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ORIGINAL ARTICLE

The Relation of Co-occurring Musculoskeletal Pain and Depressive Symptoms With Work Ability

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Objective: To examine the relationship of musculoskeletal pain and depressive symptoms, occurring alone or both together, with self-rated current work ability and thoughts of early retirement. **Methods:** In a nationally representative sample drawn in 2000–2001, we studied actively working subjects aged 30 to 64 years ($n = 4009$). **Results:** Musculoskeletal pain was associated with moderate/poor physical work ability (adjusted odds ratio [OR] = 2.9; 95% confidence interval [CI], 2.0 to 4.2) and mental work ability (OR = 1.6; 95% CI, 1.2 to 2.2). Depressive symptoms were associated with moderate/poor mental work ability only (adjusted OR = 4.2; 95% CI, 2.3 to 7.9). Moreover, only musculoskeletal pain was associated with thoughts of early retirement (OR = 1.4; 95% CI, 1.1 to 1.8). There was an interaction between musculoskeletal pain and depressive symptoms regarding physical work ability and thoughts of early retirement. **Conclusion:** Co-occurrence of musculoskeletal pain and depressive symptoms is strongly related to poor self-rated physical work ability.

Musculoskeletal and mental disorders are common health problems worldwide, posing a high burden on both individuals and the society.[1,2] The prevalence of depression increases as the number of physical disorders increases.[3] Musculoskeletal pain is highly comorbid with depression,[1,4] and the relation between these two conditions seems to be bidirectional.[5,6] Change in the severity of depression predicts subsequent pain severity, and vice versa.[5] Depression is more common in individuals having chronic pain, frequent episodes of pain, or multisite pain.[6]

Although depression is a commonly occurring condition, its diagnosis is often missed in primary care practice.[7] The routine screening of patients with severe or chronic musculoskeletal pain for depressive symptoms has been recommended.[7]

Both musculoskeletal and mental disorders are associated with work-loss days and impaired work ability.[8,9] Musculoskeletal pain predicts poor self-assessed work ability.[10] Pain in more than one location has a stronger adverse effect on work ability than pain in only one area of the body.[11,12] Depression is associated with work disability,[13] and low coping and self-esteem predict poor prognosis of self-assessed work ability.[10] Moreover, chronic musculoskeletal pain[14] and depression[15,16] increase the risk of subsequent disability retirement.

So far, however, very little is known about the effect of co-occurring musculoskeletal pain and depressive symptoms on work ability. Previous studies have usually adjusted only for the other symptom group.[17,18] The aim of this study was to assess the effects of co-occurrence of pain and depressive symptoms on self-rated work ability and thoughts of early retirement.

MATERIALS AND METHODS

Population

We used the data of the national population-based Health 2000 Survey. The target population in this study consisted of men and women aged 30 years or older, residing in mainland Finland, between the fall of 2000 and the spring of 2001. A two-stage stratified cluster sampling design was used to obtain a representative sample of the Finnish population. The sample was stratified according to the five university hospital regions, each containing roughly one million inhabitants. From each university hospital region, 16 health care districts were sampled as clusters.

The purpose of the survey was to provide up-to-date information on major public health problems in Finland, their causes and treatment, as well as functional capacity and work ability of the population.[19] Information was gathered by means of interview, survey, and clinical health examination. At the comprehensive health examination, specially trained nurses carried out a symptom interview on musculoskeletal and psychological complaints as well as other medical conditions, and physicians performed a standardized physical examination.

The original sample consisted of 8028 subjects aged 30 to 99 years (5871 subjects aged 30 to 64 years). Of them, 51 died before the interview, 6986 (87.6%) were interviewed, and 6354 (79.7%) participated in the health examinations. In the current analysis, we included 4009 participants, aged 30 to 64 years, who were actively working during the preceding 12 months and had no missing data on work ability. The ethical committee of Epidemiology and National Welfare of the Helsinki University Hospital District approved the Health 2000 Survey on the September 21, 1999. All participants gave their informed consent.

Outcomes

Perceived *current physical work ability* and *current mental work ability* were assessed by the following questions:[20] (1) How is your work ability in comparison to the physical demands of your present/latest work? and (2) How is your work ability in comparison to the mental demands of your present/latest work? The response options were "very good," "good," "moderate," "poor," and "very poor."

Thoughts of early retirement were assessed by a single question: Have you thought about retiring early, before the age of the old-age pension? There were four response alternatives: "no," "sometimes," "often," and "I have already handed in my pension application."

Musculoskeletal Pain

The subjects were asked in the interview whether they had experienced pain, ache, or motion-related soreness during the last 30 days in the following body areas: back, neck, shoulder, upper arm, elbow, wrist, fingers, hip, knee, ankle, or foot. We defined

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musculoskeletal pain as having pain in at least one of the aforementioned locations during the preceding month.

Depressive Symptoms

The presence of depressive symptoms was assessed by the Beck Depression Inventory.[21] This tool consists of 21 questions (on a scale of four grades) and assesses current depressive symptoms. Using the total score (0 to 63 points) on the questionnaire, depressive symptoms were classified as follows: no symptoms (score, 0 to 9 points) and depressive symptoms (score, 10 points or more).[22]

Covariates

[AQ4] The interview elicited information on *age*, *gender*, *years of education*, and *marital status*.

Physical Workload Factors

The presence (frequency or duration per day) of the following physical exposures in the current job was inquired (elicited).[23,24] Heavy work, working with hands above the shoulder level, manual handling of loads more than 5 kg at least two times per minute for at least 2 hours, manual handling of loads more than 20 kg at least 10 times per day, working with a vibrating tool, work demanding high handgrip forces and repetitive movements of the hands or wrists, and work demanding keyboard use, bending, and squatting. The number of physical workload exposures was included in the regression models.

Psychosocial Factors at Work

Social support at work (four items for supervisor and coworker support), job demands at work (five items), and job control at work (nine items) were measured as work-related psychosocial factors with the Karasek Job Content Questionnaire.[25] We included these three factors in the analyses as separate variables.

Lifestyle Risk Factors

Smoking status was assessed by an interview, and the *subjects* were defined as (1) current smokers, if they smoked cigarettes, cigars, or a pipe at the time of the interview; (2) former smokers, if they had smoked for at least 1 year in the past and were not current smokers; (3) occasional smokers; and (4) never smokers. Leisure-time physical activity was assessed by a single question: "How often do you exercise so that you are short of breath or sweating?" We classified physical activity into three levels: 1 or less, two to three, and four or more times per week. Height and weight were measured, and body mass index was estimated.

Medical Conditions

Information on cardiovascular diseases (eg, ischemic heart disease, arrhythmia, heart bypass surgery), cerebrovascular disease, respiratory diseases (eg, asthma, chronic obstructive pulmonary disease), inflammatory joint diseases (eg, rheumatoid arthritis), osteoarthritis, injuries, and metabolic disorders (eg, diabetes) was confirmed by the examining physician.

Moreover, information on some other medical conditions, such as gastrointestinal diseases (eg, peptic ulcer, bowel disease), osteoporosis, cancer, substance use disorders, and other mental disorders, was gathered through the interview. We included the number of medical conditions in the analyses.

Statistical Analysis

Multinomial logistic regression models were fitted to study the associations of musculoskeletal pain and depressive symptoms with self-rated work ability and thoughts of early retirement. The subjects' age (continuous), gender, years of education (continuous), body mass index (continuous), physical activity, smoking, the number of physical workload factors, psychosocial factors at work (social support, job demands, and job control), and the number of medical conditions were included in the multivariable models as confounders. We studied the associations of musculoskeletal pain and depressive symptoms, occurring alone and in conjunction with each other, with work ability with stratified analysis. We also performed gender-specific analyses. Moreover, we assessed whether the associations of co-occurring pain and depressive symptoms with work ability were modified by age.

We assessed the biological interaction (as the deviation from additivity)[26] by calculating the attributable proportion because of interaction by the following formula:[27]

> Attributable proportion = relative excess risk because of interaction ÷ odds ratio (OR) of comorbid pain and depressive symptoms.
>
> Relative excess risk = OR of comorbid pain and depressive symptoms − OR of pain alone − OR of depressive symptoms alone + 1.

The attributable proportion because of interaction measures the proportion of the joint effect that is due to interaction. If there is no biological interaction, it is equal to 0. The attributable proportion can range from −1 to +1. In the presence of positive interaction, it is greater than zero.

We performed survey data analysis by using *svy* prefix command of STATA (Stata Corp, College Station, TX). Survey data analysis considers the weighting, clustering, and stratification of the survey design to correct imbalances in the probabilities of selection and to estimate the right standard errors. We performed both complete-case and multiple imputation-based analyses. The missing data on psychosocial factors at work (8% to 10%), musculoskeletal pain (6%), depressive symptoms (9%), physical workload factors (1%), and body mass index (1%) were imputed using the method of multiple imputation by chained equations described by van Buuren et al[28] and implemented in the STATA software by Royston.[29] We used STATA *ice* command and created 50 data sets. In the imputation model, we included all variables used in our analyses (covariates with or without missing values and outcome variables) as well as some auxiliary variables that predicted missingness. We used STATA, version 10, software to analyze the data.

RESULTS

Two thirds of the study population (66%) reported musculoskeletal pain during the preceding 30 days, 19% had depressive symptoms, and 15% had co-occurring musculoskeletal pain and depressive symptoms (Table 1). The prevalence of depressive symptoms was 23% in subjects having musculoskeletal pain and 12% in those free from pain. [T1]

Fourteen percent of the study participants reported moderate current physical work ability, and 2% reported poor/very poor current physical work ability (Table 1). Twelve per cent had moderate and 2% poor/very poor current mental work ability. Moreover, 17% of the study population had often thought about retiring early, and 1% had handed in their application.

Current physical work ability was correlated with current mental work ability (Spearman rank correlation coefficients, 0.56). Thoughts of early retirement were neither correlated with current physical work ability (Spearman rank correlation coefficients, 0.20) nor with current mental work ability (Spearman rank correlation coefficients, 0.17).

Odds ratios produced by multiple imputation-based analyses were slightly smaller than those produced by complete-case analyses. Overall, complete-case and multiple imputation-based analyses yielded similar results. Therefore, we reported only the results of the complete-case analyses.

Musculoskeletal pain was strongly associated with current physical work ability (adjusted OR = 2.9; 95% confidence interval

TABLE 1. Background Characteristics of the Study Population

Characteristic	Mean (SD)	%
Age, yr	44.3 (8.4)	
30–39		34
40–49		36
50–64		30
Years of education	12.7 (3.6)	
Body mass index	26.4 (4.5)	
Number of comorbid medical conditions	1.8 (1.6)	
Number of physical workload factors	2.4 (2.3)	
Smoking		
Former		19
Occasional		7
Current		26
Determinants		
Musculoskeletal pain during the preceding month		66
Depressive symptoms		19
Comorbid musculoskeletal pain and depressive symptoms		15
Outcomes		
Current physical work ability		
Very good		45
Good		39
Moderate		14
Poor/very poor		2
Current mental work ability		
Very good		41
Good		45
Moderate		12
Poor/very poor		2
Thoughts of early retirement		
No		47
Sometimes		35
Often		17
Applied for		1

[CI], 2.0 to 4.2; for moderate, poor, or very poor physical work ability) (Table 2), while the association for depressive symptoms was weak. On the contrary, depressive symptoms were strongly associated with current mental work ability (adjusted OR = 4.2; 95% CI, 2.3 to 7.9; for moderate, poor, or very poor mental work ability). In addition, there was a biological interaction between musculoskeletal pain and depressive symptoms regarding current physical work ability. For moderate, poor, or very poor current physical work ability, 37% of the effect of musculoskeletal pain and depressive symptoms was because of interaction. There was no biological interaction between pain and depressive symptoms regarding current mental work ability.

The weak association between depressive symptoms and physical work ability disappeared after further adjustment for mental work ability. Moreover, musculoskeletal pain was not anymore associated with mental work ability after further adjustment for physical work ability.

Only musculoskeletal pain was statistically significantly associated with thoughts of early retirement (adjusted OR = 1.4; 95% CI, 1.1 to 1.8) (Table 3). There was a biological interaction between musculoskeletal pain and depressive symptoms on thoughts of early retirement. In those who thought often about retiring early or had already handed in their pension application, 38% of the increased risk was because of interaction between pain and depressive symptoms. After further adjustment for current physical and mental work ability, only the association between co-occurring musculoskeletal pain and depressive symptoms, and thoughts of early retirement remained statistically significant.

In the gender- or age-stratified analyses, the associations of co-occurring musculoskeletal pain and depressive symptoms with work ability or thoughts of early retirement did not differ significantly between men and women and between different age groups.

DISCUSSION

Pain and depression are two common and often co-occurring conditions.[6] The current study showed that the co-occurrence of musculoskeletal pain and depressive symptoms is more markedly related to poor physical work ability than either condition alone. Musculoskeletal pain and depressive symptoms potentiated each other's adverse effects on physical work ability and thoughts of early retirement.

In individuals with co-occurrence of pain and depression, other concomitant medical comorbidity may also contribute to reduced work ability. In this study, the effect of co-occurring pain and depressive symptoms on work ability did not differ in subjects with 2 or less or more than 2 comorbid medical conditions. Thus, the adverse effect of the co-occurrence of pain and depressive symptoms on work ability seems to be independent of other concomitant medical conditions.

In addition to chronic medical conditions, we also controlled for some psychosocial factors at work. We may, therefore, have underestimated the effects of co-occurring pain and depressive symptoms on work ability. Depression is a risk factor for some chronic medical disorders (eg, cardiovascular disease) and adversely affects job satisfaction.[2] Moreover, job strain is a risk factor for developing depressive symptoms.[30]

We found that depressive symptoms alone, though associated with current mental work ability, were not associated with current physical work ability or thoughts of early retirement. A prospective study[31] also found that depression alone may not always lead to disability pension.

The co-occurrence of musculoskeletal pain and depressive symptoms was strongly associated with poor physical work ability. Pain negatively affects the treatment of depression, and depression increases pain severity and related disability.[6] Remission from an episode of depression is less likely without concomitant treatment of depression and pain in patients with comorbid pain, while patients with early improvement in pain are more likely to achieve remission with the treatment of depression only.[32] Patients with chronic or multisite musculoskeletal pain need routine screening for depressive symptoms. Depression may result from a functional deficiency or imbalance of serotonin, norepinephrine, and dopamine.[6,33] These neurotransmitters modulate pain signals coming in the brain from the body. In people with depression, a minor signal from the body is amplified, and pain is associated with increased attention and negative affect.[6] Our study suggests that the assessment and treatment of both pain and depression are more effective in reducing work disability than the treatment of either condition alone.

The strengths of this study include a fairly large sample that is well representative of the Finnish population, high participation rate, and rich information on work-related physical and psychosocial factors, lifestyle factors, and medical conditions. A limitation of this study is its cross-sectional nature. There is also a possibility of reverse causality. Depressive symptoms can be a consequence rather than a cause of decreased work ability. Another limitation of this study is that musculoskeletal pain, depressive symptoms, and work ability were based on self-reports.

TABLE 2. Associations of Musculoskeletal Pain and Depressive Symptoms With Current Work Ability (Reference Group is "Very Good Work Ability")

		Current Work Ability			
		Good		Moderate, Poor, or Very Poor	
Pain	Depressive Symptoms	OR*	95% CI	OR*	95% CI
Physical work ability					
No	No	1		1	
Yes	No	1.4	1.1–1.7	2.9	2.0–4.2
No	Yes	1.3	0.8–2.1	1.9	0.9–3.9
Yes	Yes	1.9	1.4–2.6	6.0	3.9–9.3
Attributable proportion because of biological interaction	0.11	−0.26 to 0.49	0.37	0.08–0.68	
Mental work ability					
No	No	1		1	
Yes	No	1.3	1.1–1.6	1.6	1.2–2.2
No	Yes	2.8	1.7–4.5	4.2	2.3–7.9
Yes	Yes	2.3	1.7–3.2	5.5	3.5–8.5

*Adjusted for age, gender, education, body mass index, physical activity, smoking, physical workload factors, psychosocial factors at work, and medical conditions.

CI, confidence interval; OR, odds ratio.

TABLE 3. Associations of Musculoskeletal Pain and Depressive Symptoms With Thoughts of Early Retirement (Reference Group is "No" Thoughts of Early Retirement)

		Thoughts of Early Retirement			
		Sometimes		Often/Applied for	
Pain	Depressive Symptoms	OR	95% CI	OR	95% CI
No	No	1		1	
Yes	No	1.1	0.9–1.3	1.4	1.1–1.8
No	Yes	1.0	0.6–1.6	1.4	0.8–2.5
Yes	Yes	1.5	1.1–2.0	3.0	2.0–4.4
Attributable proportion because of biological interaction	0.27	−0.10 to 0.63	0.38	0.07–0.70	

*Adjusted for age, gender, education, body mass index, physical activity, smoking, physical workload factors, psychosocial factors at work, and medical conditions.

CI, confidence interval; OR, odds ratio.

CONCLUSIONS

The co-occurrence of musculoskeletal pain and depressive symptoms seems to pose a stronger adverse effect on physical work ability and thoughts of early retirement than musculoskeletal pain or depressive symptoms alone. This comorbidity should be addressed as an occupational health priority to improve work ability and to reduce the risk of disability.

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