagestad, Cecilie, Håkon A. Johannessen, Tore Tynes, Hans Magne Gravseth, ja Tom Sterud. 2014. ”Work-Related Psychosocial Risk Factors for Long-Term Sick Leave: A Prospective Study of the General Working Population in Norway”. *Journal of Occupational and Environmental Medicine* 56(8):787–93.

Albertsen, Karen, Thomas Lund, Karl B. Christensen, Tage S. Kristensen, ja Ebbe Villadsen. 2007. ”Predictors of Disability Pension over a 10-Year Period for Men and Women”. *Scandinavian Journal of Public Health* 35(1):78–85.

Allebeck, Peter ja Arne Mastekaasa. 2004. ”Chapter 5. Risk Factors for Sick Leave - General Studies”. *Scandinavian Journal of Public Health* 32(5):49–108.

Björkenstam, Charlotte, Kristina Alexanderson, Michael Wiberg, Jan Hillert, ja Petter Tinghög. 2015. ”Heterogeneity of Sickness Absence and Disability Pension Trajectories among Individuals with MS”. *Multiple Sclerosis Journal - Experimental, Translational and Clinical* 1:205521731559563.

Blank, Nelson ja Finn Diderichsen. 1995. ”Short-Term and Long-Term Sick-Leave in Sweden: Relationships with Social Circumstances, Working Conditions and Gender”. *Scandinavian Journal of Social Medicine* 23(4):265–72.

Broubonnais, R. ja M. Mondor. 2001. ”Job strain and sickness absence among nurses in the province of Quebec”. *American Journal of Industrial Medicine* 39:194–202.

Canivet, Catarina, BongKyoo Choi, Robert Karasek, Mahnaz Moghaddassi, Carin Staland-Nyman, ja Per-Olof Östergren. 2013. ”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”. *International Archives of Occupational and Environmental Health* 86(3):307–19.

Cerdas, Sara, Annika Härenstam, Gun Johansson, ja Anna Nyberg. 2019. ”Development of Job Demands, Decision Authority and Social Support in Industries with Different Gender Composition – Sweden, 1991–2013”. *BMC Public Health* 19(1):758.

Clausen, Thomas, Hermann Burr, ja Vilhelm Borg. 2014. ”Do Psychosocial Work Conditions Predict Risk of Disability Pensioning? An Analysis of Register-Based Outcomes Using Pooled Data on 40,554 Observations”. *Scandinavian Journal of Public Health* 42(4):377–84.

De Lange, Annet H., Toon W. Taris, Michiel A. J. Kompier, Irene L. D. Houtman, ja Paulien M. Bongers. 2004. ”The Relationships between Work Characteristics and Mental Health: Examining Normal, Reversed and Reciprocal Relationships in a 4-Wave Study”. *Work & Stress* 18(2):149–66.

Farrants, Kristin, Emilie Friberg, Sara Sjölund, ja Kristina Alexanderson. 2018. ”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”. *Journal of Occupational Rehabilitation* 28(4):678–90.

Fila, Marcus J. 2016. ”The job demands, control, support model: Where are we now?” *International Journal for Research in Management* 1(1):15–44.

Haukka, Eija, Leena Kaila-Kangas, Ritva Luukkonen, Esa-Pekka Takala, Eira Viikari-Juntura, ja Päivi Leino-Arjas. 2014. ”Predictors of Sickness Absence Related to Musculoskeletal Pain: A Two-Year Follow-up Study of Workers in Municipal Kitchens”. *Scandinavian Journal of Work, Environment & Health* 40(3):278–86.

Haukka, Eija, Leena Kaila-Kangas, Anneli Ojajärvi, Helena Miranda, Jaro Karppinen, Eira Viikari-Juntura, Markku Heliövaara, ja Päivi Leino-Arjas. 2013. ”Pain in Multiple Sites and Sickness Absence Trajectories: A Prospective Study among Finns”: *Pain* 154(2):306–12.

Hiilamo, Aapo, Rahman Shiri, Anne Kouvonen, Minna Mänty, Peter Butterworth, Olli Pietiläinen, Eero Lahelma, Ossi Rahkonen, ja Tea Lallukka. 2019. ”Common Mental Disorders and Trajectories of Work Disability among Midlife Public Sector Employees – A 10-Year Follow-up Study”. *Journal of Affective Disorders* 247:66–72.

Kain, K. ja S. Jex. 2010. ”Karasek’s (1979) job demands-control model: A summary of current issues and recommendations for future research”. Ss. 237–68 teoksessa *New developments in theoretical and conceptual approaches to job stress*, toimittanut P. L. Perrewe ja D. C. Ganster. Bingley, UK: Emerald Group Publishing Limited.

Karasek, Robert A. 1979. ”Job Demands, Job Decision Latitude, Mental Strain: Implications for job redesign”. *Administrative Science Quarterly* 24(2):285.

Karasek, Robert ja Töres Theorell. 1990. *Healthy Work: Stress, Productivity, and the Reconstruction of Working Life*. New York: Basic Books.

Kivimäki, Mika, Solja T. Nyberg, G. David Batty, Eleonor I. Fransson, Katriina Heikkilä, Lars Alfredsson, Jakob B. Bjorner, Marianne Borritz, Hermann Burr, Annalisa Casini, Els Clays, Dirk De Bacquer, Nico Dragano, Jane E. Ferrie, Goedele A. Geuskens, Marcel Goldberg, Mark Hamer, Wendela E. Hooftman, Irene L. Houtman, Matti Joensuu, Markus Jokela, France Kittel, Anders Knutsson, Markku Koskenvuo, Aki Koskinen, Anne Kouvonen, Meena Kumari, Ida EH Madsen, Michael G. Marmot, Martin L. Nielsen, Maria Nordin, Tuula Oksanen, Jaana Pentti, Reiner Rugulies, Paula Salo, Johannes Siegrist, Archana Singh-Manoux, Sakari B. Suominen, Ari Väänänen, Jussi Vahtera, Marianna Virtanen, Peter JM Westerholm, Hugo Westerlund, Marie Zins, Andrew Steptoe, ja Töres Theorell. 2012. ”Job Strain as a Risk Factor for Coronary Heart Disease: A Collaborative Meta-Analysis of Individual Participant Data”. *The Lancet* 380(9852):1491–97.

Knardahl, Stein, Håkon A. Johannessen, Tom Sterud, Mikko Härmä, Reiner Rugulies, Jorma Seitsamo, ja Vilhelm Borg. 2017. ”The Contribution from Psychological, Social, and Organizational Work Factors to Risk of Disability Retirement: A Systematic Review with Meta-Analyses”. *BMC Public Health* 17(1).

Kolstad, H. A., A. M. Hansen, A. Kaergaard, J. F. Thomsen, L. Kaerlev, S. Mikkelsen, M. B. Grynderup, O. Mors, R. Rugulies, A. S. Kristensen, J. H. Andersen, ja J. P. Bonde. 2011. ”Job Strain and the Risk of Depression: Is Reporting Biased?” *American Journal of Epidemiology* 173(1):94–102.

Kondo, Kyoko, Yuka Kobayashi, Kumi Hirokawa, Akizumi Tsutsumi, Fumio Kobayashi, Takashi Haratani, Shunichi Araki, ja Norito Kawakami. 2006. ”Job Strain and Sick

Leave among Japanese Employees: A Longitudinal Study". *International Archives of Occupational and Environmental Health* 79(3):213–19.

Laaksonen, Mikko, Janne Pitkäniemi, Ossi Rahkonen, ja Eero Lahelma. 2010. "Work Arrangements, Physical Working Conditions, and Psychosocial Working Conditions as Risk Factors for Sickness Absence: Bayesian Analysis of Prospective Data". *Annals of Epidemiology* 20(5):332–38.

Labriola, M., K. A. Holte, K. B. Christensen, H. Feveile, K. Alexanderson, ja T. Lund. 2011. "The Attribution of Work Environment in Explaining Gender Differences in Long-Term Sickness Absence: Results from the Prospective DREAM Study". *Occupational and Environmental Medicine* 68(9):703–5.

Lallukka, Tea, Leena Kaila-Kangas, Minna Mänty, Seppo Koskinen, Eija Haukka, Johanna Kausto, Päivi Leino-Arjas, Risto Kaikkonen, Jaana I. Halonen, ja Rahman Shiri. 2019. "Work-Related Exposures and Sickness Absence Trajectories: A Nationally Representative Follow-up Study among Finnish Working-Aged People". *International Journal of Environmental Research and Public Health* 16(12):2099.

Lund, Thomas, Merete Labriola, Karl Bang Christensen, Ute B??ltmann, Ebbe Villadsen, ja Hermann Burr. 2005. "Psychosocial Work Environment Exposures as Risk Factors for Long-Term Sickness Absence Among Danish Employees: Results From DWECS/DREAM": *Journal of Occupational and Environmental Medicine* 47(11):1141–47.

Mutambudzi, Miriam, Töres Theorell, ja Jian Li. 2019. "Job Strain and Long-Term Sickness Absence From Work: A Ten-Year Prospective Study in German Working Population". *Journal of Occupational and Environmental Medicine* 6(4).

Nagin, Daniel S., Bobby L. Jones, Valéria Lima Passos, ja Richard E. Tremblay. 2018. "Group-Based Multi-Trajectory Modeling". *Statistical Methods in Medical Research* 27(7):2015–23.

Norberg, Jan, Kristina Alexanderson, Elisabeth Framke, Reiner Rugulies, ja Kristin Farrants. 2019. "Job Demands and Control and Sickness Absence, Disability Pension and Unemployment among 2,194,692 Individuals in Sweden". *Scandinavian Journal of Public Health* 140349481984636.

North, FM, S. L. Syme, A. Feeney, M. J. Shipley, ja M. G. Marmot. 1996. "Psychosocial work environment and sickness absence among British civil servants: the Whitehall II study". *American Journal of Public Health* 86:332–40.

Ropponen, Annina, Åsa Samuelsson, Kristina Alexanderson, ja Pia Svedberg. 2013. "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 Musculoskeletal Disorders* 14(1).

Rugulies, Reiner. 2012. "Studying the Effect of the Psychosocial Work Environment on Risk of Ill-Health: Towards a More Comprehensive Assessment of Working Conditions". *Scandinavian Journal of Work, Environment & Health* 38(3):187–92.

SCB. 1982. *Yrkesklassificeringar i Fob 85*. 4. Stockholm, Sweden: Statistika centralbyrån.

Sundstrup, Emil, Åse Marie Hansen, Erik Lykke Mortensen, Otto Melchior Poulsen, Thomas Clausen, Reiner Rugulies, Anne Møller, ja Lars L. Andersen. 2018. ”Retrospectively Assessed Psychosocial Working Conditions as Predictors of Prospectively Assessed Sickness Absence and Disability Pension among Older Workers”. *BMC Public Health* 18(1).

Virtanen, M., M. Kivimäki, M. Zins, R. Dray-Spira, T. Oksanen, J. E. Ferrie, A. Okuloff, J. Pentti, J. Head, M. Goldberg, ja J. Vahtera. 2015. ”Lifestyle-Related Risk Factors and Trajectories of Work Disability over 5 Years in Employees with Diabetes: Findings from Two Prospective Cohort Studies”. *Diabetic Medicine* 32(10):1335–41.

Virtanen, Marianna, Jussi Vahtera, Jaana Pentti, Teija Honkonen, Marko Elovainio, ja Mika Kivimäki. 2007. ”Job Strain and Psychologic Distress”. *American Journal of Preventive Medicine* 33(3):182–87.

White, M., S. Wagner, Z. Schultz Izabela, E. Murray, M. Bradley Susan, Vernita Hsu, L. McGuire, ja W. Schulz. 2013. ”Modifiable workplace risk factors contributing to workplace absence across health conditions: A stakeholder-centered best-evidence synthesis of systematic reviews”. *Work* (4):1–12.

SUPPLEMENTARY FILES

Supplementary Table 1. Fit statistics for the group-based trajectory analysis.

	Count per group	Posterior probabilities	Total probabilities	Odds of correct classification	Odds of correct classification weighted on posterior probability	Observation probability of group vs. probability	Based on the posterior probabilities

Women							
Group 1	834260	0.978	0.769	12.674	13.128	0.775	0.769
Group 2	155393	0.910	0.150	60.396	57.582	0.150	0.150
Group 3	86389	0.980	0.008	575.612	574.124	0.008	0.080
Men							
Group 1	1027785	0.998	31.565	31.784	0.932	0.932	0.932
Group 2	74936	0.974	532.399	528.399	0.068	0.068	0.068

Supplementary table 2. Associations of demographic variables with SA/DP trajectories in women and men. Fully adjusted odds ratios with their 95 % confidence intervals from multinomial logistic regression analyses.

	Women						**Men**	
	Medium vs. Low (ref.)		High increasing vs. Low (ref.)		High increasing vs. Medium (ref.)		High increasing vs. Low (ref.)	
	OR	**95 % CI**	**OR**	**95 % CI**	**OR**	**95 % CI**	**OR**	**95 % CI**
Age groups (ref. 30-34)								
35–40	1.09	1.07-1.11	1.58	1.53-1.63	1.41	1.37-1.46	1.42	1.38-1.46
41-44	1.21	1.19-1.24	2.41	2.34-2.48	1.93	1.87-2.00	1.92	1.86-1.98
45-50	1.31	1.29-1.34	3.13	3.05-3.23	2.38	2.31-2.45	2.71	2.63-2.79
51-53	1.41	1.39-1.44	4.33	4.21-4.46	3.10	3.01-3.20	3.90	3.79-4.01
Type of living area (ref. urban: Sthlm, Gothenburg, Malmö)								
Medium-sized town (>90,000 inhabitants)	1.04	1.02-1.05	1.21	1.19-1.23	1.18	1.16-1.21	1.02	1.00-1.04
Rural or small town (<90,000 inhabitants)	1.09	1.07-1.11	1.27	1.25-1.30	1.19	1.17-1.22	1.06	1.04-1.08
Country of birth (ref. Sweden)								
Outside Sweden	1.17	1.15-1.19	1.65	1.62-1.69	1.44	1.40-1.48	1.75	1.71-1.79
Family composition (ref. married/coh. w/o children)								
Married/cohabiting with children	1.06	1.04-1.09	1.28	1.24-1.31	1.22	1.19-1.25	1.26	1.22-1.29
Single/divorced/separated/widowed w/o children	1.45	1.43-1.47	1.41	1.38-1.45	1.03	1.00-1.05	1.34	1.29-1.40
Single/divorced/separated/widowed with children	1.19	1.17-1.21	1.51	1.48-1.54	1.29	1.26-1.32	1.50	1.48-1.53
Education (ref. <= 9 years)								
Secondary (10–12)	0.91	0.89-0.92	0.69	0.67-0.71	0.73	0.71-0.75	0.82	0.80-0.84
Tertiary (> 12)	0.80	0.78-0.82	0.48	0.46-0.49	0.55	0.53-0.57	0.57	0.55-0.58
Previous sickness absence (ref. no)								
Yes	6.64	6.56-6.72	14.24	14.00-14.47	2.20	2.16-2.24	10.11	9.94-10.28

Supplementary Table 3. Associations of job demands and control with SA/DP trajectories in women and men. Fully adjusted odds ratios with their 95 % confidence intervals from multinomial logistic regression analyses. Calculations for figure 3A and 3B.

	Women	**Men**

		Medium vs. Low (ref.)	High vs. Low (ref.)	High vs. Medium (ref.)	High vs. Low (ref.)
Low demands	Low control	1.34 [1.34, 1.36]	1.38 [1.35, 1.42]	1,05 [1.02, 1.08]	1,14 [1.11, 1.18]
Low demands	Medium control	1,23 [1.20, 1.25]	1,09 [1.05, 1.12]	0,90 [0.87, 0.93]	1,18 [1.14, 1.22]
Low demands	High control	0,98 [0.96, 1.10]	0,93 [0.89, 0.96]	0,94 0.90, 0.98[]	1,18 [1.13, 1.24]
Medium demands	Low control	1,09 [1.06, 1.12]	1,11 [1.07, 1.15]	1,07 [1.03, 1.11]	1,05 [1.02, 1.09]
Medium demands	Medium control	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Medium demands	High control	1,00 [0.97, 1.02]	0,83 [0.80, 0.85]	0,83 [0.80, 0.86]	0,97 [0.923, 1.02]
High demands	Low control	1,31 [1.26, 1.36]	1,14 [1.09, 1.21]	0,89 [0.84, 0.94]	1,13 [1.08, 1.18]
High demands	Medium control	0,95 [0.91, 0.98]	0,80 [0.76, 0.85]	0,86 [0.81, 0.91]	0,80 [0.77, 0.83]
High demands	High control	0,95 [0.93, 0.97]	0,77 [0.74, 0.79]	0,82 [0.78, 0.85]	0,75 [0.72, 0.78]