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Pain in multiple sites and sickness absence trajectories: A prospective study among Finns

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ABSTRACT

We studied the number of musculoskeletal pain sites as a predictor of sickness absence during a 7-year follow-up among a nationally representative sample (the Health 2000 survey) of occupationally active Finns 30 to 55 years of age (3420 subjects who did not retire or die during the follow-up). Baseline data (questionnaire, interview, clinical examination by a physician) were gathered in 2000 to 2001 and linked with information from national registers on annual compensated sickness absence periods ($\geqslant$10 workdays) covering the years 2002 to 2008. Pain during the preceding month in 18 body locations was inquired and combined into 4 sites (neck, upper limbs, low back, lower limbs). Demographic factors, BMI, smoking, leisure-time physical activity, sleep disorders, physical and psychosocial workload, and chronic diseases were assessed. Four distinct sickness absence trajectories emerged, labeled as Low (59% of the subjects), Ascending (21%), Mixed (11%), and High (9%). In multinomial logistic regression, the odds ratios (ORs) for belonging to the High vs. the Low trajectory increased with the number of pain sites, being 2.1 for single-site pain, 2.6 for 2 pain sites, 2.9 for 3 pain sites, and 4.1 for 4 pain sites, after adjustment for chronic diseases, demographic and lifestyle factors, and workload. The confidence intervals of the ORs did not include unity. The adjusted ORs for belonging to the Ascending trajectory were 1.1, 1.3, 1.7, and 1.7, respectively. As the number of pain sites was a strong independent predictor of work absenteeism, early screening of workers with multisite pain and interventions to support work ability seem warranted.

1. Introduction

Sickness absence is a complex phenomenon with multiple causes. It is costly to the society due to productivity losses and workers' compensation [8,9]. Pain due to musculoskeletal disorders is the most common reason for absence from work within the EU countries [6]. Several factors, such as increasing age, female gender, occupation, low socioeconomic position [23], mental distress, work-related physical and psychosocial loading [1,9,21,23,38], obesity, smoking [1,7,21], low leisure-time physical activity [12,36], and sleep problems [30], have also been shown to be risk factors for sickness absence. Several of these factors often associate with musculoskeletal pain as well.

Studies on the pain-related causes of sickness absence have mostly focused on low back pain and neck/shoulder pain [5,15,34], while little is known on the effects of pain in other sites [3]. It has recently been emphasized that there is a need to pay increased attention to multisite musculoskeletal pain, since multisite pain is more common and may be more disabling than pain at a single site [13].

There is some, partly inconsistent, evidence of the importance of multisite pain in relation to sickness absence, mainly based on self-reports. Among dentists, sickness absence increased when more than 1 musculoskeletal symptom was present [2], and among aluminium industry workers, the relative risk of sickness absence increased with the increase in the number of pain sites [25]; however, concurrent low back and neck/shoulder disorders did not

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increase the risk of sickness absence because of low back pain among industrial workers [16].

Self-reported sickness absence data may have low reliability because of recall bias. However, only a few studies on multisite pain in relation to register-based information on sickness absence exist. These have looked at the effects of certain combinations of concurrent pain. Low back pain and sciatica with neck pain predicted sickness absence among municipal workers [20], pain in hand/wrist, neck/shoulder, and low back increased the risk of sickness absence among white-collar workers [3], and neck/shoulder disorders together with those of the low back were associated with a higher risk for sickness absence [29].

As an individual may take sickness absence repeatedly, and as sickness absence behavior may undergo changes in time, an analytical approach that is able to detect such development is warranted. The need for longitudinal studies with repeated measurements [10,11], as well as studies focusing on factors contributing to the persistently high sickness absence, have recently been emphasized [8].

We studied the number of pain sites as a predictor of sickness absence among Finnish workers who participated in a nationally representative health survey (the Health 2000 study). First, we examined the course of sickness absences over a 7-year follow-up by using trajectory analysis to identify subgroups with distinctive patterns over time. Second, we studied the relationships of the number of pain sites with the course of sickness absence behavior, allowing for several co-varying factors related to working conditions, health, and health-related lifestyle.

2. Methods

2.1. Study sample

A nationally comprehensive health examination survey, the Health 2000 survey, was conducted in Finland between September 2000 and June 2001 to obtain an overall view of the population's health. The survey consisted of questionnaires, a comprehensive home interview, a clinical examination, tests of functional capacity and laboratory tests, described in detail elsewhere [14].

A representative population sample of Finnish adults aged 30 years or more was drawn using a 2-stage cluster sampling with the country stratified into 20 strata (i.e., 15 larger cities and 5 university hospital districts). The original sample consisted of 8028 subjects aged 30 to 99 years. Of these, 51 died before being interviewed, 6986 were interviewed (87.6%), and 6354 (79.7%) participated in the health examination [4]. In the current study, the 30- to 55-year-old subjects who were actively working during the year preceding the baseline, who participated in the clinical examination, and who did not die or retire during the follow-up, constituted the study sample (n = 3420). Register-based follow-up information on sickness absence during the years 2002 to 2008 was linked to the data.

2.2. Sickness absence

The information on sickness absence consisted of the number of compensated sickness absence periods per year, based on the national registries of the Social Insurance Institution of Finland.

The outcome of this study was the count of sickness absence periods per each year of follow-up. As a prerequisite of sickness allowance, a waiting period that covers the day of onset of work incapacity and the following 9 workdays, is required. The sickness absence periods in our data thus comprise all periods lasting ⩾10 workdays, each corresponding to roughly 2 weeks' absence. No information on diagnoses related to sickness absence or their more exact dates was available.

2.3. Multisite musculoskeletal pain

The number of body sites with pain, here expressed as multisite musculoskeletal pain (MSP), was the main determinant of interest. The assessment was based on the home interview carried out before the health examination. Pain (yes/no) during the preceding month in 18 locations was inquired about. The items were combined to represent 4 sites: the neck (the neck and the areas between neck and shoulders), upper limbs (shoulders, elbows, wrists, fingers), low back, and lower limbs (hips, knees, ankles, feet). A manikin illustrated the body sites. Pain in the upper and lower limbs included left, right, or both sides. If at least 1 site in the category of upper and lower limbs was defined as "yes", the combined variable was defined as "yes". A variable with 5 categories was created (0 = no pain to 4 = pain in 4 sites) [24].

2.4. Covariates

The covariates were selected based on previous literature to control for possible confounding of the association between MSP and sickness absence. A more detailed description of the variables has been presented elsewhere [14].

2.4.1. Demographic factors

Of the demographic factors we considered gender, age (continuous), and education classified into 3 levels according to the highest qualification achieved, corresponding to approximately ⩽9, 10 to 12, and ⩾13 years of education.

2.4.2. Chronic musculoskeletal, mental, cardiovascular, and other somatic diseases

Information on diagnosed diseases was based on a clinical examination carried out to obtain a medical assessment of the subject's main chronic diseases. Physicians were specially trained to perform the examinations according to a standardized written protocol with uniform diagnostic criteria. Diagnostic assessments were made based on clinical findings, symptoms, and disease histories [14]. The occurrence (at least 1 disease in the category) of chronic musculoskeletal, mental, cardiovascular, or other somatic diseases was considered. Musculoskeletal diseases included chronic neck, low back, and shoulder syndromes, chronic epicondylitis and carpal tunnel syndrome, hip and knee osteoarthritis, inflammatory arthritis, amputations and injuries to knee and ankle ligaments, and other musculoskeletal diseases. Mental diseases included depression, dementia, psychosis, and other mental disorders. Cardiovascular diseases included angina pectoris, myocardial infarction, cardiac insufficiency, hypertension, arrhythmia, valvular disease, intermittent claudication, cerebrovascular disease and other cardiovascular diseases, and having had coronary surgery. The category of other somatic diseases included asthma, chronic obstructive pulmonary disease, allergic rhinoconjuctivitis and other respiratory disease, diabetes, cancer, hyperlipidemia, Parkinson's disease, cataract, glaucoma, chronic eczema, hypothyroidism, and other defined somatic disease. As an exception, history of cancer was collected during the home interview.

2.4.3. Lifestyle factors

Leisure-time physical activity was assessed with questionnaire as follows: "How much do you exercise and strain yourself physically during your leisure time?" The original 4 categories were dichotomized to inactive ("reading, watching television, doing minor activities that do not strain physically") and active ("walking, cycling, or moving in other ways ⩾4 h/week", "vigorous physical activity >3 h/week", or "competitive sports") [26]. Body mass index (BMI, kg/m^2) was based on measured weight and height and classified as ⩽24.9 (normal), 25 to 29.9 (overweight), and

⩾30.0 (obese) [37]. Smoking was assessed during home interview, and subjects were categorized as never smokers, ex-smokers, and current smokers. Sleep disorders were inquired by asking: "Have you had insomnia or sleeping disorders during the past month?" The original 5 categories were classified into "no", "sometimes", and "often".

2.4.4. Physical workload

Physical workload was assessed in the home interview by inquiring whether the subjects had been exposed (yes/no) in their current or past jobs to heavy physical work involving lifting or carrying heavy objects, or excavating, digging, or pushing.

2.4.5. Psychosocial workload

The Job Content Questionnaire [19] was used to measure psychosocial workload. The indicator of job demands consisted of 5 items (Cronbach's α = 0.79) and that of job control of 9 (Cronbach's α = 0.84), both had a 5-point scale. The sum scores were dichotomized at their median to create high (>16) and low (⩽16) job demands, and low (>20) and high (⩽20) job control. Using the questionnaire, the subjects were also asked whether they are provided with adequate support from their supervisor and co-workers when needed. The items were categorized as 1 = fully agree, 2 = quite agree, 3 = do not agree or disagree, 4 = quite disagree, and 5 = completely disagree. These were dichotomized as high (1–2) or low (3–5) supervisor and co-worker support.

2.5. Statistical methods

2.5.1. Sickness absence trajectories

The count of sickness absence periods per each follow-up year was analyzed by trajectory analysis (PROC TRAJ in SAS version 9.2) [17,27]. This is a semiparametric modeling method that identifies different latent groups (trajectories), which tend to have a similar profile over time. The selection of the optimal model, the number of trajectories, and their shapes, is based on the Bayesian information criterion, and each person is assigned to the trajectory to which the posterior membership probability, varying from 0 to 1 (at least ⩾0.70), is largest [27]. A model based on the Poisson distribution was used, with gender as a covariate (i.e., we created gender-adjusted trajectories).

2.5.2. Multisite musculoskeletal pain in relation to sickness absence trajectories

Multinomial logistic regression was used to determine the role of MSP in predicting belonging to the sickness absence trajectories. In all models, trajectory 1 (no sickness absence; Fig. 1) was the reference group. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. The first model was adjusted for age, the second for age and chronic diseases (musculoskeletal, mental, cardiovascular, and other somatic diseases as separate variables), and the third model in addition for leisure-time physical activity, BMI, smoking, sleep disorders, physical and psychosocial workload, and education.

The proportion of missing values in models 1 and 2 was less than 4%. Because psychosocial factors at work included >10% missing values, the third model was made, first, by excluding the subjects with missing values in these variables, and second, by creating a separate category for them. As these analyses yielded similar results regarding the estimates for MSP, and as the excluded subjects did not differ from the total sample with respect to background characteristics at baseline, the first analysis was included in the final model.

The analyses were performed using SPSS, version 20.

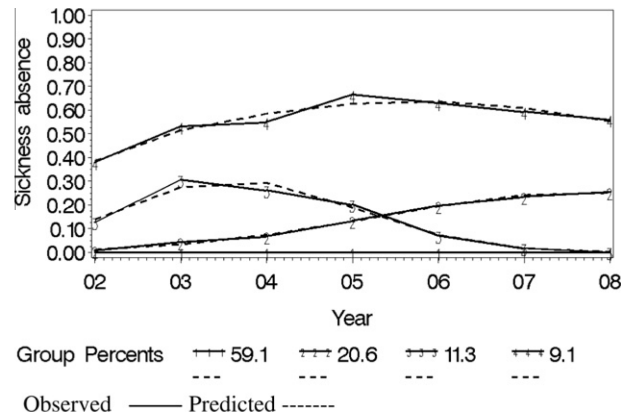

Fig. 1. Four sickness absence (⩾10 workdays) trajectories among 3420 occupationally active Finns, based on national registers covering the years 2002 to 2008. 1 = Low (no sickness absence), 2 = Ascending (increase in sickness absence), 3 = Mixed (first increase then decrease of sickness absence), 4 = High (high occurrence of sickness absence).

2.5.3. Sensitivity analyses

The analyses (models 1–3) were repeated by preliminarily excluding the subjects with inflammatory polyarthritis (n = 42) from the analyses.

An additional analysis was performed also by substituting the overall assessment of the occurrence of musculoskeletal diseases for specific diseases. Simultaneous adjustment was made for inflammatory polyarthritis, chronic neck syndrome, chronic low back syndrome, chronic syndromes in the upper limbs (shoulder syndrome, epicondylitis, and carpal tunnel syndrome combined), and osteoarthritis of the hip and knee (combined).

3. Results

3.1. Sickness absence trajectories

The annual number of compensated sickness absence periods varied between 0 and 5. In trajectory analysis, a 4-group model including 1 trajectory with an intercept and 3 with a quadratic shape had the best fit (Fig. 1). The largest trajectory, labeled as Low, was composed of workers (n = 2021, 59%) who had no sickness absence (⩾10 workdays) over the 7-year follow-up. Of the subjects, 9% (n = 310) belonged to a group labeled as High, with an average occurrence of sickness absence between 0.4 and 0.6 periods annually. There were 2 intermediary groups, 1 group with an ascending pattern of sickness absence (Ascending, n = 703, or 21%) and another group with an ascending pattern of sickness absence until the year 2003 and thereafter a decrease (Mixed, n = 386 or 11%). The mean (standard deviation) assignment probabilities were 0.68 (0.03) for the Low, 0.78 (0.16) for the Ascending, 0.71 (0.11) for the Mixed, and 0.86 (0.15) for the High trajectory group.

One-third of the study sample reported pain in 1 site, and another third reported pain in at least 2 sites at baseline (Table 1). Chronic diseases were common, with 27% of the subjects having a musculoskeletal disease, 8% a mental disease, 13% cardiovascular disease, and 32% some other somatic disease. More than half of the subjects were overweight or obese, 26% were current smokers, and 25% inactive during their leisure time. Frequent sleep disorders during the past month were reported by 26%. Of the sample, 40% had been engaged in physically strenuous work during their work history. The distributions of MSP and the covariates in the different sickness absence trajectories are also shown in Table 1.

Table 1
Background characteristics of the 3420 occupationally active Finns at baseline and in 4 sickness absence (⩾10 workdays) trajectories, based on national registers covering the years 2002 to 2008.

	Total (n = 3420)	Sickness absence trajectories			
		Low (n = 2021)	Ascending (n = 703)	Mixed (n = 386)	High (n = 310)
Determinant					
Number of pain sites, n (%)					
0	1183 (35)	796 (40)	216 (31)	114 (30)	57 (19)
1	1092 (32)	645 (32)	224 (32)	117 (31)	106 (35)
2	658 (20)	352 (18)	143 (21)	90 (24)	73 (24)
3	316 (9)	151 (8)	82 (12)	39 (10)	44 (14)
4	122 (4)	51 (3)	28 (4)	18 (5)	25 (8)
Covariates					
Gender, female, n (%)	1788 (52)	981 (49)	392 (56)	188 (49)	227 (73)
Age, years, mean (95% CI)	42.3 (42.1–42.6)	41.9 (41.6–42.2)	42.3 (41.8–42.8)	43.7 (43.0–44.5)	43.2 (42.5–43.9)
Musculoskeletal disease, n (%)	927 (27)	464 (23)	215 (31)	126 (33)	122 (39)
Mental disease, n (%)	257 (8)	118 (6)	66 (9)	38 (10)	35(11)
Cardiovascular disease, n (%)	429 (13)	231 (11)	89 (13)	54 (14)	55 (18)
Other somatic disease, n (%)	1091 (32)	622 (31)	229 (33)	123 (32)	117 (38)
Leisure-time physical activity, inactive, n (%)	833 (25)	478 (24)	173 (25)	99 (26)	83 (27)
Body mass index, kg/m^2, n (%)					
⩽24.9	1512 (44)	948 (47)	286 (41)	165 (43)	113 (36)
25–29.9	1317 (39)	782 (39)	278 (40)	150 (39)	107 (35)
⩾30.0	590 (17)	290 (14)	139 (20)	71 (18)	90 (29)
BMI, mean (95% CI)	26.2 (26.0–26.3)	25.9 (25.7–26.1)	26.5 (26.2–26.9)	26.3 (25.8–26.7)	27.2 (26.7–27.8)
Smoking, n (%)					
Never	1602 (47)	995 (49)	302 (43)	178 (46)	127 (41)
Ex-smoker	923 (27)	551 (27)	200 (28)	90 (23)	82 (27)
Current smoker	882 (26)	467 (23)	200 (29)	116 (30)	99 (32)
Sleep disorder, n (%)					
No	1527 (45)	963 (48)	308 (44)	151 (40)	105 (34)
Sometimes	974 (29)	578 (29)	200 (29)	112 (29)	84 (28)
Often	887 (26)	458 (23)	194 (28)	119 (31)	116 (38)
Physical workload, yes, n (%)	1375 (40)	730 (36)	297 (42)	178 (46)	170 (55)
Psychosocial workload					
Job demands, high, n (%)	1334 (44)	766 (43)	263 (42)	164 (47)	141 (48)
Job control, low, n (%)	1399 (46)	733 (41)	317 (50)	183 (52)	166 (58)
Supervisor support, low, n (%)	949 (31)	563 (32)	200 (31)	89 (25)	97 (33)
Co-worker support, low, n (%)	528 (17)	315 (18)	97 (15)	59 (17)	57 (19)
Education, years, n (%)					
⩾13	1711 (50)	1078 (54)	348 (50)	165 (43)	120 (39)
10–12	1109 (33)	610 (30)	239 (34)	135 (35)	125 (41)
⩽9	581 (17)	322 (16)	113 (16)	84 (22)	62 (20)

CI = confidence interval.

3.2. MSP in relation to sickness absence trajectories

As illustrated in Table 2, MSP was a strong independent predictor for the course of sickness absence over time. With the Low trajectory as reference, ORs (95% CIs) for belonging to the High trajectory increased with the number of pain sites, being 2.3 (1.7–3.3) for 1 pain site and 6.5 (3.7–11.2) for 4 pain sites in age-adjusted analysis. When musculoskeletal and other chronic physician-diagnosed diseases were included in the model, the estimates for MSP attenuated varying from 2.2 (1.5–3.1) to 4.8 (2.7–8.6), respectively. However, the independent effect of MSP remained after adjustment for all covariates, when the ORs were 2.1(1.5–3.1) for 1 pain site, 2.6 (1.7–3.9) for 2 pain sites, 2.9 (1.8–4.8) for 3 pain sites, and 4.1 (2.1–7.8) for 4 pain sites.

MSP predicted also belonging to the Ascending trajectory when compared with the Low trajectory. In the age-adjusted model, the ORs varied from 1.3 (1.0–1.6) for 1 pain site to 2.0 (1.2–3.2) for 4 pain sites. Inclusion of chronic diseases in the analysis attenuated the estimates slightly, but consideration of the other covariates had only a negligible effect. In the fully adjusted model, the ORs were 1.1 (0.9–1.4) for 1 pain site, 1.3 (1.0–1.8) for 2 pain sites, 1.7 (1.2–2.5) for 3 pain sites, and 1.7 (1.0–3.0) for 4 pain sites.

When the Mixed and Low trajectories were compared, MSP predicted belonging to the former. Again, the effect of MSP attenuated when the chronic diseases were added in the model. The consideration of all covariates further attenuated the effect of MSP slightly.

3.2.1. Effects of covariates on sickness absence trajectories

The effects of all covariates are seen in model 3 in Table 2. With the Low sickness absence trajectory as contrast, increasing age, musculoskeletal and mental diseases, physical workload, and low job control predicted belonging to the Ascending, Mixed, and High trajectories, obesity and current smoking belonging to the Ascending and High trajectories, and sleep disorders (often) belonging to the Mixed and High trajectories.

3.2.2. Sensitivity analyses

The preliminary exclusion of 42 subjects with inflammatory arthritis at baseline did not change the results. The ORs of belonging to the High trajectory as contrasted with the Low for the different classes of MSP in the fully adjusted model were 2.1, 2.6, 2.7, and 4.4.

With specific musculoskeletal diseases separately in the model, the ORs for MSP were 2.2, 2.8, 3.1, and 4.2.

Table 2
Number of musculoskeletal pain sites as a determinant of sickness absence (⩾10 workdays) trajectories, based on national registers covering the years 2002 to 2008 among 3420 occupationally active Finns.

	Sickness absence trajectories[a]					
	Ascending vs low		Mixed vs low		High vs low	
	OR	95% CI	OR	95% CI	OR	95% CI
Model 1 (n = 3371)						
Age (years)	1.00	0.99–1.02	1.03	1.02–1.05	1.02	1.00–1.04
Number of pain sites						
0	1.00		1.00		1.00	
1	1.28	1.04–1.59	1.28	0.97–1.70	2.31	1.65–3.25
2	1.49	1.17–1.91	1.76	1.30–2.39	2.87	1.99–4.15
3	1.99	1.46–2.71	1.74	1.16–2.61	3.98	2.59–6.13
4	1.99	1.23–3.24	2.24	1.26–3.99	6.47	3.73–11.22
Model 2 (n = 3342)						
Age (years)	1.00	0.99–1.02	1.03	1.02–1.05	1.01	0.99–1.03
Number of pain sites						
0	1.00		1.00		1.00	
1	1.20	0.97–1.49	1.23	0.93–1.63	2.18	1.54–3.07
2	1.39	1.08–1.79	1.65	1.20–2.26	2.48	1.69–3.63
3	1.78	1.29–2.44	1.52	1.00–2.32	3.37	2.16–5.27
4	1.69	1.02–2.78	1.92	1.06–3.47	4.81	2.71–8.56
Musculoskeletal disease (yes vs no)	1.30	1.06–1.59	1.31	1.01–1.69	1.55	1.18–2.03
Mental disease (yes vs no)	1.60	1.16–2.20	1.70	1.15–2.52	1.81	1.20–2.74
Cardiovascular disease (yes vs no)	1.06	0.81–1.40	1.06	0.75–1.48	1.41	0.99–2.01
Other somatic disease (yes vs no)	1.03	0.85–1.24	0.97	0.76–1.23	1.18	0.91–1.53
Model 3 (n = 2868)						
Age (years)	1.01	1.00–1.03	1.04	1.02–1.05	1.02	1.00–1.04
Number of pain sites						
0	1.00		1.00		1.00	
1	1.13	0.89–1.43	1.19	0.88–1.61	2.11	1.45–3.07
2	1.34	1.02–1.77	1.59	1.13–2.24	2.60	1.73–3.92
3	1.72	1.21–2.45	1.26	0.79–2.04	2.91	1.77–4.77
4	1.70	0.97–2.96	1.58	0.80–3.12	4.08	2.12–7.83
Musculoskeletal disease (yes vs no)	1.31	1.05–1.64	1.29	0.98–1.71	1.46	1.09–1.96
Mental disease (yes vs no)	1.45	1.00–2.09	1.76	1.14–2.71	1.80	1.14–2.83
Cardiovascular disease (yes vs no)	0.95	0.69–1.29	1.07	0.74–1.56	1.19	0.80–1.76
Other somatic disease (yes vs no)	1.05	0.85–1.30	1.08	0.83–1.41	1.12	0.84–1.48
Leisure-time physical activity (inactive vs active)	0.89	0.71–1.12	0.99	0.75–1.32	0.98	0.72–1.34
Body mass index, kg/m^2						
⩽24.9	1.00		1.00		1.00	
25–29.9	1.13	0.91–1.39	1.09	0.83–1.43	1.02	0.74–1.39
⩾30.0	1.54	1.16–2.04	1.30	0.91–1.87	1.98	1.37–2.85
Smoking						
Never smoked	1.00		1.00		1.00	
Ex-smoker	1.11	0.88–1.40	0.90	0.66–1.22	1.05	0.76–1.46
Current smoker	1.36	1.07–1.73	1.24	0.92–1.68	1.35	0.97–1.89
Sleep disorder						
No	1.00		1.00		1.00	
Sometimes	1.07	0.86–1.34	1.11	0.83–1.49	1.19	0.86–1.66
Often	1.13	0.88–1.45	1.33	0.97–1.81	1.68	1.20–2.34
Physical workload (yes vs no)	1.23	1.01–1.51	1.35	1.04–1.75	1.95	1.48–2.58
Psychosocial workload						
Job demands (high vs low)	0.89	0.73–1.08	1.16	0.91–1.48	1.05	0.80–1.37
Job control (low vs high)	1.37	1.12–1.66	1.47	1.15–1.89	1.65	1.25–2.18
Supervisor support (low vs high)	0.98	0.79–1.23	0.62	0.46–0.84	0.85	0.62–1.16
Co-worker support (low vs high)	0.78	0.59–1.04	0.99	0.69–1.41	0.95	0.65–1.38
Education (years)						
⩾13	1.00		1.00		1.00	
10–12	1.06	0.85–1.33	1.08	0.81–1.45	1.38	1.01–1.88
⩽9	0.79	0.58–1.08	1.02	0.70–1.48	0.94	0.62–1.44

Multinomial logistic regression, odds ratios (OR) with their 95% confidence intervals (CI).
[a] Number of subjects in sickness absence trajectories: Ascending (n = 703), Mixed (n = 386), High (n = 310), and Low (n = 2021).

4. Discussion

This study among actively working Finns identified 4 distinct patterns of sickness absence behavior, allowing for gender. Over the 7-year follow-up, more than 50% of the workers had no sickness absences of the studied duration of at least 10 consecutive workdays, whereas 9% belonged to a group with a relatively high absence level persistently over the study period. Of the workers, 20% experienced an increase in absenteeism, and 11% an increase during the first year but thereafter a decrease.

The number of pain sites at baseline was a strong independent predictor especially of persistently high absenteeism over time, increase in the number of pain sites showing a graded relationship with the risk. Among those reporting pain at all 4 sites the risk of high absenteeism remained 4-fold compared to those without pain, even when all the covariates were considered. In addition, chronic musculoskeletal and mental diseases, obesity, current smoking, sleep disorders, high physical workload, low job control, as well as increasing age, predicted the course of sickness absence. The estimates were, however, lower than those of multiple pain sites.

Although comparison to the results of previous studies is complicated because of differences in study designs, insurance systems, and definitions of the outcome and the determinants, our findings are in line with 2 population-based reports using register data on sickness absence. A Danish 2-year follow-up study [3] examined the impact of pain in different body sites on sickness absence among blue- and white-collar workers. Hand/wrist pain and low back pain were found to be risk factors in both groups, and neck/shoulder pain among white-collar workers. However, among white-collar workers with concurrent pain in the hand/wrist, neck/shoulder, and low back, the relative risk for sickness absence was the highest, even when self-reported diagnosed disease, lifestyle, and demographic factors were controlled for. In a Swedish 5-year follow-up study, having concurrent low back and neck/shoulder disorders increased the risk for sickness absences compared to having only 1 of the conditions, when allowed for age, self-reported physical illnesses, and diminished psychological well-being [29].

It is noteworthy that having pain already at 2 of 4 sites caused a higher risk for persistently high absenteeism than musculoskeletal or mental diseases, or any other of the covariates. Earlier studies have reported corresponding findings. Age, smoking, sleep disorders, physical workload [18,28], BMI [3,18], and self-reported diagnosed diseases [3] have been found to predict sickness absence or work disability with a lower impact than the number of pain sites.

Previous studies with self-reported data on work disability are congruent with our finding that an increase in the number of pain sites had a linear effect on the risk for persistently high absenteeism. We recently used the same definition of the number of pain sites as in the current study and found in a cross-sectional analysis a similar graded association with self-reported indicators of work ability [24]. In a Norwegian study, an increase in the number of pain sites at baseline strongly predicted self-reported disability pensions 14 years later, the linear effect remaining, even after adjustment for demographic and lifestyle factors, psychological distress, and work-related physical risk factors [18].

A sensitivity analysis with the preliminary exclusion of the subjects with inflammatory polyarthritis did not change the effects of the number of pain sites on sickness absence, probably because of the small number of subjects with polyarthritis. When considering the confounding effect of musculoskeletal diseases, we compiled physician-diagnosed diseases into 1 overall variable, because some of the specific diseases were indeed rare. This approach did not lead to any overestimation of the effect of the number of pain sites, as this effect was somewhat accentuated in the sensitivity analyses including the specific musculoskeletal diseases.

It has been pointed out that there is a lack of studies on factors associated with the persistence of sickness absence over time [8]. We identified 1 group with a constantly (relatively) high level of sickness absence, and 3 others with distinct courses of its occurrence, supporting the importance to examine underlying factors for different sickness absence behavior. Although the group with high absenteeism in our study was rather small, it may pose a particular challenge for health care professionals. The workers were predominantly women, of whom more than one-third had some physician-diagnosed musculoskeletal disease and among whom one-half reported pain in at least 2 body sites. Furthermore, approximately one-third were inactive during their leisure time, or were obese, were current smokers, or often experienced sleep problems. One-half of the subjects in this group reported low job control and had been exposed to physically strenuous labor during their work history.

In addition to the groups of factors that we examined, there may be societal influences on sickness absence behavior. It is known that sickness absence may fluctuate because of changes in the economic life and labor market [22]. Unemployment in Finland decreased during our follow-up period [33]. Associations of sickness absence with unemployment are pro-cyclical: that is, during the up-trend, when unemployment rates are low, sickness absences increase, and during the down-trend, when unemployment rates are high, they decrease [22]. Such changes may have contributed to high and increased absenteeism in our sample, and could have diluted the effects of the determinants we studied. If so, this underlines the finding of the importance of multisite pain as a determinant of high absenteeism.

Our study has several strengths. In a prospective design, we had access to official register-based data on absenteeism, eliminating recall bias. In the Health 2000 survey, the participation rate of the working population was 83% to 88%, and the study sample represented well the occupationally active Finns. The data included a standardized clinical health examination on which information on clinical diseases and BMI were based, and a comprehensive home interview. When possible, items were selected based on standardized, generally accepted recommendations or nationally established practice [14]. Pain during the preceding month was assessed, as is common in epidemiological studies to minimize recall bias [24]. We were able to consider a variety of possible confounders in the analyses. The number of missing values in the determinants was low, and the outcome was comprehensively assessed.

Trajectory analysis seems to be a novel method in the study of sickness absence. Trajectories have some advantages over more traditional analyses, in better identifying changes and groups with a similar development over time [10,11]. The group assignment probabilities were high. We adjusted the trajectories for gender for simplicity. Identifying gender-specific trajectories and possible gender differences in the determinants of these trajectories would be worth further study. We used a risk-based point of view, but it would be equally interesting to examine factors protecting from absenteeism.

We lacked information on pain duration or intensity. The number of pain sites, however, has been shown to be a stronger predictor of functioning than chronicity or the location of pain [32]. Also, any current pain per se has been shown to independently predict sickness absence [31].

The national registers used do not provide information on short-term absences, and we could not assess the effect of multisite pain on less than 10 days' absence. Longer sickness absences are generally certified by a physician and are also likely to be more closely linked with pain than are shorter periods. Among middle-aged employees of Helsinki City, the largest municipal employer in Finland, pain accounted for roughly one-third (37% in women and 30% in men) of absences lasting for more than 14 days, whereas for absences lasting from 4 to 14 days, the corresponding figures were 23% and 25%, and for 1 to 3 days' self-certified sickness absences 13% and 8% [31].

In Finland, sickness absence compensation has increased from 494 to 813 million euros per year during 2000 to 2010, the longer absences causing the majority of the costs [35]. At the same time, the workforce is ageing, and there is a pressure to extend working careers beyond the current retirement age. Examination on the causes of longer sickness absences is increasingly important to control absenteeism and to maintain work ability, as longer absences are shown to predict permanent work disability [8]. As information on the diagnoses on which the absences were based was lacking, we could not focus specifically on musculoskeletal sickness absence. It seems reasonable to expect that multisite pain would be an even stronger predictor of sickness absence due to musculoskeletal disorders than of the overall absenteeism studied here.

To our knowledge, this is the first prospective study concentrating on the impact of the number of musculoskeletal pain sites on the course of sickness absences over time using register-based data.

4.1. Conclusion

In conclusion, 4 distinct sickness absence trajectories among occupationally active Finns were identified, and the number of pain sites was a strong independent predictor of these, particularly of persistently high work absenteeism. This implies that multisite pain is an important phenomenon to consider for occupational health providers and clinicians when screening and planning interventions to support work ability.

Conflicts of interest statement

The authors have no conflicts of interest.

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References

[1] Alavinia SM, van den Berg TI, van Duivenbooden C, Elders LA, Burdorf A. Impact of work-related factors, lifestyle, and work ability on sickness absence among Dutch construction workers. Scand J Work Environ Health 2009;35:325–33.
[2] Alexopoulos EC, Stathi IC, Charizani F. Prevalence of musculoskeletal disorders in dentists. BMC Musculoskel Disord 2004;5:16.
[3] Andersen LL, Mortensen OS, Hansen JV, Burr H. A prospective cohort study on severe pain as a risk factor for long-term sickness absence in blue- and white-collar workers. Occup Environ Med 2011;68:590–2.
[4] Aromaa A, Koskinen S, editors. Health and functional capacity in Finland: baseline results of the Health 2000 Health examination survey, vol. B12. Helsinki, Finland: Publications of the National Public Health Institute; 2004.
[5] Bergström G, Bodin L, Bertilsson H, Jensen IB. Risk factors for new episodes of sick leave due to neck or back pain in a working population. A prospective study with an 18-month and a three-year follow-up. Occup Environ Med 2007;64:279–87.
[6] Bevan S, Quadrello T, McGee R, Mahdon M, Vavrovsky A, Barham L. Fit for work? Musculoskeletal disorders in the European workforce. London: Work Foundation; 2009.
[7] Christensen KB, Lund T, Labriola M, Bultmann U, Villadsen E. The impact of health behaviour on long term sickness absence. Results from DWECS/DREAM. Ind Health 2007;45:348–51.
[8] Dekkers-Sánchez PM, Hoving JL, Sluiter JK, Frings-Dresen MH. Factors associated with long-term sick leave in sick-listed employees: a systematic review. Occup Environ Med 2008;65:153–7.
[9] Duijts SF, Kant I, Swaen GM, van den Brandt PA, Zeegers MP. A meta-analysis of observational studies identifies predictors of sickness absence. J Clin Epidemiol 2007;60:1105–15.
[10] Dunn KM, Jordan K, Croft PR. Characterizing the course of low back pain: a latent class analysis. Am J Epidemiol 2006;163:754–61.
[11] Dunn KM, Jordan KP, Mancl L, Drangsholt MT, Le Resche L. Trajectories of pain in adolescents: a prospective cohort study. PAIN® 2011;152:66–73.
[12] Eriksen W, Bruusgaard D. Physical leisure-time activities and long-term sick leave: a 15-month prospective study of nurses' aides. J Occup Environ Med 2002;44:530–8.
[13] Grotle M, Croft P. More pain, less gain. Occup Environ Med 2010;67:434–5.
[14] Heistaro S, editor. Methodology report. Health 2000 survey, vol. B26. Helsinki, Finland: Publications of the National Public Health Institute; 2008.
[15] Holtermann A, Hansen JV, Burr H, Søgaard K. Prognostic factors for long-term sickness absence among employees with neck-shoulder and low-back pain. Scand J Work Environ Health 2010;36:34–41.
[16] Ijzelenberg W, Burdorf A. Impact of musculoskeletal co-morbidity of neck and upper extremities on healthcare utilisation and sickness absence for low back pain. Occup Environ Med 2004;61:806–10.
[17] Jones BL, Nagin DS. Advances in group-based trajectory modeling and an SAS procedure for estimating them. Soc Methods Res 2007;35:542–71.
[18] Kamaleri Y, Natvig B, Ihlebaek CM, Bruusgaard D. Does the number of musculoskeletal pain sites predict work disability? A 14-year prospective study. Eur J Pain 2009;13:426–30.
[19] Karasek R, Brisson C, Kawakami N, Houtman I, Bongers P, Amick B. The Job Content Questionnaire (JCQ): an instrument for internationally comparative assessments of psychosocial job characteristics. J Occup Health Psychol 1998;3:322–55.
[20] Kääriä S, Laaksonen M, Leino-Arjas P, Saastamoinen P, Lahelma E. Low back pain and neck pain as predictors of sickness absence among municipal employees. Scand J Work Environ Health 2012;40:150–6.
[21] Labriola M, Lund T, Burr H. Prospective study of physical and psychosocial risk factors for sickness absence. Occup Med (Lond) 2006;56:469–74.
[22] Livanos I, Zangelidis A. Sickness absence: a pan-European study. MPRA paper No. 22627. <http://www.mpra.ub.uni-muenchen.de/22627/1/MPRA_paper_22627.pdf>; 2010 [accessed 11.10.2012].
[23] Lund T, Labriola M. Sickness absence in Denmark—research, results, and reflections. Scand J Work Environ Health 2009;(Suppl. 7):5–14.
[24] Miranda H, Kaila-Kangas L, Heliövaara M, Leino-Arjas P, Haukka E, Liira J, Viikari-Juntura E. Musculoskeletal pain at multiple sites and its effects on work ability in a general working population. Occup Environ Med 2010;67:449–55.
[25] Morken T, Riise T, Moen B, Hauge SH, Holien S, Langedrag A, Pedersen S, Saue IL, Seljebø GM, Thoppil V. Low back pain and widespread pain predict sickness absence among industrial workers. BMC Musculoskel Disord 2003;4:21.
[26] Mäkinen T, Kestilä L, Borodulin K, Martelin T, Rahkonen O, Leino-Arjas P, Prättälä R. Occupational class differences in leisure-time physical inactivity—contribution of past and current physical workload and other working conditions. Scand J Work Environ Health 2010;36:62–70.
[27] Nagin DS. Group-based modeling of development. Cambridge, MA: Harvard University Press; 2005.
[28] Natvig B, Eriksen W, Bruusgaard D. Low back pain as a predictor of long-term work disability. Scand J Public Health 2002;30:288–92.
[29] Nyman T, Grooten WJ, Wiktorin C, Liwing J, Norrman L. Sickness absence and concurrent low back and neck-shoulder pain: results from the MUSIC-Norrtälje study. Eur Spine J 2007;16:631–8.
[30] Rahkonen O, Lallukka T, Kronholm E, Vahtera J, Lahelma E, Laaksonen M. Sleep problems and sickness absence among middle-aged employees. Scand J Work Environ Health 2012;38:47–55.
[31] Saastamoinen P, Laaksonen M, Lahelma E, Leino-Arjas P. The effect of pain on sickness absence among middle-aged municipal employees. Occup Environ Med 2009;66:131–6.
[32] Saastamoinen P, Leino-Arjas P, Laaksonen M, Martikainen P, Lahelma E. Pain and health related functioning among employees. J Epidemiol Community Health 2006;60:793–8.
[33] Statistics Finland. Labour force survey, release, <http://www.stat.fi/til/tyti/2012/04/tyti_2012_04_2012-05-22_tie_001_en.html>; 2012 [accessed 11.10.2012].
[34] Steenstra IA, Verbeek JH, Heymans MW, Bongers PM. Prognostic factors for duration of sick leave in patients sick listed with acute low back pain: a systematic review of the literature. Occup Environ Med 2005;62:851–60.
[35] Social Insurance Institution. Statistical yearbook of the social insurance institution 2010. Official statistics of Finland. Helsinki, Finland: Vammalan kirjapaino Oy; 2010. 2011.
[36] van Amelsvoort LG, Spigt MG, Swaen GM, Kant I. Leisure time physical activity and sickness absenteeism; a prospective study. Occup Med (Lond) 2006;56:210–2.
[37] World Health Organization. Global database on body mass index. An interactive surveillance tool for monitoring nutrition transition, <http://www.apps.who.int/bmi/index.jsp?introPage=intro_3.html>; [accessed 11.10.2012].
[38] Voss M, Floderus B, Diderichsen F. Physical, psychosocial, and organisational factors relative to sickness absence. a study based on Sweden Post. Occup Environ Med 2001;58:178–84.