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Original Article

Relationship between Comorbid Health Problems and Musculoskeletal Disorders Resulting in Musculoskeletal Complaints and Musculoskeletal Sickness Absence among Employees in Korea

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ABSTRACT

Background: To investigate the relationship between musculoskeletal disorders and comorbid health problems, including depression/anxiety disorder, insomnia/sleep disorder, fatigue, and injury by accident, and to determine whether certain physical and psychological factors reduce comorbid health problems.

Methods: In total, 29,711 employees were selected from respondents of the Third Korean Working Conditions Survey and categorized into two groups: Musculoskeletal Complaints or Musculoskeletal Sickness Absence. Four self-reported health indicators (overall fatigue, depression/anxiety, insomnia/sleep disorder, and injury by accident) were selected as outcomes, based on their high prevalence in Korea. We used multiple logistic regression analysis to determine the relationship between comorbid health problems, musculoskeletal complaints, and sickness absence.

Results: The prevalence of musculoskeletal complaints and musculoskeletal sickness absence due to muscular pain was 32.26% and 0.59%, respectively. Compared to the reference group, depression/anxiety disorder and overall fatigue were 5.2–6.1 times more prevalent in the Musculoskeletal Complaints Group and insomnia/sleep disorder and injury by accident were 7.6–11.0 times more prevalent in the Sickness Absence Group. When adjusted for individual and work-related physical factors, prevalence of all four comorbid health problems were slightly decreased in both groups.

Conclusion: Increases in overall fatigue and depression/anxiety disorder were observed in the Musculoskeletal Complaints Group, while increases in insomnia/sleep disorder and injury by accident were observed in the Sickness Absence Group. For management of musculoskeletal complaints and sickness absence in the workplace, differences in health problems between employees with musculoskeletal complaints and those with sickness absence as well as the physical and psychological risk factors should be considered.

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1. Introduction

Work-related musculoskeletal disorders (MSD) are a significant health problem due to temporary or permanent incapacity to work, sickness absence, and ill-health retirement among the working population [1,2]. Thus, much research on MSD has been focused on professionals in various jobs, including nurses [3], farmers [4], and office clerks who use computers [5]. Studies have demonstrated that many physical and psychosocial factors are associated with MSD, including heavy physical work, lifting, forceful movements, awkward postures, whole-body vibration, stress, job satisfaction, work demands, and the organizational culture of the workplace [6–9].

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MSD can be reduced by controlling certain physical and working conditions [10–12]. Lipscomb et al [13] suggested that preventing MSD in registered nurses requires systemic approaches to scheduling, aimed at reducing the time of exposure to demanding work conditions. Another study reported that other protective measures against MSD include teamwork and coworker support, reduction in unabated repetitive work, lower management strain and noise at work, better work postures, satisfaction with their supervisor's attitude, and leisure exercise [14].

Due to these factors, MSD is frequently accompanied by various comorbid health symptoms. Leclerc et al [15] reported that depression and anxiety have frequently been observed in concurrence with neck disorders, and another study reported that sleep duration and efficiency was lower in a group of people with musculoskeletal pain than in a control group [16]. Additionally, fear of pain, fear of work related activities, fear of movement, and fear of injury is a particular characteristic of workers with MSD [17]. Overall, these comorbid diseases result in a lower quality of life and diminished social involvement [18].

Many studies have been conducted to investigate depression, anxiety, injury, and insomnia among workers with MSD, but thus far, none have examined the relationship between the overall measure of comorbid symptoms and MSD. Although several studies showed that reducing workload and working hours could reduce MSD, it is still not clear whether these factors can reduce the symptoms of comorbid health conditions.

The purpose of our study was to investigate the relationship between musculoskeletal disorders and comorbid symptoms such as depression/anxiety disorder, insomnia/sleep disorder, fatigue, and injury by accident. In addition, we investigated whether physical and psychological factors such as workload, working hours, and job satisfaction result in reduced comorbid symptoms.

2. Materials and methods

2.1. Participants and study sample

The Third Korean Working Conditions Survey was performed by the Korea Occupational Safety and Health Agency (KOSHA). The survey was based on a representative sample of the economically active population aged 15–64 years. At the time of the interview, selected participants were either working employees or were self-employed. In general, random face-to-face surveys involve considerable and increasing difficulties in reaching respondents because of not only refusals and/or lack of response, but also logistical problems such as difficulty in attaining building access and empty households. Retired and unemployed persons, homemakers, and students were excluded and written informed consent was obtained from each respondent before the survey. The survey was conducted in June 2011 using three-stage stratified sampling. The questionnaire was similar to that used in the European Working Conditions Survey [19] and the Labour Force Survey (Labour Force Survey User Guide-Volume2-2011 Questionnaire Office for National Statistics) in the UK. The survey contained questions regarding time spent working, physical risk factors, organization of the workplace, impact of work on health, satisfaction with working conditions, and violence/bullying/harassment in the workplace. The response rate was 35.4%, and the questionnaires were completed by 50,032 workers. As our investigations excluded self-employed persons, the final total analyzed population in this study comprised of 29,711 employees.

2.2. Measures

In this study, participants were classified as having "musculoskeletal complaints" if they responded positively to the survey question, "Over the past 12 months, did you have muscular pain in your upper or lower body, except back pain, due to your job (yes/no)?" Of the patients in this group, 328 participants were excluded from the analysis because the cause of their pain was not work related. Participants were classified as having "musculoskeletal sickness absence" if they reported being absent at least 1 day after January 1, 2010, because of muscular pain in their upper body or lower body, or back pain due to their job (not including accidents as a cause).

Covariates investigated included age in years, gender, years in current job, and employment status. With respect to shift work, the participants were questioned on whether they were engaged in shift work or not. Regarding working hours, Korean labor law limits working hours to 8 h/d, 5 d/wk (or 40 h/wk in total). Participants were grouped into three groups based on Korea labor law: $>$ 48 h/wk, $\geq$ 40 hours and $\leq$ 48 hours, and $<$ 40 hours a week.

Work-related physical factors included high workloads that were defined as working at very high speeds or under tight deadlines for more than half of the work day. Work-related psychosocial factors included job satisfaction that was rated on a 4-point scale as "very satisfied," "satisfied," "not very satisfied," and "not at all satisfied." High job satisfaction was defined as a response of "very satisfied" or "satisfied."

Outcome-related health problems were used to assess the overall comorbid health problems of workers with MSD. Occurrence of comorbid health problems were measured by response to the question, "Over the past 12 months, did you suffer from any of the following health problems? (yes/no)." Four self-reported health indicators (overall fatigue, insomnia/sleep disorder, depression/anxiety, and injury by accident) were selected as outcomes based on their high prevalence in Korea [20,21].

2.3. Statistical analysis

The frequency and prevalence rates of sociodemographic characteristics of the participants were calculated. Logistic regression analysis was performed to examine associations between musculoskeletal complaints and sickness absence, and occurrence of comorbid health problems. The odds ratios (ORs) and 95% confidence intervals were calculated. Data were analyzed by logistics regression using SAS 9.2 (SAS Institute Inc., Cary, NC, USA). Hence, the SAS procedure used is proc surveylogistic and the weighted value is the benchmarking weight. In general, the weight of the sample survey is composed of design weight, nonresponse adjustment weight, and benchmarking weight. Design weight is calculated by multiplying response rate with the reciprocal of the extraction rate. In the case of nonresponse weight, weight is calculated under the assumption that the response rates within each class are identical to each other by considering the whole response rate. All p values were two-tailed, and $p < 0.05$ was considered statistically significant.

3. Results

The characteristics of the participants are presented in Table 1. The prevalence of musculoskeletal complaints was 33.06%, and prevalence of musculoskeletal sickness absences was 0.72% due to muscular pain in their upper limbs, lower limbs, or their back. Notable differences were observed in the prevalence rates between the baseline characteristics; older age groups, people working for $>$ 48 h/wk, people working for $<$ 40 h/wk, people who had spent $<$ 5 years in their current job, temporary and day employees, and shift workers had a higher prevalence of musculoskeletal complaints and musculoskeletal sickness absences compared with other subgroups.

Table 1
Prevalence of musculoskeletal disorders by sociodemographic characteristics

Classification	Reference Group		Musculoskeletal Complaints Group			Musculoskeletal Sickness Absence Group		
	$N = 19,310$ (64.99%)	$N = 23,034$ (66.21%)	$N = 10,201$ (34.33%)	$N = 11,501$ (33.06%)	Prevalence rate (%)	$N = 200$ (0.67%)	$N = 252$ (0.72%)	Prevalence rate (%)
	Frequency	Weighted frequency	Frequency	Weighted frequency		Frequency	Weighted frequency	
Gender								
Male	11,882	14,213	5,351	6,176	30.08	113	143	0.70
Female	7,428	8,821	4,850	5,325	37.36	87	109	0.76
Age (y)								
15–24	1,249	1,851	499	644	25.78	2	3	0.11
25–34	5,284	7,129	2,239	2,594	26.55	35	47	0.49
35–44	6,114	6,679	2,975	3,153	31.81	66	80	0.81
45–54	4,225	4,723	2,696	3,067	38.99	61	76	0.96
55–65	2,438	2,653	1,792	2,044	43.11	36	45	0.96
Working hour per week (h)								
> 48 h	1,840	2,169	1,109	1,234	35.97	21	26	0.77
40–48 h	8,202	10,291	3,307	3,941	27.57	52	66	0.46
< 40 h	9,268	10,575	5,785	6,326	37.08	127	159	0.93
Years in current job								
≥ 5 y	10,900	13,470	5,753	6,568	32.55	105	137	0.68
< 5 y	8,410	9,565	4,448	4,934	33.76	95	115	0.78
Employment status								
Regular	15,517	18,801	7,608	8,590	31.16	139	175	0.63
Temporary	2,843	3,134	1,653	1,781	35.92	33	43	0.87
Day-employee	950	1,100	940	1,130	49.92	28	33	1.48
Work size								
< 50	14,174	16,622	7,752	8,472	33.52	143	180	0.71
≥ 50	5,136	6,412	2,449	3,029	31.84	57	72	0.75
Shift work								
Yes	1,772	2,156	1,039	1,226	35.89	28	34	0.98
No	17,538	20,879	9,162	10,275	32.75	172	218	0.69

Table 2 shows the association between the prevalence of comorbid health problems in the Musculoskeletal Complaints Group and Sickness Absence Group. After adjusting for individual and work-related factors, we found that ORs for depression/anxiety disorder and insomnia/sleep disorder were higher than the unadjusted ORs. Depression/anxiety disorder and overall fatigue were 4.6–4.7 times more prevalent in the Musculoskeletal Complaints Group compared with the Reference Group. Insomnia/sleep disorder and injury by accident were 6.1–7.9 times more prevalent in the Sickness Absence Group than in the Reference Group.

Table 3 shows the association between the prevalence of comorbid health problems, musculoskeletal complaints, and sickness absence after adjustment for individual work-related physical and psychosocial factors. When adjusted for individual and work-related physical factors, prevalence of all four comorbid health problems was slightly decreased in both the Musculoskeletal Complaints Group and Sickness Absence Group. The maximum decrease in prevalence was observed for insomnia/sleep disorder.

4. Discussion

Our study findings show that depression/anxiety disorder, insomnia/sleep disorder, overall fatigue, and injury by accident were associated with reported musculoskeletal complaints and sickness absence due to pain in the upper limbs, lower limbs, and back. We can infer that musculoskeletal pain becomes a disease in itself, causing fatigue, depression/anxiety disorder, insomnia/sleep disorder, injury by accident, and other symptoms. Dersh et al [22] reported an increased prevalence of psychiatric disorders in patients with work-related musculoskeletal pain disability. Individual psychosocial factors play a major role in the development, maintenance, and exacerbation of chronic disability of musculoskeletal

Table 2
The association between the occurrence of comorbid health problems in musculoskeletal complaints and sickness absence groups

Variable	Crude odds ratio	95% confidence interval	Odds ratio*	95% confidence interval
Depression and anxiety disorder				
Reference group	1.00	–	1.00	–
Musculoskeletal complaints	4.56	3.49–5.96	4.58	3.46–6.07
Musculoskeletal sickness absence	1.25	0.26–5.92	1.26	0.26–6.00
Insomnia and sleep disorder				
Reference group	1.00	–	1.00	–
Musculoskeletal complaints	2.96	2.43–3.60	3.21	2.62–3.95
Musculoskeletal sickness absence	7.53	4.01–14.11	7.91	4.11–15.25
Overall fatigue				
Reference group	1.00	–	1.00	–
Musculoskeletal complaints	5.00	4.66–5.36	4.69	4.37–5.04
Musculoskeletal sickness absence	3.53	2.41–5.17	3.19	2.15–4.74
Injury by accident				
Reference group	1.00	–	1.00	–
Musculoskeletal complaints	4.02	3.27–4.94	3.54	2.85–4.40
Musculoskeletal sickness absence	7.41	3.45–15.91	6.11	2.80–13.32

* Adjusted age, gender, type of occupation, years in current job, employment status, size of the work, and shift work.

Table 3
The association between the occurrence of comorbid health problems, musculoskeletal complaints, and sickness absence after adjusting for individual work-related physical and psychosocial factors

Variable	Odds ratio*	95% confidence interval	Odds ratio†	95% confidence interval
Depression and anxiety disorder				
Reference group	1.00	–	1.00	–
Musculoskeletal complaints	4.43	3.32–5.91	4.06	3.04–5.44
Musculoskeletal sickness absence	1.18	0.25–5.67	0.93	0.19–4.47
Insomnia and sleep disorder				
Reference group	1.00	–	1.00	–
Musculoskeletal complaints	3.10	2.52–3.82	2.89	2.34–3.57
Musculoskeletal sickness absence	7.24	3.71–14.12	5.93	3.06–11.50
Overall fatigue				
Reference group	1.00	–	1.00	–
Musculoskeletal complaints	4.50	4.18–4.83	4.34	4.04–4.67
Musculoskeletal sickness absence	2.91	1.93–4.39	2.58	1.70–3.91
Injury by accident				
Reference group	1.00	–	1.00	–
Musculoskeletal complaints	3.32	2.67–4.12	3.17	2.55–3.95
Musculoskeletal sickness absence	5.47	2.51–11.93	4.89	2.26–10.61

* Adjusted age, gender, type of occupation, years in current job, employment status, size of the work, shift work, and work intensity.
† Adjusted age, gender, type of occupation, years in current job, employment status, size of the work, shift work, work intensity, and job satisfaction.

disorders [23]. Another study reported that musculoskeletal disease and depression increase the likelihood of disability pension [24].

Our results showed that there are differences between the Musculoskeletal Complaints Group and the Sickness Absence Group in terms of accompanying health problems. Overall fatigue and depression/anxiety disorder are more prevalent in the Musculoskeletal Complaints Group than in the Sickness Absence Group and Reference Group. Work-related fatigue is assumed when there is insufficient opportunity to recover from regular work exertions, which leads to subjective complaints such as depression, psychosomatic complaints, emotional exhaustion, and weakening health over the long term [25–27]. A Swedish study reported an equivalent increase in fatigue and sick-leave days between 1993 and 1999 and a lower prevalence of fatigue and anxiety among younger people with a high number of sick-leave days [28]. A substantial increase in the number of people taking sick leave due to mental disorders has been reported in some countries in the past few decades [29,30]. Depression, fatigue, or stress may increase the risk of sickness absence [31,32]. Work-related fatigue or subjective complaints, (e.g., depression and mental disorders), can be reduced with sickness absence or paid vacations; however, sickness absence may not be an appropriate solution for many health problems. Our results also showed that the Sickness Absence Group overall had higher fatigue and depression complaints than the Reference Group. Therefore, to decrease comorbid health symptoms, (e.g., overall fatigue and depression), it is necessary to use an integrated approach that addresses various physical, psychological, and social functioning (i.e., increasing aerobic fitness [33] and decreasing work-related stress and job demands [34,35]).

In the Sickness Absence Group, there was a higher risk for insomnia/sleep disorder and injury by accident compared with the Musculoskeletal Complaints Group and Reference Group. Some studies indicate that work-related sleep disturbances lead to sickness absence, but it is also possible that worries about work or other consequences during sickness absence may lead to sleep disturbances, which could in turn prevent employees from returning to work. There is also a cultural tendency to blame health problems on work [28,36]. Of the four comorbid health problems examined, the prevalence of insomnia/sleep disorder decreased the most, after adjusting for physical and job satisfaction factors. Sleep disorders may indeed be a mediator between work-related factors and psychological factors, and further research is required to clarify the relationship between sleep disturbances and sickness absence.

The primary reasons why MSD complaints showed higher impacts on depression and overall fatigue than MSD sickness absence could be explained by the lack of exercise therapy and the lack of appropriate return-to work programs.

Fear of movement and injury is a particular characteristic of patients with musculoskeletal disorders [37]. Avoiding daily activities may finally result in functional disability and the so-called “disuse syndrome”, involving both physical deconditioning and mood disturbances such as irritability, frustration, and depression [17]. We note that physical and psychosocial factors such as work time, work intensity, and job satisfaction play a role in modulating (buffer) in logistic models.

Musculoskeletal pain, avoidance due to fear, and disuse are known to be associated with injury and reinjury [38]. Steps such as early accurate identification of injured workers at high risk for chronic disability and early intervention for these workers may have an enormous positive impact in preventing the overwhelming financial and individual, (e.g., quality of life), expenses of disability [39].

The differences in health problems may be explained by absence from work. A better understanding of the differences in musculoskeletal complaints and musculoskeletal sickness absence is essential and will contribute to the effectiveness of intervention programs.

Our results support the findings of previous research that high physical and psychosocial activity levels were associated with musculoskeletal complaints and sickness absence [34,35]. Our study demonstrated that physical and psychosocial factors were associated with comorbid health problems seen with work-related MSD. Decreasing working hours, avoiding tight deadlines, and higher job satisfaction may be important to prevent work-related MSD. The results of our study imply that primary prevention strategies (aimed at minimizing the risks of the occurrence of symptoms of work-related musculoskeletal complaints) and secondary prevention strategies (aimed at reducing the comorbid health problems associated with work-related musculoskeletal disorders) may need to address different sets of risk factors. Because multiple questions of the Korean Working Conditions Survey are derived from the EWCS and Labour Force Survey in the U.K., the baseline period is different. We used the “12 months of MS complaints” as a baseline period defined by the Eurofound EWCS, while employing another baseline period (17 months of MS sickness absence) from the Labour Force Survey in the U.K. Thus, convenience sampling may occur in the statistical estimation process due to the different

baseline periods. However, these differences do not significantly affect beta coefficients in a logistic model where MSD is a main influencing factor in depression/anxiety disorder, insomnia/sleep disorder, fatigue and injury by accident.

Our study had its strengths as well as limitations. A strength of this study is that the study population was not concentrated to a particular workplace or locale, but was representative of the working population of Korea. Our results support promoting a coordinated or integrated approach to the control of comorbid health problems accompanying MSD. To reduce MSD and comorbid health problems, it is clear that improvement in the psychosocial work environment and large-scale organizational changes are required. Multiple health indicators can improve with a health-motivated, multifaceted program designed to promote institutional change. Our study results suggest that using preventive strategies may reduce MSD, as well as comorbid health problems. There are also several potential limitations in our study. Firstly, our study was cross-sectional; thus, the possibility of reversed causality cannot be ruled out. The musculoskeletal complaints and sickness absence may affect the experience of overall fatigue, depression/anxiety, insomnia/sleep disorder, and injury by accident. Such reversed causality between comorbid symptoms and MSD is a possible explanation for the observed associations. Further research should examine prospective data to determine whether MSD leads to increased comorbid symptoms and may use the results of this study as a baseline. Secondly, the comorbid health problems examined were necessarily broad measures, as were many of the individual covariates. The health outcomes related to work were dichotomized. The health problem indicators were measured by very simple and broad indicators. Therefore, we analyzed health outcomes using indicators of musculoskeletal sickness absence, since sickness absence was more specific than musculoskeletal complaints. In the future, researchers should consider including more specific indicators such as professional diagnosis and symptoms.

In conclusion, employees with musculoskeletal complaints and sickness absence were more likely to have comorbid depression/anxiety disorder, insomnia/sleep disorder, overall fatigue, and injury by accidents. Overall fatigue and depression/anxiety disorder were seen more often in the Musculoskeletal Complaints Group than in the Sickness Absence Group and Reference Group. Insomnia/sleep disorder and injury by accident were seen more often in the Sickness Absence Group than in the Musculoskeletal Complaints Group and Reference Group. For management of musculoskeletal complaints and sickness absence in the workplace, differences in health problems between employees with musculoskeletal complaints and those with sickness absence as well as the physical and psychological risk factors should be considered.

We found that physical and psychosocial factors such as work time, work intensity, and job satisfaction play a buffer role that reduces comorbid health problems.

Conflicts of interest

The authors declare that there are no conflicts of interests regarding the publication of this article.

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