RESEARCH REPORT

Pain and health related functioning among employees

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Study objective: Although employees report high rates of pain, little is known about the effects of pain on health related functioning among them. This study examined the effects of pain on employees' health related functioning by bodily locations of pain, number of painful locations, and whether pain was acute or chronic.

Design: Cross sectional questionnaire survey. Data on pain and health related functioning as measured with the eight subscales of the short form 36 health survey (SF-36) were obtained in the years 2001 and 2002.

Setting: Municipal employees of the City of Helsinki, Finland.

Participants: All employees who reached the age of 40, 45, 50, 55, and 60 years during each study year. Response rate was 66% (n = 5829).

Main results: Compared with those reporting no pain, those with pain had considerably poorer functioning on all SF-36 subscales. The lowest scores for health related functioning were seen in the physical domain of health, whereas the mental domain was less affected. The association of pain with functioning was practically independent of the bodily location of pain. Whether pain was acute or chronic had only a modest effect on functioning. Widest variation in functioning was found by the number of painful locations.

Conclusions: Among employees pain complaints, irrespective of the location, are associated with a decreased level of functioning. The number of painful locations is likely to be the most useful measure to identify employees with a high risk of poor functioning.

Pain is a common health problem that is likely to limit people's everyday functioning. At least a third of the adult population report chronic pain[1 2] and about 10% report moderately or severely limiting pain.[1] Among aging municipal employees the prevalence of pain is lower: 29% report chronic pain and 7% limiting chronic pain.[3] Employees are usually healthier than the general population as those with severe health problems may not enter paid work at all, or exit early from work life. Thus, the effects of pain on functioning may differ from those in the general population because of such health based selection and the demands of work life. Previous studies examining the effects of pain on functioning have focused on general populations or pain patients[4–9] and do not provide sufficient understanding on the associations of pain with functioning among employees. However, understanding the effects of pain among employees is vital because labour markets are dependent on healthy employees. Moreover, poor functioning causes high financial costs in terms of sickness absence, early retirement, and reduced productivity.[10–12] The problems of pain and functioning are particularly relevant among aging employees as health problems accumulate over life course. To be able to prevent the effects of pain on functioning and to reduce the related costs, a better understanding on the extent to which pain may affect functioning and which areas of functioning are most affected, is needed.

The multidimensional nature of pain constitutes a challenge for the examination of the effects of pain on health related functioning among employees. Pain may occur in any part of the body, or simultaneously in several locations, and it may be acute or chronic. All of these may have a bearing on health related functioning. Several studies have shown that widespread pain, defined as pain in both left and right side of the body and above and below the waist,[13] is associated with poorer health than regional pain, which is any pain or pains that do not meet the definition of widespreadness.[7 9 14–17] However, widespread pain is a more complex measure of pain than the number of painful locations, as it requires pain in at least four locations in specific sides of the body. Furthermore, regional pain does not disclose the impact that pain in different bodily locations may have on functioning, although this may be equally important and useful[18 19] in particular among the generally healthy working populations. Simultaneous study on the effects of the location of pain, the number of painful locations, and acuteness or chronicity of pain on functioning is needed to find the most disabling aspects of pain.

We aim to examine the associations of pain with health related functioning as measured by the short form 36 health survey (SF-36), among aging municipal employees. More specifically, we compare whether and how the three pain measures—that is, the bodily location of pain, the number of painful locations, and pain being acute or chronic—differ in their associations with health related functioning.

METHODS

Data

This study is part of the ongoing Helsinki health study, which focuses on key health outcomes, including pain and health related functioning, among aging employees of the City of Helsinki. The City of Helsinki is the capital of Finland and the largest municipal employer in the country with about 40 000 employees, of whom 72% are women. The mean age of the employees is 45 years.[20] The City of Helsinki is responsible for providing social and health care services, educational and cultural services, public transport, as well as technical and construction services to its citizens. Therefore, the staff represents a multitude of both blue collar and white collar occupations. The employees work under common administration, and the city provides occupational health care for all its employees.

This study was based on two cross sectional surveys carried out in 2001 and 2002. Questionnaires were mailed to all employees reaching 40, 45, 50, 55, and 60 years of age in each

Table 1 Distribution of independent variables by sex (number, %)

	Women		Men	
	Number	%	Number	%
Pain locations*				
Neck or shoulders	1315	28	218	19
Low back	769	16	183	16
One or both arms	732	16	115	10
One or both legs	819	18	155	14
Head and facial area	317	7	41	4
Abdominal area	245	5	47	4
Somewhere else	213	5	43	4
Multiple pains				
No pain (0)	2629	56	731	64
Pain in one location (1)	776	17	183	16
Pain in two to three locations (2–3)	995	21	195	17
Pain in four or more locations (4+)	282	6	38	3
Acute/chronic pain				
No pain	2621	56	728	64
Acute pain	686	15	139	12
Chronic pain	1306	28	271	24
Age				
40	931	20	204	18
45	1009	22	226	20
50	998	21	242	21
55	1185	25	304	27
60	559	12	171	15
Marital status				
Married or cohabiting	3114	67	869	77
Single	647	14	132	12
Separated or widowed	896	19	134	12
Education				
Higher	1119	24	358	31
Secondary	1547	33	331	29
Basic	1984	43	454	40
Total	4682		1147	

*Several pain locations could be reported.

study year. The response rate in the pooled data was 66% (n = 5829; 4682 women and 1147 men).

Health related functioning

Health related functioning was measured with the Finnish translation of the SF-36.[21 22] The SF-36 is a generic health measure permitting group comparison of the relative burden of diseases.[21 23] It measures health related functioning and wellbeing along eight subscales: (1) physical functioning (PF) measures the ability to perform physical activities, for example, to walk shorter or longer distances, lift heavy goods, lift and carry groceries, climb stairs, bathe, and dress. (2) Role limitations because of physical health problems (RP) assesses physical ability to perform work or other daily activities. (3) Bodily pain (BP) assesses limitations in the ability to work or engage in other daily activities because of

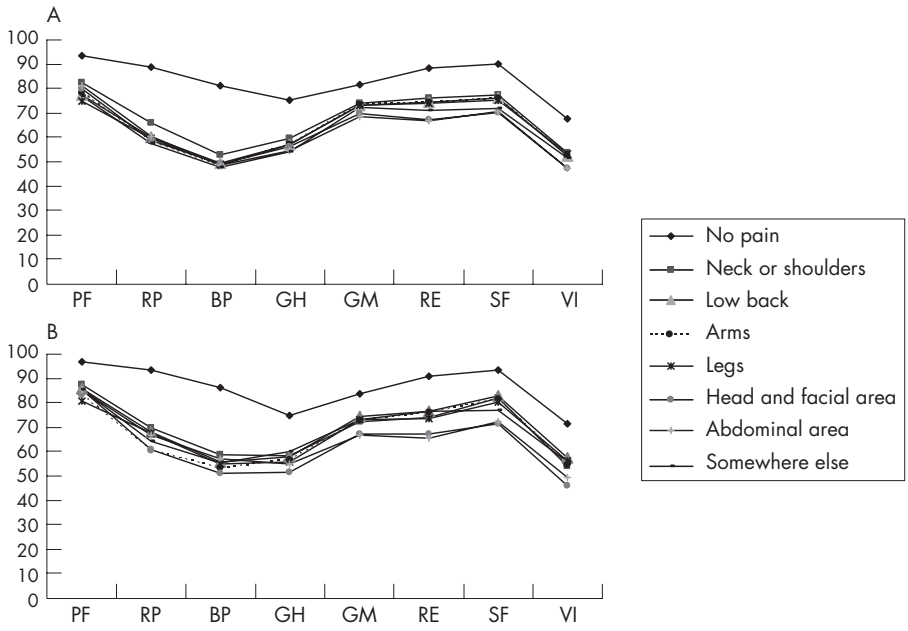

Figure 1 (A) Women. SF-36 subscale means by bodily locations of pain, adjusted for age, education, and marital status. (B) Men. SF-36 subscale means by bodily locations of pain, adjusted for age, education, and marital status. 100 = best possible functioning. PF, physical functioning; RP, role limits because of physical problems; BP, bodily pain, GH, general health perceptions; GM, general mental health; RE, role limits because of emotional problems; SF, social functioning; VI, vitality.

pain. (4) General health perceptions (GH) is based on the assessment of one's health compared with others and on future expectations of one's health. (5) General mental health (GM) measures the state of mind such as happiness, peacefulness, nervousness, and depression. (6) Role limitations because of emotional problems (RE) assesses limitations in the ability to perform work and daily activities associated with emotional problems. (7) Social functioning (SF) covers the ability to perform normal social activities. (8) Vitality (VI) assesses the feeling of energy or fatigue—that is, subjective wellbeing.[21] GM, RE, SF, and VI are included in the mental domain of health and PF, RP, BP, and GH in the physical domain of health.[23]

Measures of pain

The respondents were asked whether they were experiencing ache or pain at the moment and if so, when the pain had started ($\leqslant$3 months ago/ $>$3 months ago). Pain was recorded as acute when lasting for a maximum of three months and chronic when persisting for more than three months. These definitions follow the recommendation of The International Association for the Study of Pain.[24]

Those reporting pain were asked to mark all locations where they felt pain. Response categories were: neck or shoulders, low back, one or both arms, one or both legs, head and facial area, abdominal area, and ''somewhere else''. If the respondents selected ''somewhere else'', they were asked to specify the location of pain. The number of painful locations was obtained by summing up the reported locations.

Covariates

Covariates were based on our previous study on pain and on a study measuring the burden of chronic diseases with SF-36.[3 25] Covariates included age (40, 45, 50, 55, and 60 years), marital status (married/cohabiting, never married, and separated/divorced or widowed) and education (higher $>$12 years, secondary 10–12 years, and basic education $<$10 years).

Statistical methods

Women and men were analysed separately because of differences, for example, in the SF-36 score levels. Covariance analysis was used to provide means for each SF-36 subscale and to adjust for the potential confounders. Pain measures (six bodily locations and catch-all category, the number of painful locations, and acute/chronic pain) were used as independent variables, and age, marital status, and education were adjusted for as covariates. Main results are presented in figures 1A–3B. Furthermore, *t* tests were performed to assess statistical significance and effects sizes[16] were calculated to compare the magnitude of the differences in the SF-36 subscale mean scores between the study groups. Effect size was calculated by dividing the difference of mean scores of two groups by the pooled standard deviation. The effect size values from zero to 0.19 are considered as trivial, from 0.20 to 0.49 as small, from 0.50 to 0.79 as medium, and from 0.80 onwards as large.[16] The *t* tests and effect size calculations are available in our web only appendix (http://www.jech.com/supplemental).

RESULTS

The highest prevalence of pain was found in neck or shoulders and the lowest in the head or facial area, the abdominal area and for ''somewhere else'' (table 1). Pain in one location was reported by 17% of women and 16% of men. Pain in two or three locations was reported by 21% and 17%, and pain in more than three locations was reported by 6% and 3%, respectively. Of women, 15% reported acute pain and 28% chronic pain. The respective figures for men were 12% and 24%.

Pain and health related functioning

To assess the effects of pain on health related functioning, those with pain were compared with those with no pain. Reporting pain, irrespective of the pain measure, was statistically significantly associated with reduced health related functioning. Effects sizes showed that the magnitude of the differences varied from small to large, and that most of the differences were large. Compared with the no pain category, larger differences—that is, poorer functioning—were seen in general health perceptions (GH), physical functioning (PF), role limitations because of physical problems (RP), and bodily pain (BP). Smaller differences were seen in general mental health (GM), role limits because of emotional problems (RE), social functioning (SF) and

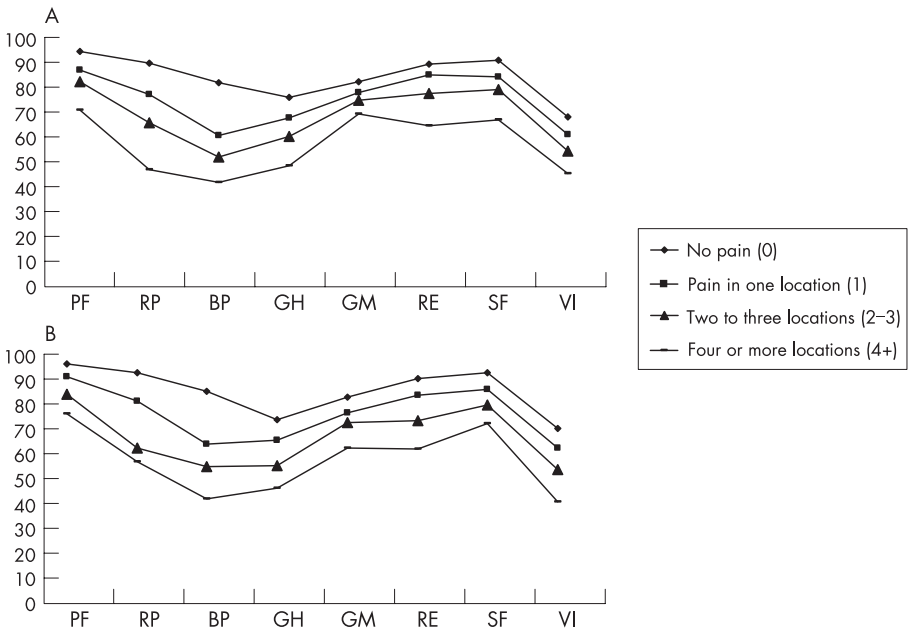

Figure 2 (A) Women. SF-36 subscale means by the number of painful locations, adjusted for age, education, and marital status. (B) Men. SF-36 subscale means by the number of painful locations, adjusted for age, education, and marital status. Abbreviations as in figure 1.

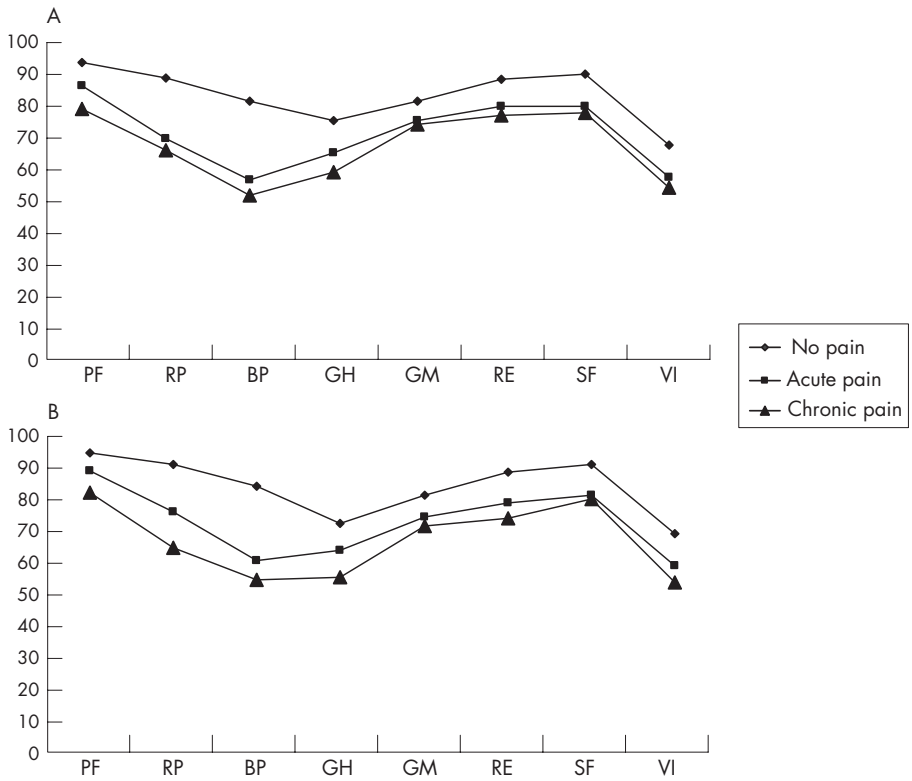

Figure 3 (A) Women. SF-36 subscale means by acute/chronic pain, adjusted for age, education, and marital status. (B) Men. SF-36 subscale means by acute/chronic pain, adjusted for age, education, and marital status. Abbreviations as in figure 1.

vitality (VI). According to effect size calculations, the largest standardised difference between those reporting pain and those reporting no pain was almost always found, in addition to bodily pain (BP), for physical functioning (PF), whereas the smallest difference was found for role limits because of emotional problems (RE).

Bodily locations of pain

The mean scores of the SF-36 subscales varied only modestly between the seven locations of pain (figs 1A and 1B). The effect of the location of pain on health related functioning was further assessed by comparing bodily locations with each other. Among women 41% and among men 10% of the differences between the locations were statistically significant, but the effect size calculations showed that the magnitude of the differences was trivial or small.

Number of painful locations

In both sexes, having pain in two or three locations was associated with a slightly worse health related functioning than having pain in one location only (figs 2A and 2B). Functioning was poorest among those reporting pain in four or more locations. All differences in the mean scores of SF-36 subscales between those with one pain location and those with several locations were statistically significant among women and most of them among men, too. The magnitude of the differences varied from small to large according to effect size calculations. The range of SF-36 subscale mean scores was wider by the number of painful locations than by bodily locations of pain.

Acute or chronic pain

Having acute pain was associated, in both sexes, with slightly better health related functioning than having chronic pain, but the difference was small for the physical domain of SF-36 and almost non-existent for the mental health domain (figs 3A and 3B). Most of the mutual comparisons between acute and chronic pain in the subscales of SF-36 were statistically significant, but the magnitude of the differences was only small or trivial.

DISCUSSION

We examined the association of pain with health related functioning among aging employees, and compared the associations of three different measures of pain—that is, bodily locations of pain, the number of painful locations, and whether pain was acute or chronic—with health related functioning. Those reporting pain had clearly reduced functioning. The number of painful locations was associated with large variation in functioning, whereas the locations themselves and whether pain was acute or chronic was less important to the variation in functioning.

Methodological considerations

As this study was a cross sectional questionnaire survey, we were unable to confirm the causal direction of the associations. Based on previous studies, we assumed that pain affects health related functioning rather than the other way around.[4 7 27–31] However, some studies have also suggested that the causal associations between pain and functioning might be bidirectional.[7 30]

The response rate of 66% is within the common range in questionnaire surveys[2 32] and can be regarded as satisfactory. According to a previous register based non-response study, our data represent the target population of 40–60 year old employees reasonably well.[33] However, younger respondents, men, those with lower socioeconomic status, and those with long term medically confirmed sickness absence were slightly less likely to respond. It is probable that long term sickness absence is related to most disabling pain. Thus, non-response among those with long episodes of sickness absence may have resulted to some underestimation of pain as well as poor functioning. The lower response activity among those with lower socioeconomic status may have had a similar effect. As

pain is more common among older employees, the over-representation of these might, in contrast, have caused some overestimation of pain and poor functioning.

Our focus on current pain may have led to exclusion of some participants with recurrent pain, but is nevertheless likely to diminish recall bias. As pain was present when the respondents filled in the questionnaire, it is probable that most effects of pain on functional capacity were caught. However, SF-36 measures functioning over the past four weeks, thus we may have missed some participants who had acute or recurrent pain during that time, but not when filling out the questionnaire. This may cause some overestimation of poor functioning among those without pain.

We adjusted our analyses for age, education, and marital status. Additional adjustment for other socioeconomic factors (occupational class, income, and housing tenure) had negligible impacts on the results. When assessing functioning, the possible presence of long term limiting illness, chronic diseases, and comorbidities is important to consider. However, long term limiting illness was not adjusted for, as it is likely to overlap with both poor functioning and chronic pain. Lifetime asthma and diabetes were adjusted for in preliminary analyses, but these adjustments had no impacts on the results and were, therefore, left out of the final analyses. We could not adjust for further comorbidities or chronic diseases. However, employees are generally a healthy population and for example cancer or severe cardiovascular disease, which might affect functioning, are comparatively uncommon. In addition to the above adjustments, subgroup differences by education and age were checked, but the associations between SF-36 mean scores and pain followed similar patterns in all subgroups.

Pain and health related functioning

Reporting pain was associated with decreased functioning on all subscales of SF-36. The poorest functioning was seen for the subscales of physical functioning, role limits because of physical problems, bodily pain and general health, whereas a smaller, but still noteworthy difference in functioning was seen for the subscales of general mental health, role limits because of emotional problems, social functioning, and vitality. This confirms that the physical domain of health is more strongly affected by pain than the mental domain, and supports results from population studies of chronic pain[5] and musculoskeletal disorders.[6 8]

Bodily locations of pain

The bodily location of pain was of little importance to the variation in health related functioning. We are unaware of other studies comparing the effects of different bodily locations of pain on health related functioning. Picavet and Hoyemans[8] compared SF-36 scores between 12 musculoskeletal diseases (for example, rheumatoid arthritis, gout, epicondylitis, whiplash syndrome, and fibromyalgia) and found differences in functional capacity between these diseases. However, as fibromyalgia and rheumatoid arthritis affect several bodily locations, it is presumable that they are associated with low levels of SF-36 scores. We focused on common locations of pain instead of disease diagnoses that are mostly rare in the working population.

What is already known of this subject?

- Pain is common among employees and causes high costs because of loss of productivity, sickness absence, and early retirement. However, the associations of pain with health related functioning among employees are poorly understood.
- Widespread pain is known to limit functioning more than regional pain, but which of the less complex measures of pain affects functioning most: bodily location of pain, the number of painful locations or acute/chronic pain?

What does this study add?

- Pain limits functioning considerably among employees. Physical functioning is affected more strongly than mental functioning.
- The number of painful locations affects functioning most. Thus, it is probably a useful tool in identifying employees with a high risk of poor functioning.

Number of painful locations

Those suffering from pain often report pain in more than one location.[34–36] Our results as well as those by Ektor-Anderssen *et al*[37] suggest that the effects of pain in one bodily location are influenced by the total burden of pain. Focusing only on one specific bodily location of pain is therefore insufficient if the aim is to achieve a comprehensive view of the associations of pain with health related functioning among large populations.

In a Swedish general population study[18] pain in one bodily location (neck and shoulders) had less harmful effects on health than pain in several locations. Our study confirms and extends the findings of that study. We studied six bodily locations plus a catch-all category, and found that the high number of painful locations was associated with poorer health than any of the bodily locations (neck or shoulders, arms, legs, low back, abdominal area, head and facial area, and somewhere else). Our results are also consistent with those from a Norwegian study on musculoskeletal symptoms and functioning in the general population, which found that the number of painful areas correlated with lowered functioning as assessed by COOP/WONCA scale.[19] However, our study was somewhat more extensive as we included even other pain than musculoskeletal pain. Thus, the simple count of painful locations without the specific requirements of widespreadness is probably applicable in detecting employees at high risk of poor functioning.

Acute and chronic pain

Unexpectedly, chronic pain differed only little from acute pain in the associations with functioning. The difference was small for physical functioning and non-existent for mental functioning. This suggests that whether pain is acute or chronic is largely unimportant to health related functioning among the studied employees. However, the cut off point of three months for chronic pain might be too short a period to show in full the adverse effects of prolonged pain. It is also possible that all employees experiencing the most disabling and longlasting pain could not be reached in our study as they probably left work life because of such complaints. A recent follow up study of chronic back pain[38] showed that prolonged pain degrades health in the long run but further studies on the effects of acute and chronic pain on functioning are needed.

CONCLUSION

Pain is a large scale problem among employees with potentially severe effects on health related functioning and consequently on the ability to work. In general, pain affects

more strongly physical than mental functioning, but both domains need to be considered in the treatment and rehabilitation of employees suffering from pain. The specific location of pain might not be a useful indicator for the assessment of health or functioning in populations where multiple pain complaints are common. The distinction between acute and chronic pain, too, turned out to be rather unimportant in detecting employees with poor functioning. Instead, the simple count of painful locations can be used in identifying poor functional capacity because of pain. The number of painful locations might therefore provide a tool for occupational health care to detect employees with a high risk of declining working capacity.

The appendix is available on line (http://www.jech.com/supplemental).

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