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Multisite musculoskeletal pain trajectories from midlife to old age: a 28-year follow-up of municipal employees

Running head: Trajectories of musculoskeletal pain from midlife to old age

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ABSTRACT

Objectives: We studied the developmental trajectories of multisite musculoskeletal pain to learn whether pain in midlife persists to old age, and whether pain trajectories associate with midlife work or lifestyle exposures or retirement from work.

Methods: Municipal employees aged 44 to 58 were studied in 1981 (N=6257) with follow-ups in 1985, 1992, 1997 and 2009. Pain in the neck, low back, and upper and lower limbs was assessed in each survey. Trajectories of the number (0-4) of pain sites were defined using growth mixture modelling (n=3093). Workload, lifestyle, and morbidity were elicited by questionnaire and retirement from registries. Associations of baseline factors with pain trajectories were assessed by multinomial logistic regression. Cumulative hazard curves for retirement by trajectory group were calculated.

Results: Three trajectories of pain over 28 years emerged: low (25%), moderate (52%), and high-decreasing (23%). In the latter, the number of pain sites first decreased sharply, stabilizing to a moderate level after most subjects had retired. The disability pension rate was highest in this trajectory, which associated with high baseline morbidity, particularly musculoskeletal disorder (OR 8.06; 95% CI 5.97-10.87). Also high biomechanical exposure (2.86, 2.16-3.78), high job demands (1.79, 1.39-2.30), high job control (OR 0.70, 95% 0.54-0.90), BMI ≥25.0 kg/m^2 (1.40, 1.09-1.80), and low leisure-time physical activity (LTPA) (1.39, 1.09-1.78) at baseline associated with this trajectory. However, high LTPA and BMI in repeated surveys also associated with the high-decreasing trajectory.

Conclusion: Musculoskeletal pain in midlife often persists to old age. However, high widespreadness of pain may decrease with retirement from work.

Keywords: Multisite pain, trajectory analysis, working conditions, leisure-time physical activity, retirement, cohort study

Key messages

What is already known about this subject?

- Multisite musculoskeletal pain is a persistent phenomenon during working life.
- Earlier studies on trajectories of the number of pain sites among working populations reported that one third to two thirds of the subjects followed a stable pattern of multisite musculoskeletal pain.

What are the new findings?

- Three trajectories of multisite pain over 28 years were found: low (25%), moderate (52%), and high-decreasing (23%).
- There was a sharp decrease in the number of pain sites during the initial 11 years of follow-up in the high-decreasing trajectory group, after which the number stabilized on a lower level.
- The study cohort experienced a rapid transition out of the workforce to retirement. The rate of retirement particularly on disability pension was the highest in the trajectory with decreasing pain, suggesting that retirement served to alleviate pain.

How might this impact policy or clinical practice in the foreseeable future?

- Strategies to identify high widespreadness of pain during working life could help to reduce the rate of disability retirement from work.

INTRODUCTION

Increased life expectancy renders people more susceptible to non-communicable diseases, including musculoskeletal disorders with pain as the main complaint [1]. The Global Burden of Disease study shows that low back pain and neck pain give rise to a considerable proportion of disability-adjusted life years [2]. It has been recognized that musculoskeletal pain rarely occurs in a single site only [3, 4]. Multisite pain has severe consequences for daily functioning [5, 6], sickness absence [7] and disability retirement [8].

Multisite pain seems to be rather persistent over time. In the general population, the number of pain sites changed little over 14 years [9]. The development of multisite pain has also been examined using trajectory analysis that describes the course of pain over time, assuming that the population is composed of distinct sub- groups, each with a different underlying pattern of change [10]. We earlier reported five trajectories of the number of pain sites among food industry workers over six years, finding that about two thirds of the subjects followed a stable (low or high) pattern [11]. Similarly, of female kitchen workers followed up for two years, two thirds had a stable level (low or high) of multisite pain [12]. On the contrary, the number of pain sites clearly increased among a third of firefighters followed up for 13 years [13]. All these studies [11-13] focused on multisite pain during the working career, whereas the developmental pathways of multisite pain from working life to old age and their potential predictors are largely unknown.

High physical workload, adverse psychosocial factors at work, low leisure-time physical activity and obesity at baseline associated with the consistently high multisite pain trajectory among female kitchen workers [12], and high physical work strain, repetitiveness, and poor work environment at baseline with the stably high and the increasing trajectory among food industry workers [11]. In the latter study the work factors associated also with the decreasing pain trajectory, complicating causal inference.

Here, we aimed to examine multisite musculoskeletal pain trajectories over 28 years among, at baseline, middle-aged municipal employees, to explore to what extent pain reported during the working career persists after retirement. We also investigated whether work-related exposures or their termination by retirement from work, or lifestyle factors may associate with the trajectories.

MATERIAL AND METHODS

Participants and design

This study is based on the Finnish Longitudinal study on Aging Municipal Employees (FLAME) following up municipal workers from 1981 to 2009 [14, 15]. In 1981, a postal questionnaire was sent to 7344 municipal workers all around Finland. In total 6257 (85.2%), 44-58-year-olds having worked as municipal workers for at least 5 years responded to the baseline questionnaire. To motivate the participants to participate in the questionnaire survey, we included common phrases on how important it was for the subject to answer in order to contribute to find reliable criteria for retirement ages in Finland [14]. Follow-up data were collected with postal questionnaires in 1985 (n=5556), 1992 (n=4534), 1997 (n=3815) and 2009 (n=3093) [15, 16]. For inclusion in the current analysis the respondent must have replied at baseline, at the last follow-up and in at least one of the intervening follow-up surveys. The respondents' exact retirement dates and disability pension diagnosis were obtained from the national pension registry and linked with the survey data. Moreover, self-reported retirement were also collected through surveys in 1992. Figure 1 presents the follow-up process in detail.

The Ethics Committee of the Finnish Institute of Occupational Health, Helsinki, Finland approved the study and ethical clearance for the register linkages was obtained from the national Data Protection Ombudsman.

(Figure 1 about here)

Measurement of variables

Multisite musculoskeletal pain

In every survey, musculoskeletal pain was measured asking "Do you have pain or ache in the following parts of the body". Using a manikin on paper, the following eight body sites were listed in all surveys: neck, shoulder, elbow, wrist, finger, lower back, thigh and ankle or foot. Hip and knee pain were not assessed in all surveys and therefore were not included in in the current analyses. The response scale for each item was: 1 = no, 2 = sometimes and 3 = constantly. The responses were first dichotomized (1 = no, 2-3 = yes). All dichotomized items were combined into four variables representing the body sites neck, upper limbs, low back, and lower limbs. Finally, a multisite musculoskeletal pain variable was created by combining these into a single variable ranging from 0 (no pain) to 4 (pain in four sites) [11]. In the analyses modeled the number of pain sites.

Age and occupational class

Age (44-58 at baseline) was used as a continuous variable in the analyses. Occupational class (white-collar, blue-collar) was created based on a detailed analysis of job profiles among 88 occupational titles, clustered into 13 job profiles and later into two major groups [17].

Working conditions

Biomechanical loading: Work-related biomechanical loading at baseline was assessed with eight questions about current exposure to the following: vibration, repeated movements, standing still, bent or twisted postures, other poor postures, continuous walking or movement, carrying objects, and sudden strenuous efforts. Response options ranged from 0 (not at all) to 4 (quite often). The composite score (Cronbach's α= 0.82) ranging from 0 to 32 was dichotomized into high and low at the median (12) [18].

Mental demands: Job demands were assessed with eight questions on current job-related demands and pressure: hectic work pace, tight time schedule, taking responsibility, conflicting demands regarding work tasks and responsibility, pressure and interference from supervisor, pressure of failing or making mistakes, isolation or loneliness and monotonous work. Response options ranged from 0 (not at all) to 4 (quite often). The composite score (Cronbach's α= 0.77) ranging from 0 to 24 was dichotomized into high and low using the median value 6 [15].

Job control: Job control in the current job was assessed at baseline using ten questions on the respondents' chances for control and influence: guidance in the job, influencing the work environment, participating in planning work, gaining promotion, chances for future training in professional skills, chances to use own abilities and talents to learn new things, get recognition and respect, work with co-workers and see the meaning of work. Responses ranged from ‘0=not at all’, ‘1= a little’, ‘2=somewhat’ or ‘3=a lot’. The sum score (Cronbach’s α= 0.86) ranging from 0 to 30 was dichotomized into low and high using the median value 16 [15].

Lifestyle characteristics

Leisure-time physical activity (LTPA) in the previous year was elicited in five categories (1=brisk exercise at least twice a week, 2=brisk exercise at least once a week, 3=some exercise at least once a week, 4=some exercise less than once a week or no exercise) and classified as high (1-2) or low (3-4). BMI (kg/m^2) was calculated using self-reported height and weight and dichotomized as <25.0 (normal) or $\geq$25.0 (overweight/obese). Smoking was measured as never smoker, ex-smoker and current smoker with number of cigarettes per day. Those reporting current smoking <19 cigarettes/day and ≥20 cigarettes/day were classified as smokers.

We also constructed variables to describe changes and stability in lifestyle from 1981 to 1992 using the dichotomized variables.

Morbidity

Information on morbidity was elicited by the question “Please indicate in the list below which diseases or impairments you have at present. In addition, check whether a physician has diagnosed or treated this condition”. The list covered 47 items. We used the following categories (yes/no) of physician-diagnosed diseases: musculoskeletal (degeneration of the cervical spine, degeneration of the lumbar spine, sciatica, arthrosis of the joints in the upper or lower limbs, rheumatoid arthritis and ‘other’), cardiovascular (hypertension, myocardial infarction, angina pectoris, cardiac insufficiency and ‘other’), respiratory (repeated respiratory infections, chronic bronchitis, chronic rhinitis, bronchial asthma, ‘other’), and gastro-intestinal disorders (thyroid gland disorders and ‘other’).

Causes of disability pension

Causes of disability pension were obtained from the national pension registry, categorized according to the World Health Organization's International Classification of Diseases, revisions 8, 9 and 10. Musculoskeletal disorders comprise the classes 710-739 of revision 8, 710-739 of revision 9, and M00-M99 of revision 10.

Statistical analyses

Participants' baseline characteristics are presented as frequencies and percentages by pain trajectory. The difference between trajectories was tested by Chi-Square test for the categorical variable and ANOVA test was used for the continuous variable.

Growth mixture modelling (GMM), an extension of the Latent Growth Curve Model (LCGM) was applied to identify trajectories of the number of pain sites as a categorical latent variable. In GMM, it is assumed that all individuals follow the growth pattern of random variation. It takes into account within-class variation in the estimation of class membership [19]. Inclusion in the analysis required having responded to the baseline survey, the last follow-up and at least one intervening survey. The number of trajectories and their shape were determined first. The quadratic function best represented the patterns of change in the data. The final model was chosen [20] based on a range of fit criteria (see appendix) including the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), sample size adjusted BIC, entropy, and Lo-Mendell Rubin (LMR) likelihood ratio test p-value [21]. A lower BIC, AIC, and sample size adjusted BIC value, a statistically significant difference in LMR in model comparisons, and entropy close to one, indicate a better model fit. Moreover, theoretical meaningfulness and interpretability was considered while choosing the best model. Based on these, a three-trajectory model was selected. The trajectory groups were illustrated by plotting the means of the number of pain sites against survey year.

Multinomial logistic regression was used to investigate the relationship of the latent classes of number of pain sites to baseline work exposures, morbidity and lifestyle factors. The trajectory group "low" was used as the reference. The results appear as odds ratios (ORs) and their 95% confidence intervals (CI). Models were built in two steps. First, univariable associations were calculated, and second, all the variables studied were entered together into the model for mutual adjustment. Similarly, for the change in lifestyle factors, a second model was adjusted for all the variables included in the univariable analysis and age, gender, and occupational status, biomechanical loading, job demands, job control, and morbidity (musculoskeletal, cardiovascular, respiratory, and gastro-intestinal) at baseline, and self-reported retirement from work.

Nelson-Aalen cumulative hazard estimates were plotted for any retirement from work, disability retirement and disability retirement due to musculoskeletal disorders, by trajectory membership. Follow-up of each subject began on 1 January 1981 and ended with censoring due to 1) death or end of follow-up in 31 Dec, 1996 (when any retirement was considered), or 2) statutory pension retirement, death, or end of follow-up (when disability retirement was considered), whichever came first.

GMM was conducted in Mplus v7.2 and the other analyses in Stata v14.

RESULTS

Based on the GMM, three distinct trajectories of the number of pain sites were identified: low (n = 777, 25.1%), moderate (n = 1612, 52.1%) and high-decreasing (n= 704, 22.8%). The low trajectory group comprised participants with low or no pain throughout the study period. The moderate trajectory included participants with a maximum of two pain sites throughout the follow-up. Just over one fifth had initially a high number of pain sites that gradually diminished, remaining almost constant after the second round of follow-up. See Supplement 1 for fit criteria for comparing models with different numbers of latent classes of the number of pain sites. Figure 2 shows the final trajectory solution.

(Figure 2 about here)

(Table 1 about here)

The levels of all baseline characteristics studied, except smoking, were different in the three trajectory groups as shown in Table 1. Subjects in the high-decreasing trajectory were older, more often women, and had low LTPA and BMI ≥25.0 kg/m2 more frequently than those of other groups. Musculoskeletal, cardiovascular, respiratory, and metabolic diseases were more prevalent in the high-decreasing trajectory group, which also was more often exposed to high biomechanical loading, high mental demands and low job control than the other trajectory groups.

(Table 2 about here)

Table 2 presents the associations of the sociodemographic variables, chronic diseases, work-related exposures, and lifestyle factors at baseline with membership of the moderate and high-decreasing trajectories, compared with that in the low trajectory. In the multivariable model, male gender was inversely associated with the moderate and the high-decreasing trajectory while age was associated only with the moderate group. The moderate and the high-decreasing trajectory associated with all categories of chronic morbidity, especially with musculoskeletal disorders (for moderate trajectory OR 3.17, 95 % CI 2-42-4.15 and for high-decreasing trajectory 8.06, 5.97-10.87). High biomechanical loading was also associated with both the moderate (1.68, 1.35-2.09) and the high-decreasing (2.86, 2.16-3.78) trajectory. In addition, high job demands (1.79, 1.39-2.30), high job control (0.70, 0.54-0.91), low LTPA (1.39, 1.09-1.78) and being overweight/obese (1.40, 1.09-1.80) were associated with the high-decreasing trajectory.

(Figure 3 about here)

Of the studied subjects, 2037 (65.9% of the 3093 subjects who responded to the 2009 survey) retired from work over the first 11 years from baseline (altogether 4645 subjects or 74.2% of those 6257 who participated at baseline). The peak of retirement occurred in 1989 – 1990. Of the retirees, 57% were allowed a statutory pension and 35% a disability pension, while 8% had other pension types. All subjects who responded in 2009 had retired by year 2000. The proportion of musculoskeletal disorder disability was 58 (7.5%) in the low trajectory, 282 (17.5%) in the moderate, and 185 (26.3%) in the high-decreasing trajectory group. Figure 3 presents the Nelson-Aalen cumulative hazard estimates by pain trajectory group for any type of retirement (Fig 3a), for retirement on disability pension (Fig 3b) and for disability retirement due to musculoskeletal disorders (Fig 3c). The estimates in the different trajectory groups diverged already early especially for disability retirement due to musculoskeletal disorders. The hazard was highest among those in the high-decreasing pain trajectory and intermediate in the moderate trajectory.

(Table 3 about here)

When examining the relationship of lifestyle changes during the first 11 years of follow-up (Table 3), we found that continuously high LTPA was associated with the high-decreasing trajectory (1.85, 1.14-3.00) and continuously high BMI with both the moderate (1.52, 1.12-2.07) and the high-decreasing (2.07, 1.40-3.05) trajectory. Moreover, compared to those still working, self-reported disability retirement from work between 1981 and 1992 was associated with both the moderate (1.84, 1.17-2.90) and high-decreasing (1.83, 1.05-3.18) trajectory.

DISCUSSION

We identified three distinct trajectories of musculoskeletal pain over 28 years of follow-up in a sample of originally middle-aged municipal employees. A central finding was that although the number of pain sites in midlife often persisted till old age, this was not necessarily so. Indeed, among those with the highest initial score - a group that comprised more than one fifth of the sample - there was a sharp decrease in the number of sites during the initial 11 years of follow-up, after which the number stabilized on a lower level similar to that of the intermediate trajectory comprising one half of the respondents. Among a fourth of the subjects, again, the number of pain sites was consistently very low.

This seems to be the first study to describe multisite musculoskeletal pain trajectories from midlife to senior age. Our results can, however, to some extent be compared with earlier findings in working cohorts. A substantial proportion of individuals seems persistently to report multisite pain [11-13]. We also found previously [11] among occupationally active subjects a clearly declining but smaller multisite pain trajectory, which however had a more moderate pain level at baseline. In the present study the high-decreasing group was characterized by high morbidity, especially due to musculoskeletal disease, high workload (high biomechanical exposures, high work demands and low level of job control) and an adverse lifestyle profile (low LTPA and being overweight or obese) at baseline. During the first 11 follow-up years altogether two thirds of the sample retired from work, putting an end to work exposures. The high-decreasing pain group had the highest rate of disability pension retirement of all trajectories. Musculoskeletal disorders comprised 35.2 % of the diagnoses based on which disability pensions were awarded in this group. The observed decrease in the pain level can be seen as consistent with the results from a French study on an occupational cohort showing that perceived health in older workers exposed to adverse working conditions improved after retirement [22]. Another study also demonstrated health benefits of retirement but only for the upper occupational class [23].

High leisure-time physical activity is considered beneficial in multisite pain conditions [24]. In our study, low LTPA rather than high was more common at baseline among those who belonged to the high-decreasing trajectory. On the other hand, we found that there was a relationship of this trajectory with a repeatedly high level of LTPA. Further, the proportion of subjects with high LTPA increased particularly by the first follow-up round (data not shown). This is in accordance with previous reports showing that people increase their physical activity when approaching statutory retirement [25, 26]. Our study finding may also partly explain the sharp decrease in the high-decreasing trajectory suggesting that a persistently high or increasing LTPA may alleviate multisite pain.

We also found that an initially as well as a persistently high BMI was associated with the high-decreasing pain trajectory. This is in line with the study on kitchen workers which reported a relationship of baseline obesity with an increasing multisite pain trajectory and that not being obese was linked with decreasing pain [12]. Again in accordance with that study, we did not find any association of smoking with multisite pain.

High biomechanical exposure, high job demands and low control during midlife were associated with the high-decreasing trajectory. Moreover, high biomechanical exposure was also associated with the moderate trajectory. The results imply that high physical and mental workload inflict a burden on musculoskeletal health, but that the effects are reversible on retirement [22]. Earlier studies with shorter follow-ups also report high physical loading and mental strain being associated with high multisite pain [11, 12]. On the contrary, a study from the Netherlands reported no associations of biological or psychosocial stress with the maintenance of chronic multisite musculoskeletal pain in a six year follow-up [27]. Participants reporting pain may also report adverse biomechanical exposures and high job strain more readily than participants without pain. Due to item formulations that referred to “the present or the latest job”, we were not able to study the relationship of pain trajectories with changes in or repeated exposures to workload factors. Blue-collar employees were in an increased risk of belonging to the high-decreasing or the moderate trajectories in the univariable model, but the difference levelled out in the multivariable model.

In the present study, older age was inversely associated with the moderate trajectory and showed no relationship with the high-decreasing group. In occupationally active cohorts, mixed results were obtained.

Among food industry workers no associations were seen [11], but in kitchen workers increasing age increased the probability of belonging to the high or ascending multisite pain trajectories [12]. These differences may derive from those in the age range, length of follow-up, or gender composition of the study samples. We found that men had a considerably decreased risk of belonging to the high-decreasing and the moderate trajectory compared to the low. This concurs with the results of an earlier study showing that women are at an increased risk of persistent and increasing multisite pain [11], possibly because of their greater pain sensitivity [28].

Our study has several limitations. The assessment of musculoskeletal pain items was crude, with the response alternatives “no”, “sometimes” or “constantly” given without a reference period, and we also collapsed the categories “sometimes” and “constantly” into one. The severity of pain was not assessed. Another limitation is the non-availability of useful information on work exposures at other time points but the baseline. However, more than 70% of respondents continued in the same job until retirement [16, 29]. Further, we cannot exclude the possibility that common method variance could have influenced our results regarding the associations of the work exposures and lifestyle with pain trajectory membership. Previous studies have shown that psychological factors are associated with pain trajectories [30]. However, the current study was limited to examining associations of working conditions and lifestyle with pain.

A major strength of our study was that the results are based on a large prospective cohort followed up for almost three decades with repeated measurements of outcome variables in five survey waves. The response rates remained high throughout. Due to the long time span, mortality was considerable, presumably leading to health-based selection where the more healthy subjects survived. The manner of defining occupational class can be considered a strength. It was created based on a detailed analysis (based on observation and interview) of the exposure profiles of 88 municipal occupations which were then clustered into 13 job profiles and further into two groups representing white-collar and blue-collar occupations [17, 31]. The data on retirement were derived from national registries and may be considered highly reliable. On the other hand, we did not have at our disposal information on the diagnoses on which disability pension awards were based.

To conclude, in this study where subjects were monitored from mid working career to old age, three distinct trajectory groups of the number of musculoskeletal pain sites were identified. More than one fifth of subjects had a high number of pain sites at baseline, which diminished during the first 11 years of follow-up stabilizing on a lower level similar to that of an intermediate trajectory comprising one half of the respondents. Among a fourth of the subjects the number of pain sites was consistently very low. The study cohort experienced a rapid transition out of the workforce to retirement. The rate of retirement particularly on disability pension was the highest in the trajectory with decreasing pain, suggesting that retirement served to alleviate pain. The decreasing pain trajectory was also associated with a repeatedly high level of leisure-time physical activity.

Contributorship

SN developed the idea, analyzed the data and wrote the first draft of the manuscript. KCP and PLA contributed to interpretation of the results. CHN, MBB, MEB, JS, TR, and JI contributed to the design of the study and data collection. PLA reviewed the manuscript and provided direction for the intellectual content, additional analyses, and context. All authors reviewed the draft manuscript and approved the final version for publication.

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Legends to Figures

Figure 1: Flow diagram of the study.

Figure 2: Developmental trajectories of the number of pain sites (0-4) from midlife to old age (n=3093).

Figure 3: Nelson-Aalen cumulative hazard estimates of remaining in work life by multisite pain trajectory group and retirement type, between 1981 and 2000. a) Any retirement b) disability retirement c) musculoskeletal disorder based disability retirement.

Table 1: Baseline characteristics of the sample by multi-site musculoskeletal pain (MSP) trajectory (1981-2009).

Characteristics	Total N=3093	MSP trajectory			P-value
		Low (n=777)	Moderate (n=1612)	High-decreasing (n=704)	
Age	49.7±3.4	49.7±3.5	49.4±3.3	50.1±3.4	<0.001
Gender					<0.001
Women	1941	402 (20.7)	1025 (52.8)	514 (26.5)	
Men	1152	375 (32.6)	587 (51.0)	190 (16.5)	
Occupational class					<0.001
Blue-collar	1327	270 (20.3)	694 (52.3)	363 (27.4)	
White-collar	1766	507 (28.7)	918 (52.0)	341 (19.3)	
Smoking					0.075
Never smoked	1973	472 (23.9)	1034 (52.4)	467 (23.7)	
Ever smoked	1120	305 (27.2)	578 (51.6)	237 (21.2)	
LTPA†					<0.001
High	1585	412 (26.0)	871 (55.0)	302 (19.1)	
Low	1444	350 (24.2)	708 (49.0)	386 (26.7)	
BMI					<0.001
<25.0	1516	426 (28.1)	790 (52.1)	300 (19.8)	
≥25.0	1549	347 (22.4)	800 (51.6)	402 (26.0)	
Musculoskeletal disorder	964	81 (8.4)	484 (50.2)	399 (41.4)	<0.001
Cardiovascular disease	526	84 (16.0)	269 (51.1)	173 (32.9)	<0.001
Respiratory disease	318	37 (11.6)	144 (45.3)	137 (43.1)	<0.001
Gastro-intestinal disorders	368	41 (11.1)	195 (53.0)	132 (35.9)	<0.001
Biomechanical loading					<0.001
Low	1546	532 (34.4)	802 (51.9)	212 (13.7)	
High	1547	245 (15.8)	810 (52.4)	492 (31.8)	
Mental demands					<0.001
Low	1446	443 (30.6)	767 (53.0)	236 (16.3)	
High	1647	334 (20.3)	468 (51.3)	468 (28.4)	
Job control					<0.001
Low	1353	271 (20.0)	704 (52.0)	378 (27.9)	
High	1739	506 (29.1)	908 (52.2)	325 (18.7)	

†Leisure-time physical activity

Table 2: Associations of developmental trajectories of multisite pain (1981-2009) with baseline factors. Multinomial logistic regression analysis. Odds ratios (OR) and 95% confidence intervals (CI).

Baseline exposures	Moderate vs low (OR, 95% CI)		High-decreasing vs low (OR, 95% CI)	
	Univariable	Multivariable[†]	Univariable	Multivariable[†]
Age	0.97 (0.94-0.99)	0.96 (0.93-0.98)	1.03 (1.00-1.06)	1.00 (0.96-1.03)
Gender				
Women	1.0	1.0	1.0	1.0
Men	0.61 (0.51-0.73)	0.55 (0.45-0.68)	0.39 (0.31-0.49)	0.33 (0.25-0.43)
Occupational class				
Blue-collar	1.41 (1.18-1.69)	1.18 (0.93-1.50)	1.99 (1.62-2.46)	1.29 (0.95-1.74)
White-collar	1.0	1.0	1.0	1.0
Biomechanical loading				
Low	1.0	1.0	1.0	1.0
High	2.10 (1.75-2.52)	1.68 (1.35-2.09)	4.62 (3.71-5.76)	2.86 (2.16-3.78)
Mental demands				
Low	1.0	1.0	1.0	1.0
High	1.46 (1.23-1.73)	1.17 (0.96-1.41)	2.63 (2.12-3.24)	1.79 (1.39-2.30)
Job control				
Low	1.0	1.0	1.0	1.0
High	0.69 (0.57-0.82)	0.86 (0.70-1.06)	0.46 (0.37-0.56)	0.70 (0.54-0.91)
Smoking				
Never or ex-smoker	1.0	1.0	1.0	1.0
<20 cig/day	0.83 (0.60-1.16)	0.81 (0.57-1.15)	0.99 (0.67-1.46)	1.03 (0.66-1.60)
≥20 cig/day	0.63 (0.42-0.94)	0.72 (0.46-1.11)	0.75 (0.46-1.21)	0.94 (0.53-1.65)
LTPA[‡]				
High	1.0	1.0	1.0	1.0
Low	0.95 (0.80-1.13)	0.90 (0.74-1.08)	1.50 (1.22-1.85)	1.39 (1.09-1.78)
BMI				
<25.0	1.0	1.0	1.0	1.0
≥25.0	1.24 (1.04-1.47)	1.19 (0.99-1.45)	1.64 (1.33-2.02)	1.40 (1.09-1.80)
Musculoskeletal disorder[§]	3.68 (2.86-4.75)	3.17 (2.42-4.15)	11.24 (8.54-14.78)	8.06 (5.97-10.87)
Cardiovascular disease[§]	1.65 (1.27-2.14)	1.35 (1.02-1.79)	2.68 (2.02-3.57)	1.61 (1.15-2.24)
Respiratory disease[§]	1.96 (1.35-2.84)	1.67 (1.12-2.49)	4.83 (3.30-7.06)	3.56 (2.31-5.49)
Gastro-intestinal disorders[§]	2.47 (1.74-3.49)	1.68 (1.16-2.45)	4.14 (2.86-5.97)	1.93 (1.26-2.93)

[†] Multivariable analysis adjusted for all variables in the table
[‡]Leisure-time physical activity
[§]The reference group is 'no disease'

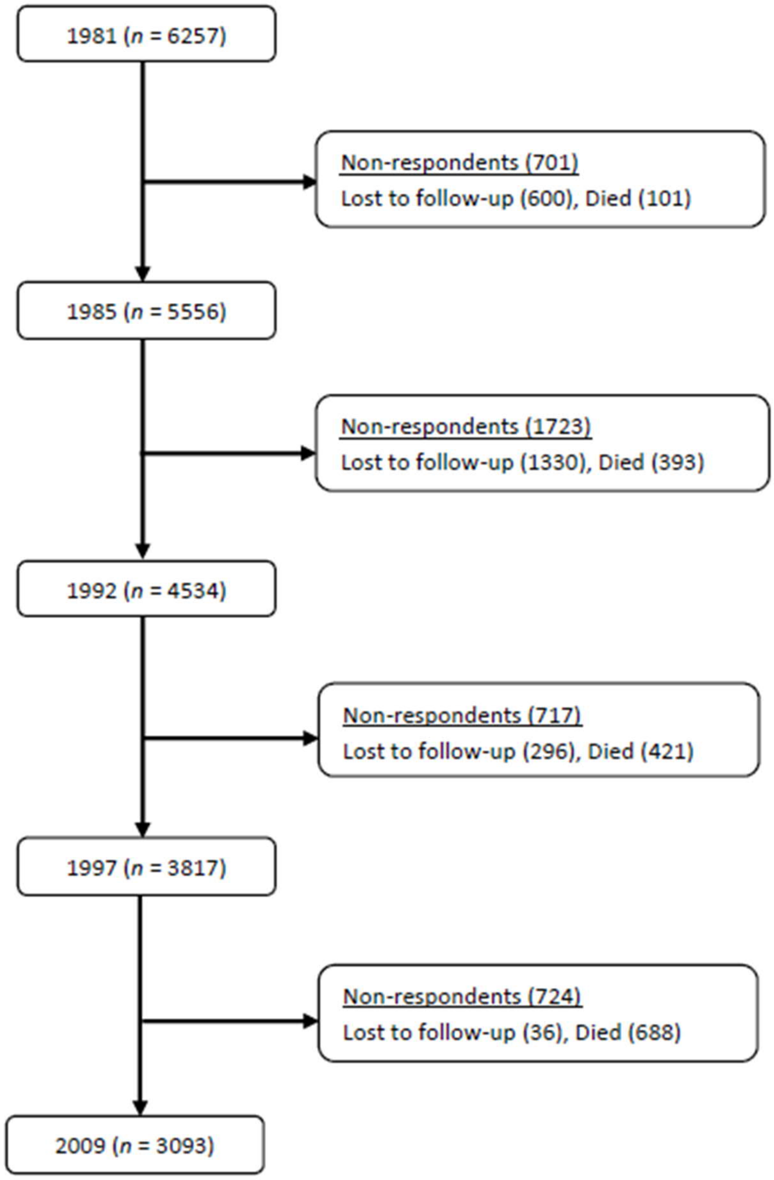
Table 3: Stability and change in smoking, leisure-time physical activity (LTPA) and body mass index (BMI) between 1981 and 1992 in relation to the developmental trajectories of musculoskeletal pain from 1981 to 2009. Multinomial regression analysis. Odds ratios (OR) and 95% confidence intervals (CI).

Change in lifestyle factors	N	Moderate vs low (OR, 95% CI)		High-decreasing vs low (OR, 95% CI)	
		Univariable	Multivariable†	Univariable	Multivariable†
Smoking					
Never	2568	1.0	1.0	1.0	1.0
Increased or constant high	204	1.37 (0.94-1.99)	1.33 (0.77-2.30)	1.33 (0.86-2.06)	1.81 (0.95-3.46)
Decreased or quit	130	0.67 (0.45-1.01)	0.67 (0.38-1.16)	0.74 (0.45-1.21)	0.75 (0.36-1.54)
LTPA					
Constant low	1125	1.0	1.0	1.0	1.0
Increased	237	1.70 (1.15-2.51)	1.27 (0.73-2.22)	1.85 (1.16-2.94)	1.38 (0.70-2.72)
Decreased	645	0.85 (0.67-1.08)	0.82 (0.60-1.14)	1.39 (1.04-1.85)	1.20 (0.80-1.78)
Constant high	514	1.19 (0.91-1.56)	1.28 (0.85-1.92)	1.79 (1.30-2.46)	1.85 (1.14-3.00)
BMI					
Constant low	893	1.0	1.0	1.0	1.0
Increased	615	0.96 (0.75-1.22)	1.52 (0.99-2.32)	1.19 (0.88-1.61)	1.73 (1.01-2.96)
Decreased	95	1.12 (0.67-1.86)	1.17 (0.58-2.34)	1.28 (0.68-2.39)	1.12 (0.45-2.80)
Constant high	1451	1.22 (1.00-1.49)	1.52 (1.12-2.07)	1.81 (1.41-2.31)	2.07 (1.40-3.05)
Self-reported retirement‡					
Still working	272	1.0	1.0	1.0	1.0
Statutory retirement	1037	1.04 (0.75-1.46)	1.13 (0.78-1.67)	0.94 (0.63-1.37)	0.95 (0.59-1.53)
Disability retirement	583	2.27 (1.53-3.35)	1.84 (1.17-2.90)	2.11 (1.36-3.29)	1.83 (1.05-3.18)

† Multivariable analysis adjusted for all variables included in univariable analysis plus age, gender, occupational class, biomechanical loading, mental demands, job control, musculoskeletal disorder, cardiovascular disease, respiratory disease, and Gastro-intestinal disorders at baseline.

‡ Self-reported retirement from work between 1981 and 1992.

Figure 1:



1981 (n = 6257)
Non-respondents (701)
Lost to follow-up (600), Died (101)
1985 (n = 5556)
Non-respondents (1723)
Lost to follow-up (1330), Died (393)
1992 (n = 4534)
Non-respondents (717)
Lost to follow-up (296), Died (421)
1997 (n = 3817)
Non-respondents (724)
Lost to follow-up (36), Died (688)
2009 (n = 3093)

Figure 2:

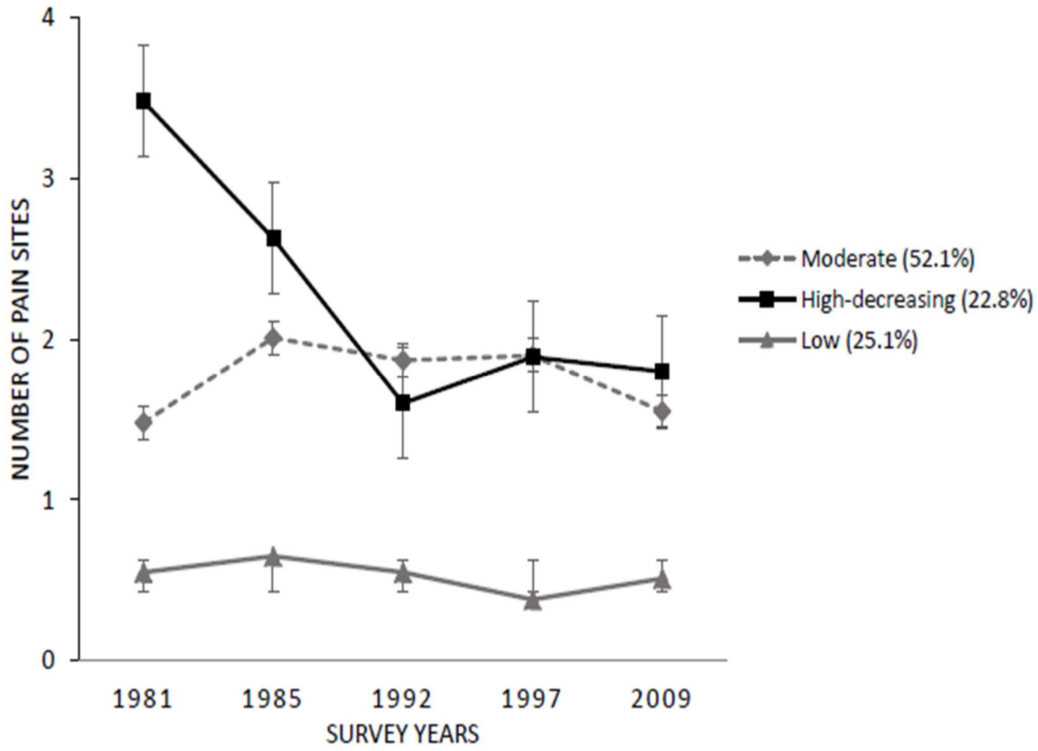


Figure 3: