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Sickness absence trajectories and retirement pathways among industrial workers

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Abstract

We studied the trajectories of sickness absences among industrial workers over 6 years and examined whether the membership of trajectories was associated with subsequent retirement type for 11 years. We used data from one of the largest Finnish food industry companies that responded to a questionnaire survey in 2003. Sickness absence days per year from 2003 to 2008 were obtained from the company's registers and linked to the register of Finnish Centre for Pension data (statutory and non-statutory) until the end of 2019. We analysed data from 633 individuals who had information on sickness absence and the type of retirement. Latent class growth modelling was used to identify trajectories of sickness absence days per year, and Cox-regression models were used to examine the association of trajectories with retirement type. The models were adjusted for baseline sociodemographic, work-related physical, and psychosocial factors. We identified three distinct trajectories of sickness absence during the 6-year period. Most respondents (51.2%) had low-fluctuating, one-third (33.9%) had moderate-stable, and 14.9% had a high-stable sickness absence trajectory throughout. The high-stable trajectory was associated with a higher risk of non-statutory retirement (hazard ratio 2.67, 95% confidence interval 1.69–4.23) when adjusted for sociodemographic, perceived health, and work-related variables. We found significant heterogeneity in the number of sick absence days per year among the private sector employees over a period of 6 years. An increase in the risk of non-statutory retirement among those with high-stable sickness absences signifies the importance of early intervention to support individuals experiencing recurring sickness absence whilst employed.

Introduction

Several studies have demonstrated that prolonged sickness absence is a strong predictor of early retirement. Both frequency and duration of sickness absences have been shown to predict the timing and type of retirement [1]. Individuals who experience recurring periods of sickness absence are more likely to transition into a disability retirement pension [2]. The recurring absence of sickness over a longer period can be better understood by person-centred group-based methods, which identify distinct subgroups within a population that follow similar developmental trajectories [3].

Sickness absence trajectories also play a pivotal role in the decision to opt for early retirement. Longitudinal studies have revealed that individuals experiencing a continuous increase in sickness absence days over time are more likely to retire earlier than those who do not [4, 5]. The risk of early retirement due to disability is higher among individuals in physically demanding, repetitive, or monotonous occupations [6] and among those exposed to poor psychosocial working conditions [7]. The risk of developing specific health conditions varies with age and working conditions [8]. Factors such as the nature of health conditions, work environment, and sociodemographic characteristics play an essential role in shaping trajectories of health conditions and influencing retirement choices [9].

Musculoskeletal and mental disorders are known as the most common diseases causing increased risk of disability and early retirement [10], while chronic health problems, low socioeconomic status, workplace conditions, and lifestyle factors such as obesity, physical inactivity, smoking, and alcohol use have been shown to increase the risk of early retirement [9, 11]. Many of these risk factors manifest early in the disability process and are associated with sickness absences [12]. From a prevention perspective, it is therefore important to understand both the risk factors for disability and how sickness absences develop into disability. Most studies examining determinants of early retirement have not adequately considered previous sickness absence. Previous research on sickness absence has predominantly viewed it in binary terms, as either present or absent [13, 14]. Few studies have indicated that the overall annual number of sick-leave days is a more accurate predictor of

disability pension outcomes or early retirement than the number of periods taken by an employee [15] and is also a better item to identify trajectories [3].

The relationship between sickness absence trajectories and retirement type is complex and multifaceted. Sickness absence patterns reflect an individual's health, functional capacity, and their ability to remain in the labour force [3]. A comprehensive understanding of these trajectories is vital for policymakers, employers, and healthcare professionals seeking to develop effective strategies for extending working lives and facilitating healthier retirement transitions. In this study, we aim to identify trajectories of sickness absence among private sector employees over a span of 6 years and their association with subsequent retirement type for 11 years. This research will contribute to a deeper understanding of the various developmental trends of sickness absence and their associations with retirement decisions.

Methods

This study was conducted among employees in one of the largest private food industry companies in Finland. Food processing is a widespread industry in Finland, with 30 000 workers employed in the food industry sector, accounting for 1%–2% of the total workforce [16]. The food industry has one of the highest sickness absence numbers due to the strenuous work environment and special hygiene regulations [17]. A questionnaire survey about sociodemographic characteristics, working conditions, work ability, and health was conducted among employees over four occasions in the interval of 2 years from 2003 to 2009. The response rate for the survey was 56%, with a total of 1220 completed questionnaires returned. Among the respondents, 71% (861 individuals) provided consent to link their survey data to registers. The mean age of the employees was 41 years (standard deviation 9.7 years), ranging from 20 to 66 years at the baseline. Information on sickness absence days per year during the period of 2003–2008 was obtained from the personnel register of the company, and the information on the type of retirement until 31 December 2019 was obtained from the Finnish Centre for Pensions and linked to the survey data. In this study, we analysed data from 633 individuals who had information on sickness absence and the type of retirement.

Sickness absence

Sickness absence diagnoses were obtained from the personnel register of the company through cooperation between the human resource office and the occupational health service. In addition to the dates when the sickness absences started and ended, the place at which the certificates were issued, as well as the diagnosis, according to the 10th revision of the International Classification of Diseases (ICD-10), was recorded to be used by occupational health care for statistics about the health of the employees. The total number of sickness absence days per year was ascertained, and those with more than 4 days of sickness absence days per year were included in this study. In Finland, daily sickness allowance compensates for loss income due to temporary work incapacity. A physician's certification is required for longer absences. Employers often compensate for the loss of salary during the waiting period for their employees. The employers often cover salary during the first 10 days of absence. The allowance lasts up to 300 workdays per illness; if work disability continues beyond this, the person may qualify for a disability pension.

Type of retirement

The original classification of the type of retirement in the register of Finnish Centre for Pensions was statutory, full-time disability, rehabilitation support, part-time, partial disability, or an unemployment pension. For the analysis, we dichotomized the type of retirement into 'statutory' and 'non-statutory retirement (includes all types of retirement other than statutory)' because of fewer cases who retired with full-time disability pension. In Finland, a disability pension may be granted if a person's work capacity is reduced by at least 60% (40% for partial pension) due to illness, injury, or disability lasting a maximum of 1 year.

Covariates

The age of the workers was used as a continuous variable, gender was classified as female and male, and occupational status as blue- and white-collar.

Environmental exposure was measured by using the question, 'Do the following factors increase your strain at your work? Draught, noise, poor indoor climate, hotness, coldness, blinding lighting, and restlessness of work environment (noisy and restless workplace)' on a scale 1 (very little) to 5 (very much). In this study, we summed all seven items into a single variable ranging from 7 to 35. The variable was dichotomized into 'low' (7–18) and 'high' (19–35) using the median value as a cut-off point.

Repetitive movements and awkward postures were measured as "Do movements/postures cause inconvenience or strain in your work?" reply options on a five-point Likert scale (1= not at all, 5= very much) were given. Both variables were dichotomized into low (1–2) and high (3–5) using the median value as a cut-off point for high versus low.

Psychosocial factors used in this study have been described in detail elsewhere [18]. Briefly, constructs on the following areas: 'incentive and participative leadership', 'task value', 'extrinsic incentives', and 'possibilities to exert influence at work' were asked with a response scale from 1 (totally disagree/very probably not) to 5 (totally agree/very probably). Responses were summed and divided by the number of variables used in the index. Cronbach's α of the measures were 0.71, 0.79, and 0.82, respectively. All psychosocial factors used in the analysis were dichotomized using the median value as the cut-off point.

Statistical analysis

The analysis was conducted in two steps. First, the trajectories of sickness absence days per year were identified using latent class growth modelling. Second, the association of the membership of trajectories of sickness absence with subsequent statutory or non-statutory retirement for a period of 11 years. To illustrate the changes and heterogeneity in sickness absence days per year over the 6 years before retirement, we used group-based latent trajectory analysis, which is a data-driven approach. Group-based latent trajectory analysis is a semiparametric modelling method that identifies different latent groups, which tend to have a similar profile of development over time [19]. A model based on the Poisson distribution was used. The selection of the optimal model, the number of trajectories, and their shapes was based on the Bayesian information criterion (BIC) and the average posterior probabilities of group membership (>0.7 is considered to indicate a good model fit). The model with the lowest BIC was selected as the best model (Supplementary Table S1). Each person was assigned to the trajectory for which the posterior probability was highest.

The statistical difference in the membership of different SA trajectories by baseline characteristics was studied by a chi-square test for the categorical variables and ANOVA for the continuous variable. Cox-regression models were used to estimate the hazard ratios (HRs) with their 95% confidence intervals (CIs) for non-statutory retirement for each trajectory. The follow-up time was calculated from 1 January 2009 (last date of sickness absence period used in the analysis) to the exact date of the employee's retirement. Three models were fitted; Model I was a crude model, Model II was adjusted for age, gender and occupational class and Model II was additionally adjusted for self-rated health, and work-related factors (environmental exposure, repetitive task, awkward posture, incentive system, task value, extrinsic incentives and possibilities to influence). Those

who retired before 2009, regardless of the type of retirement, were excluded to prevent reverse causation. Nelson-Aalen cumulative hazard curves were plotted to show the rate of non-statutory retirement among different trajectories of SA during the follow-up.

All statistical analysis was conducted using Stata v17.

Results

Figure 1 shows the trajectories of sickness absence days per year among employees from 2003 to 2008. A three-class model was selected as a final solution. The majority of employees (51.2%) were in the low-fluctuating sickness absence trajectory, which slightly increased during follow-up, then decreased and remained at a low level until the end of the follow-up. One-third (33.9%) of the employees were in the trajectory of moderate sickness absence, while 14.9% were in the trajectory of high sickness absence.

The distribution of work characteristics by sickness absence trajectories is presented in Table 1. Significantly more women were in the high-stable sickness absence trajectory compared to men (23.9% versus 15.5%), with more men in the low-fluctuating trajectory. Overall, the mean age of participants was 51.1 years (SD 8.3), and those belonging to the high-stable trajectory were significantly younger than those in the other two trajectory groups. Employees in the low-fluctuating trajectory were the oldest (mean age 53.5, SD 6.4). More than a quarter of the blue-collar employees belonged to the high-stable trajectory. No white-collar employees belonged to the high trajectory. White-collar employees were mostly in the low-fluctuating trajectory. Significantly more employees with suboptimal health belonged to the high-stable trajectory (29.8%), and about half of the employees with good self-rated health belonged to the low-fluctuating trajectory.

Among work-related factors, those having high environmental exposures, high repetitive tasks, high awkward posture, poor incentive system, poor task value, poor extrinsic incentives, and poor possibility to influence were mostly in the high-stable sickness absence trajectory.

In total, 44% of the employees retired on non-statutory retirement. Among them, the majority had rehabilitation allowance (31%), followed by full-time disability pension (26%), rehabilitation support (14%), partial disability pension (8%), partial early retirement (8%), and others (13%). Among all, one-third of participants (33.9%) were in the high-stable sickness absence trajectory group, significantly higher than those with statutory retirement (12.4%). More than half of the employees with statutory retirement (55.9%) belonged to the low-fluctuating sickness absence trajectory.

The association of sickness absence trajectories with non-statutory retirement is given in Table 2. In the crude model, compared to a low-fluctuating sickness trajectory, employees belonging to a moderate-stable trajectory had a 1.6-fold risk of having non-statutory retirement (HR 1.64, 95% CI 1.16–2.30). The risk was attenuated when the model was adjusted for age, gender, and occupational status in Model II and in further adjustment with self-rated health, physical, and psychosocial work exposures in Model III. Belonging to a high-stable trajectory was associated with a 3.46-fold higher risk of non-statutory retirement (HR 3.46, 95% CI 2.44–4.92) in the crude model, which remained significant in Model II and the fully adjusted model (Model III), but the risk was attenuated (HR 2.67, 95% CI 1.69–4.23).

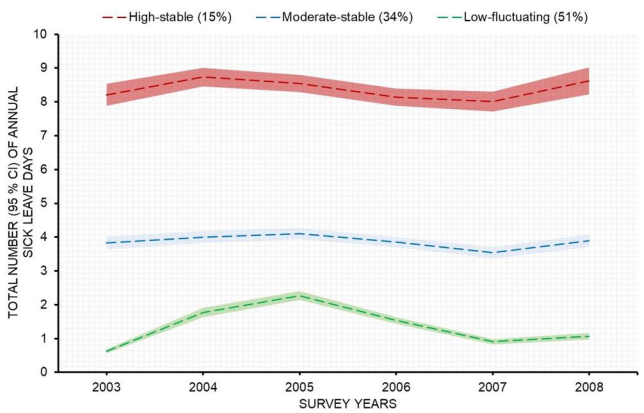

Figure 1. Trajectory of sickness absence days among industrial employees from 2003 to 2008.

Among other variables, males were at 1.4 times higher risk of non-statutory retirement in the final model (HR 1.44, 95% CI 1.04–1.98), and older age was associated with 4% lower risk of non-statutory retirement (HR 0.96, 95% CI 0.94–0.98) in the final model. White-collar employees had a 35% lower risk of having non-statutory retirement compared to blue-collar employees in the crude model. However, the direction of the association was changed, but it lost its significant association in the final model when all studied variables were simultaneously adjusted. Suboptimal self-rated health was associated with increased risk of non-statutory retirement in the crude model, but the significance of the association was lost in the final model.

Among work-related factors, high repetitive tasks and high awkward postures were associated with increased risk of non-statutory retirement in the crude model only. Similarly, good incentive systems and good possibilities to influence were associated with a lower risk of non-statutory retirement in the crude model only.

Figure 2 shows the cumulative hazard rate of non-statutory retirement among different trajectories of SA during the follow-up. The rate of non-statutory retirement was higher in a high-stable trajectory, which significantly increased during the follow-up. The trajectories diversified after 1 year of follow-up.

Discussion

This study aimed to investigate the developmental patterns of sickness absence among food industry employees over a period of 6 years and examined the association of these patterns with the type of retirement during the next 11 years. Our findings revealed three distinct developmental patterns of sickness absence: high-stable, moderate, and low-fluctuating. About 15% of the employees had high-stable sickness absences, one-third had moderate, and more than half had low-fluctuating sickness absences. The high-stable sickness absence trajectory was found to be associated with non-statutory retirement, even when adjusted for potential confounders. The risk estimates show that the risk of non-statutory retirement was highest for those belonging to the high-stable trajectory and lowest for the low-fluctuating trajectory group.

The identification of these distinct patterns is important as it provides insights into the heterogeneity of sickness absence behaviours among industrial employees. Previous research has often focused on overall sickness absence rates or the presence or absence of sickness absence, without considering the different trajectories individuals may follow over a period of time [13, 14]. By examining the developmental patterns, we were able to capture the dynamic nature of sickness absence and gain a more comprehensive understanding of its changes.

Our results showed that ∼15% of employees exhibited a high-stable sickness absence trajectory, indicating a consistent and elevated level of sickness absence over the 5-year period. This finding is consistent with previous studies that have identified a high rate of sickness absence among a similar proportion of municipal employees [3] and a high and increasing rate of sickness absence among industrial and municipal employees [20]. Furthermore, our study found that one-third of employees followed a moderate sickness absence trajectory. The identification of this trajectory is important, as it indicates a group of employees who may benefit from interventions aimed at improving the work environment and thereby reducing sickness absence. In Finland, a full disability pension

Table 1. Distributions of sickness absence trajectories by baseline characteristics

Characteristics	Total ($N = 633$)	Sickness absence trajectories			*P*-value[a,b]
		Low fluctuating ($n = 277$)	Moderate stable ($n = 218$)	High stable ($n = 138$)	
Gender					<.001
Women	410	39.3	36.8	23.9	
Men	194	56.2	28.4	15.5	
Age (mean ± SD)	51.1 ± 8.3	53.5 ± 6.4	50.3 ± 8.6	47.3 ± 9.7	.004
Occupational Class					<.001
Blue-collar	462	32.5	40.0	27.5	
White-collar	141	85.1	14.9	0	
Self-rated health					<.001
Good	350	49.4	34.9	15.7	
Suboptimal	245	37.1	33.1	29.8	
Environmental exposure					<.001
Low	257	56.4	27.6	16.0	
High	306	36.9	37.6	25.5	
Repetitive task					<.001
Low	377	55.2	28.9	15.9	
High	219	26.0	43.4	30.6	
Awkward posture					<.001
Low	387	54.8	30.2	15.0	
High	207	25.6	41.6	32.9	
Incentive system					.003
Poor	304	36.8	38.2	25.0	
Good	329	50.2	31.0	18.8	
Task value					<.001
Poor	313	35.5	36.4	28.1	
Good	320	51.9	32.5	15.6	
Extrinsic incentives					.034
Poor	324	38.9	38.3	22.8	
Good	309	48.9	30.4	20.7	
Possibility to influence					.001
Poor	335	37.0	37.9	25.1	
Good	298	51.3	30.5	18.1	
Retirement type					<.001
Statutory	356	55.9	31.7	12.4	
Non-statutory	277	28.2	37.9	33.9	

Abbreviation: SD, standard deviation.
a: Chi square for categorical variables.
b: Analysis of variance for continuous variables.

may be awarded to a person whose work ability has decreased by 60% or more, and a partial disability for a reduced work ability of 40%–60% due to a disease, injury, or handicap for at least a year. If a person is employed in the public sector when the disability occurs, some consideration is also given to the ability to work in the current position or job in particular [21].

More than half of the employees in our study exhibited a low-fluctuating sickness absence trajectory, which could be explained by the fact that many employees in the public sector tend to have sporadic or intermittent sickness absence [3, 22]. Understanding the characteristics and factors contributing to this trajectory may provide insights into successful management and prevention of sickness absence.

We found that employees belonging to the high-stable trajectory had the highest risk of non-statutory retirement, even after adjusting for potential confounders. This finding suggests that individuals with a persistent sickness absence pattern are at a higher risk of early retirement. Previous studies have also identified a link between sickness absence and subsequent disability pension or early retirement [22, 23]. The association between sickness absence trajectories and non-statutory retirement has important implications for both employees and employers. Employees with a high-stable sickness absence trajectory may face increased financial and social challenges associated with early retirement and a subsequent increased societal burden. Employers, on the other hand, may experience productivity losses and increased costs due to the replacement and training of new employees. Therefore, interventions aimed at reducing sickness absence and promoting sustainable work participation are crucial.

Among the covariates, we found no statistically significant association between work-related factors and non-statutory retirement in the fully adjusted model, although high repetitive tasks and high awkward posture were associated with increased risk of non-statutory retirement and decreased risk due to a good incentive system and the possibility to influence in the crude model. Earlier studies have reported that high physical work demands decrease the likelihood of statutory retirement and psychosocial factors such as higher influence, higher level of recognition from management and better possibilities for development increased the likelihood of statutory retirement as well as working beyond retirement age [24, 25] and decrease risk of disability pension [26].

Among other covariates, suboptimal self-rated health was associated with higher risk of non-statutory retirement only in the crude model, whilst men, in comparison to women, were at higher risk of non-statutory retirement in the adjusted model. On the contrary, earlier studies found higher disability pension among female trade and retail employees in Norway [27] and Sweden [28]. Another Finnish study also reported a higher risk of disability retirement among women than men in municipal workers [12]. Consistent with other previous studies, we found a lower risk of non-statutory retirement among older employees in our study [28].

Table 2. Cox-regression analysis for the associations of sickness absence trajectories with non-statutory retirement

	Model I		Model II		Model III	
	HR	95% CI	HR	95% CI	HR	95% CI
Sickness absence trajectories						
Low fluctuating	1.0	–	1.0	–	1.0	–
Moderate-stable	1.64	1.16–2.30	1.34	0.90–2.0	1.35	0.89–2.05
High-stable	3.46	2.44–4.92	2.59	1.67–4.02	2.67	1.69–4.23
Gender						
Women	1.0	–	1.0	–	1.0	–
Men	1.10	0.86-1.39	1.31	0.97-1.78	1.44	1.04-1.98
Age	0.95	0.94-0.96	0.96	0.94-0.98	0.96	0.94-0.98
Occupational class						
Blue-collar	1.0	–	1.0	–	1.0	–
White-collar	0.65	0.48–0.87	1.05	0.66–1.68	1.32	0.78–2.23
Self-rated health						
Good	1.0	–			1.0	–
Suboptimal	1.67	1.38–2.09			1.28	0.94–1.75
Environmental exposure						
Low	1.0	–			1.0	–
High	1.16	0.92–1.45			1.19	0.83–1.69
Repetitive task						
Low	1.0	–			1.0	–
High	1.36	1.09–1.70			1.05	0.72–1.52
Awkward posture						
Low	1.0	–			1.0	–
High	1.46	1.16–1.83			1.18	0.82–1.71
Incentive system						
Poor	1.0	–			1.0	–
Good	0.74	0.56–0.97			0.77	0.53–1.13
Task value						
Poor	1.0	–			1.0	–
Good	0.78	0.59–1.03			1.43	0.95–2.15
Extrinsic incentives						
Poor	1.0	–			1.0	–
Good	0.85	0.65–1.12			1.22	0.83–1.78
Possibility to influence						
Poor	1.0	–			1.0	–
Good	0.73	0.55–0.97			0.75	0.49–1.15

Note: Model I: Crude model. Model II: Adjusted for age, gender, and occupational class. Model III: + additionally adjusted for self-reported health, physical work exposures (Environmental exposure, repetitive movements, awkward posture), and psychosocial work exposures (Incentive system, Task value, Extrinsic incentives, Possibility to influence).
Abbreviations: CI, confidence interval; HR, hazard ratio.

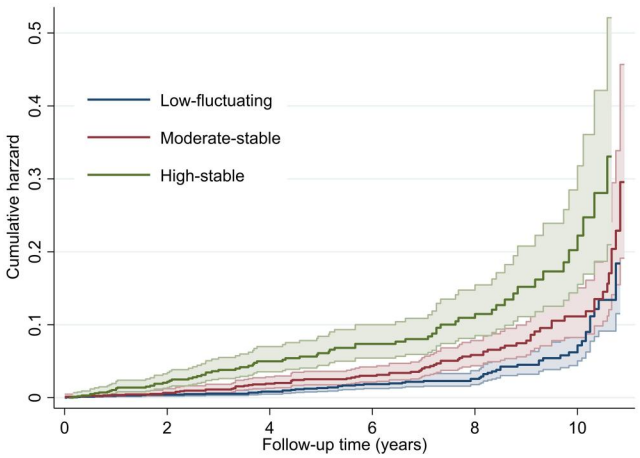

Figure 2. Nelson-Aalen cumulative hazard curve for non-statutory retirement by sickness trajectories.

Study strengths and limitations

The major strength of this study is the use of register data on sickness absences, which eliminates the recall bias, and information on the type of retirement was also obtained from registers, which minimized the risk of misclassification. Trajectories of annual number of sickness days were identified using group-based latent trajectory analysis, which identifies varying developmental patterns within a population without any preconceived assumptions and may be a better approach than conventional longitudinal methods. A limitation of this study is the small sample size, which may reduce the power. Nonetheless, the selection of individuals with data on sickness absence and the type of retirement reduced the sample size in our study. For the same reason, adjustment to the final model with all potential confounders, such as morbidity, was also limited. Only a few cases ($n = 73$) were accessing a full-time disability pension; therefore, we analysed those with rehabilitation support, a part-time pension, partial disability pension, or the unemployment pension together as non-statutory retirement. Nevertheless, these pension types, other than statutory pension, are an official early exit route from the labour market and can be treated in one group.

While larger sample sizes and more events are generally preferred, there are common situations where confounding cannot be effectively managed without breaching the rule of thumb [29], in which a minimum of 10 events per predictor variable should be used [30]. In such instances, the findings should be interpreted with caution. Nevertheless, our findings can be generalizable to employees working in industrial settings.

In conclusion, our study provides valuable insights into the developmental patterns of sickness absence among industrial

employees and their association with non-statutory retirement. The identification of distinct sickness absence trajectories highlights the heterogeneity in the annual number of sickness absences. The finding that a high-stable sickness absence trajectory is associated with an increased risk of non-statutory retirement emphasizes the importance of early intervention and support for individuals with recurring sick leaves. Further research is needed to explore the underlying factors contributing to these trajectories.

The identification of a high-stable trajectory highlights the need for targeted interventions and support for individuals experiencing prolonged sickness absence, which often leads to non-statutory retirement. Further research in this area will contribute to a more comprehensive understanding of the factors that drive retirement decisions and ultimately lead to better-targeted interventions to support the ageing workforce.

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Supplementary data

Supplementary data are available at *EURPUB* online.

Conflict of interest: None declared.

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Data availability

Data are not publicly available but may be obtained from a third party. The data used in this study were obtained from the survey data conducted by Tampere University, the companies register, and the Finnish Centre for Pensions.

Ethics approval

This study was approved by the Ethics Committee of the Pirkanmaa Hospital District (R03043), and written consent to link the survey information to their register data was obtained from each participant.

Key points

- Three distinct trajectories of sickness absence over the 6 years were found, with the majority (51%) having low-fluctuating, one-third (34%) having moderate-stable, and 15% having a high-stable sickness absence trajectory throughout the follow-up.
- The high-stable trajectory was associated with a higher risk of having non-statutory retirement (HR 2.67, 95% CI 1.69–4.23).
- Early intervention among individuals experiencing recurring sickness absence whilst employed may support minimizing early exit pathways from the labour market.

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