The European Journal of Public Health, Vol. 26, No. 6, 1050–1055
© The Author 2016. Published by Oxford University Press on behalf of the European Public Health Association. All rights reserved.
doi:10.1093/eurpub/ckw081 Advance Access published on 21 June 2016

Sickness allowance trajectories preceding disability retirement: a register-based retrospective study

Mikko Laaksonen[1], Jenni Blomgren[2], Raija Gould[1]

1 The Finnish Centre for Pensions (ETK), Eläketurvakeskus, Finland
2 The Social Insurance Institution of Finland (KELA), Helsinki, Finland

Correspondence: Mikko Laaksonen, Finnish Centre for Pensions, FI-00065 Eläketurvakeskus, Finland, Tel: +358 29 411 2156, Fax: + 358 29 411 2410, e-mail: mikko.laaksonen@etk.fi

Objectives: To identify subgroups of disability retirees with different pre-retirement sickness allowance histories and to examine whether the diagnosis of disability pension and socio-demographic variables discriminate these subgroups. **Methods:** The data included all Finnish residents aged 30–64 years who were granted a full disability pension in 2011 ($N = 17\ 208$). Sickness allowance trajectories during the preceding 10 years were searched using latent trajectory analysis. Multinomial logistic regression analysis was used to explore determinants of the trajectories. **Results:** Six distinct sickness allowance trajectories were identified. Four large subgroups with a long sickness allowance period during the final pre-retirement year were found, characterized by increasing (29% of retirees), early high (21%), stable low (24%) or stable high (16%) sickness allowance histories. In addition, two small subgroups (6 and 4%) with only a little sickness allowance during the final year were identified. The diagnosis of disability pension strongly influenced assignment to the trajectory groups. Women were more likely to have followed the stable high or the early high sickness allowance trajectory. Older age strongly increased but being a lower non-manual employee or self-employed decreased the probability of belonging to the two small trajectory groups. Long-term unemployment slightly increased belonging to the stable low trajectory and was strongly associated with the small subgroups with little or no sickness allowance during the final year preceding retirement. **Conclusions:** Different pre-retirement sickness allowance trajectories can be found. Assignment to the trajectories differed by the diagnosis of disability pension but associations with socio-demographic variables were weak.

Introduction

In most developed countries, disability benefits constitute of sickness allowance that compensates for short-term work disability and disability pension granted after longer or permanent work incapacity.[1] Most of those who retire due to disability first receive sickness allowance. This is the case also in Finland, where disability pension is normally granted after a sickness allowance period lasting 1 year.[2] However, the receipt of sickness allowance predicts disability retirement also on longer term.[3–10] Longer length of sickness allowance increases the risk of disability retirement and the strength of the association also varies by diagnosis of sickness allowance and socio-demographic variables.[7–9] Yet, little is known about the development of sickness allowance histories before disability retirement. On average, sickness allowance days increase when disability retirement approaches[11,12] but there may be different subgroups that do not follow a similar pattern. The aim of this study was to identify subgroups of disability retirees with different pre-retirement sickness allowance trajectories and to examine whether the diagnosis of the disability pension and socio-demographic variables discriminate these trajectories.

Methods

The data included all Finnish residents who had been granted a new full-time disability pension in 2011, identified from the registers of the Social Insurance Institution of Finland (flat-rate national pensions) and the Finnish Centre for Pensions (earnings-related pensions). To permit sufficient time for tracing back the pre-retirement sickness allowance histories, those younger than 30 years were excluded. The data thus included 17 208 disability retirees.

Sickness allowance

Data on sickness allowance were based on the register of the Social Insurance Institution. The register includes all sickness allowance periods that exceed a waiting period which normally consists of 10 working days. For those who have not been engaged in any gainful activities during the preceding 3 months, the waiting period is 55 days.[13] The number of sickness allowance days was examined in 1-year (365 days) intervals counting backwards from the start of the pension. The length of each sickness allowance period was calculated as the difference between the last and the first allowance day.

Covariates

The primary diagnosis of the disability pension was classified into eight groups based on the ICD-10 classification. The categories were depression (F32-F33), other mental and behavioural disorders (other illnesses in Chapter F), back problems (M40-M54), other musculoskeletal disorders (other illnesses in Chapter M), diseases of the circulatory system (I00-I99), neoplasms (C00-D48), diseases of the nervous system (G00-G99), injury (S00-T98) and all other illnesses.

Age at the end of 2010 was classified into 30–44, 45–54 and 55–64 years. Educational level was derived from Statistics Finland and classified into those with primary education, lower-secondary, upper-secondary and tertiary education. Social class was derived by first separating wage earners and self-employed based on the type of their employment insurance. Wage earners were then classified into manual workers, lower non-manual employees and upper non-manual employees.[14] Unemployment history was classified into <90 days, more than 90 days and entire year during any 1-year interval during the preceding 6 years.

Downloaded from https://academic.oup.com/eurpub/article-abstract/26/6/1050/2616254 by National Library of Health Sciences user on 16 October 2018

Statistical methods

Sickness allowance histories during the 10 years preceding disability retirement were examined using latent trajectory analysis.[15] The method identifies distinct subgroups that have similar developmental profiles from data based on repeated measurements. The censored normal probability distribution was used with the annual number of sickness allowance days as the dependent variable. Models with varying number of trajectory groups were compared using the Bayesian information criterion (BIC) to find the best model in terms of model fit and parsimony. Posterior probabilities were used to assign each disability retiree into the trajectory group with the highest probability of membership.

Multinomial logistic regression analysis was used to examine whether the diagnosis of the disability pension and socio-demographic variables discriminate the trajectories. We present the odds ratios from the model where all covariates have been adjusted for each other.

Results

Solutions with 2–10 trajectory groups were tried. Solutions with six or eight trajectory groups showed the best fit (Supplementary Table S1). The eight class model was marginally the best, judged purely by the BIC, but this solution included several subgroups with very little participants. Therefore, we favoured the six class solution.

The selected model with six latent trajectories is shown in figure 1. There were four large subgroups with a high number of sickness allowance days during the final pre-retirement year but with different developmental profiles during the preceding years. The largest trajectory group (28.9%) showed an increasing sickness allowance history starting 5–6 years before disability retirement. The second largest trajectory group (23.5%) had a stable low sickness allowance history during the 10 years preceding the rise just before disability retirement. The third largest trajectory group (21.4%) was characterized by an early high sickness allowance pattern with decreasing number of sickness allowance days before retirement. The fourth largest trajectory group (16.4%) had stable high sickness allowance history for the whole 10-year observation period with an earlier pre-retirement increase and somewhat lower number of sickness allowance days during the final year than in the other subgroups. Furthermore, two small trajectory groups with only a little or no sickness allowance during the year immediately preceding disability retirement were found, but those in the larger one (6.2%) had some prior sickness allowance history whereas those in the smaller one (3.6%) did not.

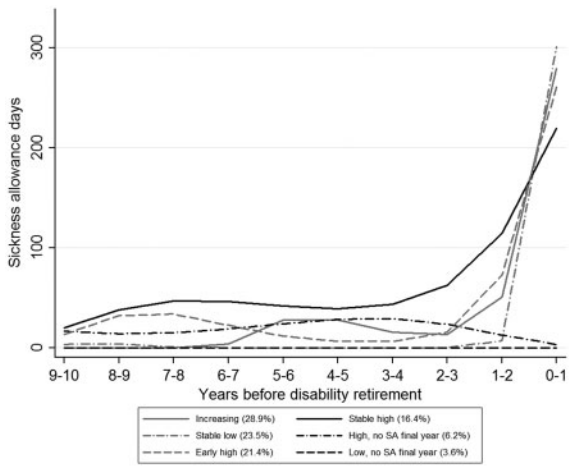

Figure 1 Latent class trajectories for sickness allowance history before disability retirement

Table 1 shows the distribution of the covariates in the whole study population and in the six trajectory groups. Differences between the four largest trajectory groups were relatively small. Those with the stable low sickness allowance history slightly less often than others had retired due to depression or musculoskeletal diseases and more often due to diseases of the circulatory system and neoplasms. Those with the stable high sickness allowance history more often had retired due to back problems, other musculoskeletal diseases or depression and less often due to diseases of the circulatory system and neoplasms. Those in the stable low trajectory group less often were women and those in the stable high trajectory less often belonged to the oldest age group. Those in the stable low trajectory group less often were lower non-manual employees and more often had a missing social class. Long-term unemployment was more common in the stable low trajectory group than in the three other large trajectory groups.

The two small trajectory groups with only a little sickness allowance during the final pre-retirement year more clearly differed from the others. In these two subgroups, other mental disorders than depression, diseases of the nervous system and 'other diseases' were particularly common diagnoses for disability retirement. Similarly to those in the stable low trajectory group, those in the small trajectory group with little previous sickness allowance history were less often women. The retirees in the two small trajectory groups were also older and more often had only primary education. The information on social class was often missing and long-term unemployment was extremely common. The differences to the other trajectory groups were more accentuated for the smallest subgroup with sparse allowance history during the past 10 years.

In the multinomial regression analysis, the odds ratios for belonging to the other trajectory groups were compared to the increasing sickness allowance trajectory (Table 2). When compared to those who retired due to depression, those retiring due to almost any other disease were more likely to have followed the stable low trajectory and less likely have followed the stable high trajectory rather than the increasing one. Exceptions were those who retired due to back problems, other musculoskeletal diseases or injury. Retiring due to other diseases than depression also increased the probability of belonging to either one of the two small subgroups with only a little sickness allowance during the final pre-retirement year. In particular, those retiring due to other mental disorders than depression, diseases of the circulatory system, and 'other diseases' tended to belong to the small subgroups. There were no differences in following the early high rather than the increasing trajectory with respect to the diagnosis of the pension.

Women had an increased probability of following the stable high or the early high sickness allowance trajectory rather than the increasing one, but the stable low trajectory was less likely among women (Table 2). Older age strongly increased the probability of belonging to the two small subgroups with only a little sickness allowance during the final pre-retirement year. Differences by educational level were small; however, those with tertiary education were less likely to follow the stable high trajectory group. Lower non-manual employees and self-employed had a decreased probability of following a trajectory with a little sickness allowance during the final pre-retirement year. Furthermore, those with a missing social class had an increased probability of belonging to the two small subgroups or the stable low sickness allowance trajectory. The association of unemployment with the trajectories depended on its length. Being unemployed one entire year strongly increased belonging to the small trajectory group with prior sickness allowance history and also to some extent to the stable low trajectory group rather than to the increasing one.

Discussion

This study searched for different subgroups of pre-retirement sickness allowance trajectories and examined whether the diagnosis

Downloaded from https://academic.oup.com/eurpub/article-abstract/26/6/1050/2616254 by National Library of Health Sciences user on 16 October 2018

Table 1 Distribution of the study variables by the sickness allowance (SA) trajectories (%)

		All	Increasing	Stable low	Early high	Stable high	High, little SA final year	Low, little SA final year
		(*N*=17 208)	(*N*=4978) 28.9%	(*N*=4043) 23.5%	(*N*=3676) 21.4%	(*N*=2817) 16.4%	(*N*=1074) 6.2%	(*N*=620) 3.6%
Diagnosis of disability pension								
	Depression	16	17	14	18	20	9	6
	Other mental health problems	13	12	14	11	11	19	31
	Back problems	13	13	10	15	17	14	8
	Other musculoskeletal diseases	18	19	15	20	23	16	9
	Diseases of the circulatory system	8	8	11	8	4	8	7
	Neoplasms	8	8	12	8	5	4	4
	Diseases of the nervous system	7	7	9	6	5	12	16
	Injury	7	8	8	7	8	6	4
	Other diseases	8	8	8	8	6	12	15
Gender								
	Men	54	55	61	48	44	57	61
	Women	46	45	39	52	56	43	39
Age								
	30–44 years	20	21	20	19	20	14	18
	45–54 years	31	31	29	32	36	23	23
	55–64 years	49	48	51	49	44	64	60
Educational level								
	Basic	31	30	33	29	30	36	43
	Lower secondary	51	52	49	53	54	49	44
	Upper secondary	10	10	9	10	10	9	8
	Tertiary	7	8	9	8	5	6	5
Occupational class								
	Upper non-manual employee	7	8	8	7	5	6	5
	Lower non-manual employee	25	26	22	30	28	15	10
	Manual worker	42	44	39	43	46	37	21
	Self-employed	10	11	12	9	10	5	4
	Missing	17	11	20	11	12	37	60
Unemployment								
	<90 days/year	59	61	60	64	59	32	51
	>90 days/year	24	26	23	23	28	20	12
	Entire year	17	13	18	13	13	48	37

of disability pension and socio-demographic variables discriminate these trajectories. Six distinct sickness allowance trajectories were identified. Four large trajectory groups with increasing, early high, stable low and stable high sickness allowance histories ending in a long pre-retirement sickness allowance period were accompanied by two small trajectory groups with a little or no sickness allowance during the year immediately preceding retirement.

Sickness allowance trajectories

Previous studies have shown that, on average, sickness allowance days gradually increase when disability pension approaches.[11,12] In our study, an increasing sickness allowance trajectory was followed by a little more than one fourth of all disability retirees. Furthermore, in the stable high trajectory group as well as in the one labelled as early high, sickness allowance days increased during the last few pre-retirement years. Previous studies have also found that disability retirement often is a long-term process during which repeated sickness allowance periods alternate with periods of work.[16,17] Such a development may lead to a stable high sickness allowance trajectory which was followed by approximately one-sixth of all retirees. However, excluding the final year, the average annual number of sickness allowance days was relatively low even in the stable high trajectory group. Thus, the years preceding disability retirement are generally not characterized by a large number of annual sickness allowance days.

About 90% of the disability retirees had a large number of sickness allowance days during the year immediately preceding retirement. This was expected as in the Finnish scheme disability pension is generally preceded by a long-term sickness allowance period.[13] However, in cases of indisputable and permanent disability, a pension may be granted also without a statutory sickness allowance period. In these cases, it may not be profitable to first apply for sickness allowance if the amount of disability pension would be higher than sickness allowance. This may happen e.g. in case of recent unemployment which reduces the amount of sickness allowance but does not to the same degree affect the level of disability pension which is based on the entire working career. Previous studies have shown that those who avoid this normal route of disability retirement are more often long-term unemployed, women, older and retire due to musculoskeletal diseases.[12,18] In this study, approximately 10% of the disability retirees followed a trajectory with only a little sickness allowance during the final year preceding retirement. In addition, the other four trajectory groups also include people who have not used the full sickness allowance period.

Diagnoses

There were some clear differences in the diagnoses of disability pension between the trajectory groups. Those who retired due to neoplasms or diseases of the circulatory system often followed the stable low trajectory but rarely the stable high trajectory. As these diseases may emerge abruptly, a sparse sickness allowance history is comprehensible. Also those who retired due to diseases of the nervous system or other mental disorders than depression often followed the stable low trajectory and rarely the stable high trajectory. In addition to typical course of the illness, the findings may be explained by differences in employment histories. A fragmentary employment history may lead to sparse sickness allowance history as it is not profitable to apply for sickness allowance instead of other social security benefits. Fragmentary employment history is frequent among those who retire due to other mental disorders than depression. Schizophrenia and other psychotic disorders that emerge at relatively early age are

Downloaded from https://academic.oup.com/eurpub/article-abstract/26/6/1050/2616254 by National Library of Health Sciences user on 16 October 2018

Table 2 Diagnosis of disability pension and socio-demographic factors as determinants of belonging to sickness allowance (SA) trajectories

		Stable low vs. increasing	Early high vs. Increasing	Stable high vs. increasing	High, little SA final year vs. increasing	Low, little SA final year vs. increasing
Diagnosis of disability pension						
	Depression	1,00	1,00	1,00	1,00	1,00
	Other mental health problems	*1,23 (1,04–1,44)*	0,89 (0,76-1,05)	*0,79 (0,66-0,94)*	*2,57 (1,96–3,37)*	*5,57 (3,79–8,17)*
	Back problems	0,87 (0,74–1,03)	1,08 (0,92-1,27)	1,11 (0,94-1,30)	*1,61* (1,21–2,14)	*1,62 (1,02–2,57)*
	Other musculoskeletal diseases	0,98 (0,84–1,14)	1,02 (0,88-1,18)	1,00 (0,86-1,17)	*1,33 (1,01–1,75)*	*1,37 (0,88–2,15)*
	Diseases of the circulatory system	*1,49 (1,24–1,80)*	0,93 (0,76-1,14)	*0,64 (0,51-0,80)*	*2,76 (2,05–3,72)*	*5,43 (3,58–8,26)*
	Neoplasms	*1,60 (1,34–1,91)*	1,00 (0,83-1,20)	*0,47 (0,37-0,60)*	*1,48* (1,07–2,05)	*2,26 (1,41–3,63)*
	Diseases of the nervous system	*1,75 (1,47–2,08)*	0,94 (0,78-1,13)	*0,52 (0,42-0,65)*	0,90 (0,61–1,32)	*1,75 (1,03–2,97)*
	Injury	1,17 (0,97–1,41)	0,97 (0,80-1,18)	0,92 (0,75-1,13)	*1,46* (1,04–2,06)	*1,72 (1,01–2,91)*
	Other diseases	*1,24 (1,03–1,50)*	0,99 (0,82-1,19)	*0,68 (0,55-0,84)*	*2,41 (1,79–3,25)*	*5,23 (3,43–7,95)*
Gender						
	Men	1,00	1,00	1,00	1,00	1,00
	Women	*0,82 (0,75–0,90)*	*1,31 (1,19-1,43)*	*1,64 (1,49-1,82)*	1,09 (0,95–1,26)	0,94 (0,78–1,13)
Age						
	30–44 years	1,00	1,00	1,00	1,00	1,00
	45–54 years	1,05 (0,93–1,18)	*1,15 (1,02-1,30)*	*1,34 (1,17-1,53)*	*1,54 (1,22–1,93)*	*1,44 (1,08–1,91)*
	55–64 years	*1,19 (1,06–1,34)*	1,12 (1,00-1,27)	1,03 (0,90-1,17)	*3,00 (2,42–3,71)*	*3,16 (2,43–4,10)*
Educational level						
	Basic	1,00	1,00	1,00	1,00	1,00
	Lower secondary	0,95 (0,86–1,05)	1,08 (0,98-1,19)	1,01 (0,91-1,13)	0,99 (0,85–1,15)	0,83 (0,68–1,00)
	Upper secondary	0,92 (0,78–1,08)	0,99 (0,84-1,17)	1,00 (0,83-1,19)	1,03 (0,79–1,34)	0,88 (0,62–1,25)
	Tertiary	1,09 (0,89–1,32)	1,08 (0,88-1,32)	*0,75 (0,59-0,96)*	0,86 (0,60–1,22)	0,69 (0,44–1,08)
Occupational class						
	Upper non-manual employee	1,00	1,00	1,00	1,00	1,00
	Lower non-manual employee	0,91 (0,75–1,10)	1,13 (0,92-1,38)	1,17 (0,92-1,48)	*0,64 (0,45–0,91)*	*0,54 (0,33–0,88)*
	Manual worker	0,90 (0,73–1,09)	1,09 (0,89-1,34)	*1,37 (1,08-1,74)*	0,76 (0,54–1,07)	0,73 (0,45–1,17)
	Self-employed	1,05 (0,85–1,31)	0,86 (0,68-1,08)	1,19 (0,91-1,55)	0,64 (0,42–0,97)	*0,50 (0,28–0,89)*
	Missing	*1,71 (1,37–2,13)*	1,04 (0,82-1,32)	1,30 (0,99-1,71)	*1,68 (1,17–2,40)*	*6,84 (4,28–10,95)*
Unemployment						
	<90 days/year	1,00	1,00	1,00	1,00	1,00
	>90 days/year	0,88 (0,79–0,97)	*0,84 (0,76-0,93)*	1,04 (0,93-1,16)	*1,38 (1,14–1,67)*	*0,35 (0,26–0,46)*
	Entire year	*1,17 (1,02–1,33)*	0,96 (0,83-1,11)	1,00 (0,86-1,17)	*5,00* (4,16–6,00)	1,04 (0,83–1,30)

The other trajectories are compared to following the increasing sickness absence trajectory. Statistically significant associations have been highlighted in italics.

common diagnoses in this group.[19] Overall, however, the four large trajectory groups were relatively similar in terms of diagnosis of the pension. The two small trajectory groups more clearly differed from all others but were quite similar to each other.

A previous Finnish study examined average sickness allowance histories in different diagnostic groups of disability pension and found a steadily increasing trend in each group.[12] However, those who retired due to depression or musculoskeletal diseases had most sickness allowance during their pre-retirement years. These findings correspond to the present study showing that those in these diagnostic groups more often followed the stable high and less often the stable low category. A previous Swedish study[11] also found no differences in pre-retirement sickness absence track record between those who retired due to various disability pension diagnoses. All diagnostic groups followed a steadily increasing pattern. However, there were differences in the overall level of sickness absence such that those retiring due to psychiatric diagnosis had most and those retiring due to neurological diagnoses least sickness absence before their retirement.

Socio-demographic covariates

Women followed more often than men the stable high or the early high sickness allowance trajectory and less often the stable low sickness allowance trajectory. The results reflect the fact that women in general have more sickness absence than men.[20] However, studies examining the risk of disability pension among those who already are on sick leave have generally not found any gender differences[21,22] but sickness absence due to mental diagnoses has more strongly predicted disability pension among men.[22,23] Thus, among men sickness absence due to mental disorders may be a better precursor for disability retirement than among women.

Older age strongly increased the probability of belonging to the two small trajectory groups with little sickness allowance during the final pre-retirement year. Older age may relate to more serious illnesses and therefore rehabilitation is considered unfeasible, which may lead to disability retirement without preceding sickness allowance. Among those above the age of 60 years, the criteria for disability retirement in the Finnish earnings related pension scheme emphasizes the characteristics of one's own occupation instead of all potential occupations when work disability is evaluated.[24]

Educational level and occupational class were not clearly associated with the trajectory groups. However, those with a missing social class had a very high probability of belonging to the low sickness allowance trajectory with little sickness allowance during the final pre-retirement year. Being unemployed one entire year was strongly associated with belonging to the other small trajectory group with little sickness allowance during the year immediately preceding retirement. Previous studies have found that unemployment is common among those who transfer to disability pension without a preceding long-term sickness allowance period.[12,18] Many of the disability retirees may have had impaired work ability already for some time, but instead of receiving sickness allowance they have received unemployment benefit. This is consistent with the slightly increased probability of the long-term unemployed to belong to the stable low sickness allowance trajectory. Thus, the low sickness absence trajectory may consist of both those who have relatively good health prior to the loss of work ability, but also of the unemployed, who tend to have poorer health than the employed.[25]

Methodological considerations

This study was based on large and nationally representative register-based sources. Instead of assuming a single average growth pattern,

Downloaded from https://academic.oup.com/eurpub/article-abstract/26/6/1050/2616254 by National Library of Health Sciences user on 16 October 2018

subgroups with different developmental trajectories were searched with a method based on repeated measurements. Each of the disability retirees was assigned exclusively into one of the six distinct trajectory groups identified. The trajectory groups are thus necessarily rather crude with internal heterogeneity in the sickness allowance patterns. For example, in the stable low subgroup some retirees may have received some sickness allowance in a given 1-year interval whereas others have not.

Data on sickness absence were derived from administrative registers and thus has some shortcomings. The measure may not properly reflect health problems of those who for some reason do not apply for it. Thus, low rate of sickness allowance may be because of good health or because the person did not apply for sickness allowance e.g. due to unemployment. Furthermore, the sickness allowance register includes all periods lasting continuously more than approximately two calendar weeks. To provide a more complete picture of the sickness absence histories, also shorter sickness absence periods should be included. Nevertheless, sickness allowance as such is a valuable indicator as the cumulative number of sickness allowance days is used in planning and scheduling of return to work efforts. Generalizability of the results to countries with different health-related benefits should be made with caution.

Conclusions

Our study revealed six distinct pre-retirement sickness allowance trajectories with some differences in the diagnoses on which the disability pension was based but weak associations with socio-demographic characteristics. The trajectory groups with more extensive sickness allowance histories offer more possibilities for interventions. The legislation on sickness allowance contains various check-points when the employee's work ability and the need for rehabilitation are assessed. A contact with a physician is always required when sickness allowance is first applied or continued. These occasions should be fully utilised in order to avoid lengthening of absence from work. Several trajectory groups showed an increasing pattern of sickness allowance a couple of years preceding disability retirement. More research is needed on these trajectories to detect prolonged work disabilities at an early stage and to recognize factors that improve the possibilities of return to work.

Funding

This research was supported by the Strategic Research Council of the Academy of Finland (decision number: 293103).

Supplementary data

Supplementary data are available at *EURPUB* online.

Conflicts of interest: None declared.

Key points

- On average, sickness allowance days increase when disability retirement approaches but there may be different subgroups that do not follow a similar pattern.
- Latent trajectory analysis identified six distinct pre-retirement sickness allowance trajectories.
- Assignment to the trajectories differed by the diagnosis of the disability pension but associations with socio-demographic characteristics were weak.
- Possibilities for interventions are better among those disability retirees who follow sickness allowance trajectories with more extensive sickness allowance histories.

References

1 OECD. Sickness, Disability and Work: Breaking the Barriers. A Synthesis of Findings Across OECD Countries. Paris: OECD, 2010.

2 Niemelä H, Salminen K. Social Security in Finland. Helsinki: Social Insurance Institution, Finnish Centre for Pensions, Finnish Pension Alliance and Ministry of Social Affairs and Health, 2006.

3 Wedegaertner F, Arnhold-Kerri S, Sittaro NA, et al. Depression- and anxiety-related sick leave and the risk of permanent disability and mortality in the working population in Germany: a cohort study. *BMC Public Health* 2013; 13:145.

4 Labriola M, Lund T. Self-reported sickness absence as a risk marker of future disability pension. Prospective findings from the DWECS/DREAM study 1990-2004. *Int J Med Sci* 2007;4:153–8.

5 Gjesdal S, Haug K, Ringdal P, et al. Sickness absence with musculoskeletal or mental diagnoses, transition into disability pension and all-cause mortality: a 9-year prospective cohort study. *Scand J Public Health* 2009;37:387–94.

6 Gjesdal S, Bratberg E. Diagnosis and duration of sickness absence as predictors for disability pension: results from a three-year, multi-register based and prospective study. *Scand J Public Health* 2003;31:246–54.

7 Kivimäki M, Ferrie JE, Hagberg J, et al. Diagnosis-specific sick leave as a risk marker for disability pension in a Swedish population. *J Epidemiol Community Health* 2007;61:915–20.

8 Alexanderson K, Kivimäki M, Ferrie JE, et al. Diagnosis-specific sick leave as a long-term predictor of disability pension: a 13-year follow-up of the GAZEL cohort study. *J Epidemiol Community Health* 2012;66:155–9.

9 Lund T, Kivimaki M, Labriola M, et al. Using administrative sickness absence data as a marker of future disability pension: the prospective DREAM study of Danish private sector employees. *Occup Environ Med* 2008;65:28–31.

10 Koopmans PC, Roelen CA, Groothoff JW. Frequent and long-term absence as a risk factor for work disability and job termination among employees in the private sector. *Occup Environ Med* 2008;65:494–9.

11 Wallman T, Wedel H, Palmer E, et al. Sick-leave track record and other potential predictors of a disability pension. A population based study of 8,218 men and women followed for 16 years. *BMC Public Health* 2009;9:104.

12 Laaksonen M, Blomgren J, Gould R. Sickness allowance, rehabilitation and unemployment history of disability retirees. A register based study. Reports 05/2014. Helsinki: Finnish Centre for Pensions, 2014.

13 Statistical Yearbook of the Social Insurance Institution 2013. Official Statistics of Finland, Social Protection. Helsinki: Kela, 2014.

14 Statistics Finland. Sosioekonomisen aseman luokitus 1989 (Classification of socio-economic groups 1989). Handbooks 17. Helsinki: Central Statistical Office of Finland, 1989.

15 Nagin DS. *Group-Based Modeling of Development*. Cambridge, MA: Harvard University Press, 2005.

16 Oyeflaten I, Lie SA, Ihlebaek CM, Eriksen HR. Multiple transitions in sick leave, disability benefits, and return to work–a 4-year follow-up of patients participating in a work-related rehabilitation program. *BMC Public Health* 2012;12:748.

17 Pedersen J, Bjorner JB, Burr H, Christensen KB. Transitions between sickness absence, work, unemployment, and disability in Denmark 2004-2008. *Scand J Work Environ Health* 2012;38:516–26.

18 Blomgren J, Hytti H, Gould R. *Työkyvyttömyyseläkkeelle siirtyneiden työttömyys- ja sairaustausta eri järjestelmissä*. Kelan Nettityöpapeita 26/2011. Helsinki: Kela, 2011.

19 Laaksonen M, Blomgren J, Tuulio-Henriksson A. Sickness allowance histories among disability retirees due to mental disorders: a retrospective case-control study. *Scand J Public Health* 2016;44:291–9.

20 Laaksonen M, Mastekaasa A, Martikainen P, et al. Gender differences in sickness absence–the contribution of occupation and workplace. *Scand J Work Environ Health* 2010;36:394–403.

21 Gjesdal S, Ringdal PR, Haug K, Maeland JG. Predictors of disability pension in long-term sickness absence: results from a population-based and prospective study in Norway 1994-1999. *Eur J Public Health* 2004;14:398–405.

22 Dorner TE, Alexanderson K, Svedberg P, et al. Sickness absence due to back pain or depressive episode and the risk of all-cause or diagnosis-specific disability pension: A Swedish cohort study of 4,823,069 individuals. *Eur J Pain* 2016;19:1308–20.

Downloaded from https://academic.oup.com/eurpub/article-abstract/26/6/1050/2616254 by National Library of Health Sciences user on 16 October 2018

23 Gjesdal S, Ringdal PR, Haug K, Mæland JG. Long-term sickness absence and disability pension with psychiatric diagnoses: a population-based cohort study. *Nord J Psychiatr* 2008;62:294–301.

24 Statistical yearbook of pensioners in Finland 2014. Official statistics of Finland. Helsinki: Finnish Centre for Pensions and The Social Insurance Institution of Finland, 2014.

25 Bambra C, Eikemo TA. Welfare state regimes, unemployment and health: a comparative study of the relationship between unemployment and self-reported health in 23 European countries. *J Epidemiol Community Health* 2009;63:92–8.

The European Journal of Public Health, Vol. 26, No. 6, 1055–1061
© The Author 2016. Published by Oxford University Press on behalf of the European Public Health Association. All rights reserved.
doi:10.1093/eurpub/ckw086 Advance Access published on 21 June 2016

Work-related stress in midlife and all-cause mortality: can sense of coherence modify this association?

Charlotta Nilsen[1], Ross Andel[2,3], Johan Fritzell[1], Ingemar Kåreholt[1,4]

1 Aging Research Center, Karolinska Institutet and Stockholm University, Stockholm, Sweden
2 School of Aging Studies, University of South Florida, Tampa, FL, USA
3 International Clinical Research Center, St. Anne's University Hospital, Brno, Czech Republic
4 Institute of Gerontology, School of Health and Welfare, Jönköping University, Jönköping, Sweden

Correspondence: Charlotta Nilsen, Gävlegatan 16, 113 30 Stockholm, Sweden, Tel: +46 (0) 76 77 60115, e-mail: charlotta.nilsen@ki.se

Background: Survival reflects the accumulation of multiple influences experienced over the life course. Given the amount of time usually spent at work, the influence of work may be particularly important. We examined the association between work-related stress in midlife and subsequent mortality, investigating whether sense of coherence modified the association. **Methods:** Self-reported work-related stress was assessed in 1393 Swedish workers aged 42–65 who participated in the nationally representative Level of Living Survey in 1991. An established psychosocial job exposure matrix was applied to measure occupation-based stress. Sense of coherence was measured as meaningfulness, manageability and comprehensibility. Mortality data were collected from the Swedish National Cause of Death Register. Data were analyzed with hazard regression with Gompertz distributed baseline intensity. **Results:** After adjustment for socioeconomic position, occupation-based high job strain was associated with higher mortality in the presence of a weak sense of coherence (HR, 3.15; 1.62–6.13), a result that was stronger in women (HR, 4.48; 1.64–12.26) than in men (HR, 2.90; 1.12–7.49). Self-reported passive jobs were associated with higher mortality in the presence of a weak sense of coherence in men (HR, 2.76; 1.16–6.59). The link between work stress and mortality was not significant in the presence of a strong sense of coherence, indicating that a strong sense of coherence buffered the negative effects of work-related stress on mortality. **Conclusions:** Modifications to work environments that reduce work-related stress may contribute to better health and longer lives, especially in combination with promoting a sense of coherence among workers.

Introduction

Adult and late-life health and survival reflect the accumulation of various environmental influences experienced over the life course. Sustained exposure to stress has negative long-term consequences on health. Given that employed adults spend much of their time at work, it follows that work-related stress might be an important indicator of the overall exposure to stress across adulthood.

Work-related stress is associated with an increased risk for ill health (e.g., coronary heart disease, depression, anxiety and musculoskeletal pain) and overall mortality.[1–9] In some studies, results differed for women and men[2,8,10]; e.g. in men, high job control has been associated with decreased mortality,[2,4] whereas in women, high job control has been associated with increased mortality and high job demands with decreased mortality.[2,4]

One way to explain why work-related stress may increase the risk of many different health problems and of dying early is via the concept of 'allostatic load'.[11] Allostatic load refers to damage to the body caused by repeated, prolonged exposure to stress (i.e. chronic stress), possibly through overactivation of the body's natural response to stress via the fight or flight response and subsequent endocrinal changes that accelerate biological ageing.[12–14] Stress often leads to a cumulative loss of resources and diminished capacity to cope with stress, which results in a stronger reaction to stress in the future.[15,16]

Sense of coherence (SOC) may be an important resource for coping with stress. SOC comprises three components that play a role in response to life stress: meaningfulness, manageability and comprehensibility.[17,18] A strong SOC increases people's capacity to find the coping strategies they need when they face challenging life events.[19] A strong SOC has been associated with healthy lifestyle factors[20] and a weak SOC with depression, burnout, anxiety and hopelessness.[17] Previous studies have found that those with a strong SOC coped better with work-related stress and had better health outcomes than those with a weak SOC.[21,22] Conversely, it could also be argued that those with a strong SOC may be more likely to enter jobs characterized by low work-related stress although this possibility could not be tested in this study.

We expanded on previous research by incorporating both self-reported and occupation-based measures of work-related stress in one study and by testing the modifying effect of SOC. The specific aims were to examine (i) the association between work-related stress in midlife and mortality, (ii) whether midlife SOC modified any observed associations and (iii) whether results differ for women and men.

Downloaded from https://academic.oup.com/eurpub/article-abstract/26/6/1050/2616254 by National Library of Health Sciences user on 16 October 2018