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Occupation-Specific Associations Between Psychosocial Stress and Low Back Pain Among Healthcare Workers: Evidence from Japan's Mandatory Stress Check Program

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Abstract

Low back pain (LBP) is a common occupational health problem among healthcare workers. While physical demands are known to contribute to LBP, few large-scale studies have investigated the contribution of psychosocial stressors. This study examined the association between occupational LBP and stress-related factors at a university hospital in Japan. In this cross-sectional study, we analyzed responses to the Brief Job Stress Questionnaire administered to 2,450 staff members. Participants were categorized into LBP and non-LBP groups. The prevalence of LBP and high stress was compared by occupation. Multivariable logistic regression analysis was performed to identify factors independently associated with LBP. The overall prevalence of frequent LBP was 29.1%, being highest in nurses (39.3%) and lowest in doctors (11.1%). The odds ratio for LBP in nurses versus doctors was 3.54 (95% confidence interval 2.22–5.63). High stress status was more common in the LBP group than in the non-LBP group (25.1% versus 6.9%). Multivariate analysis showed that subjective physical workload, interpersonal stress in the workplace, physical fatigue, depressive symptoms, support from supervisors, work/life satisfaction, and body mass index were independently associated with LBP. These findings provide epidemiological evidence that both physical and psychosocial stressors are associated with occupational LBP among healthcare workers.

Introduction

Low back pain (LBP) is one of the most common occupational health problems in the healthcare setting, with a reported 12-month prevalence ranging from 15% to 64% in developed countries and even higher in developing regions [(1)]. Nurses are the healthcare workers with the highest incidence of LBP, with evidence indicating that up to 82% of nurses experience LBP at some point in their lifetime [(2)]. LBP among healthcare workers not only impairs their quality of life and ability to perform professional duties but also leads to absenteeism and a high job turnover rate. It also has a negative impact on healthcare delivery and is costly in terms of treatment and worker compensation.

Traditionally, physical factors such as prolonged standing, frequent handling and lifting of patients, and performing tasks while in awkward postures have been regarded as the primary contributors to LBP among healthcare workers. Accordingly, many countries have implemented preventive measures, including training programs on safe patient handling and the introduction of assistive devices. In recent years, increasing attention has been focused on the influence of psychosocial factors on the onset and chronicity of LBP. Psychosocial stressors, such as interpersonal conflict in the workplace, excessive job stress, dissatisfaction with work, and burnout have been identified as potential risk factors for musculoskeletal disorders, including LBP [(3)]. Furthermore, high workload, increased occupational stress levels, and lack of social support in the workplace have been reported to contribute to development of chronic LBP, underscoring the need to address psychological and social aspects alongside physical factors when considering the mechanisms of LBP [(4)].

However, few large-scale studies have comprehensively assessed both the psychological and social factors that contribute to occupational LBP. Moreover, data on the relationship between occupational stress and LBP in healthcare workers are scarce, particularly in Japan.

Since 2015, workplaces in Japan with more than 50 employees have been legally required to perform annual stress checks, institutionalizing the assessments of mental health and workplace-related stress factors [5]. In this study, we examined the relationship between occupational LBP and stress among healthcare workers at a Japanese university hospital using large-scale data obtained as part of a nationwide stress check program.

Methods

Study Design and Participants

This cross-sectional observational study analyzed the responses to the Brief Job Stress Questionnaire (BJSQ) (Supplementary Table 1) administered to all working staff at a medical university with its affiliated hospital in Tokyo, Japan, during a stress check in 2022 [6, 7]. This annual stress check is mandated under the Industrial Safety and Health Act. The questionnaire consists of 57 items and evaluates workplace stress factors and workers' health responses. It covers stress-related factors, including job demands and job control, physical and psychological stress reactions such as fatigue and depressive symptoms, and social support from supervisors and colleagues.

The study protocol was approved by the ethics committees of the Institute of Science Tokyo (approval number I2024-103). All procedures were performed in accordance with the ethical standards of the institutional and national research committee and with relevant guidelines and regulations. The study was conducted in accordance with the principles of the Declaration of Helsinki and its later amendments. As this study was a retrospective study based on existing information, we obtained informed consent via an opt-out approach, providing participants with the opportunity to decline participation by posting posters in the institution and on the websites of the institution. Participants who did not undergo stress testing and annual health checkups, those who declined to participate in the study, individuals under 20 or over 70 years of age, and those not employed as healthcare professionals, researchers, faculty, or administrative staff were excluded. All data were processed/pseudonymized/anonymized by removing information regarding names, gender, and working places, and age was grouped into broad age categories to create a pooled database, which was subject to statistical analyses.

Outcome Measures

The primary outcome measures were the presence of LBP and stress scores. The presence of LBP was assessed using item 40 ("I have had lower back pain during the past month") in the physical stress response domain of the BJSQ. Responses were recorded on a four-point Likert scale as follows: (1)

“Almost never,” (2) “Sometimes,” (3) “Often,” or (4) “Almost always.” For this study, a response of 3 or 4 was classified as “LBP present”.

A high stress classification was determined according to the BJSQ scoring guidelines using the raw score conversion method. Each stress domain score was calculated from the corresponding questionnaire items according to the raw score conversion table and subsequently transformed into a stress assessment score (Supplementary Table 2).

Participants were classified as “high stress” if they met either of the following conditions: (1) a total stress assessment score on subscale B (stress response) of ≤ 12 points or (2) a total stress assessment score on subscales A (job stressors) and C (social support) of ≤ 26 points and a total subscale B score of ≤ 17 points.

Participants were then divided into two groups based on the presence or absence of LBP for intergroup comparisons. For a more detailed analysis of stress factors and to maintain anonymity, we extracted the following nine specific subscales with high clinical relevance to LBP: A1 (psychological job demand), A3 (subjective physical workload), A4 (interpersonal stress in the workplace), A6 (job control), B3 (physical fatigue), B5 (depressive symptoms), C1 (support from supervisors), C3 (support from family and friends), and D (work/life satisfaction). Lower scores on these subscales indicated higher levels of stress.

Statistical Analysis

First, the overall prevalence of LBP and the proportion of employees classified as having high stress were calculated as percentages and compared across occupational categories. Next, the proportion (percentage) of employees with high stress was calculated separately for those with and without LBP, and the mean score for each stress subscale was compared between the two groups. The results were compared according to occupational category using chi-squared tests, and stress scores were compared between groups using the Mann–Whitney U test.

Multivariable logistic regression analysis was performed to identify factors that were independently associated with the presence of LBP. The dependent variable was the presence or absence of LBP, and independent variables included the nine stress-related subscales, age group, body mass index (BMI), and occupation. BMI is measured during an annual health checkup. A backward stepwise selection procedure based on the Wald test was applied, whereby variables with a p-value of > 0.10 were sequentially removed from the model. The variables that remained were included in the final multivariable logistic regression model. The results of the logistic regression analysis are expressed as odds ratios (ORs) with 95% confidence intervals (CIs). All statistical analyses were performed using EZR version 1.68 [(8)]. A *p*-value of < 0.05 was considered statistically significant.

Results

Among the 3,856 individuals eligible for the stress check, 2,883 (74.8%) completed the stress check. Following the application of exclusion criteria, 2,450 individuals were included in the study.

The respondents included 235 doctors, 661 nurses, 356 allied health professionals, 93 dentists, 540 researchers, and 565 clerical staff.

Prevalence of low back pain and occupational differences

The overall prevalence of LBP was 29.1% (n = 713). By occupation, the prevalence was lowest in doctors (11.1%) and highest in nurses (39.3%) (Table 1, Fig. 1). The prevalence of LBP was also above the overall average among allied health professionals (31.2%) and clerical staff (30.3%), albeit not as high as that in nurses. The differences in prevalence among the various occupational groups were statistically significant (chi-squared tests, $p < 0.001$).

Table 1
Prevalence of low back pain and high stress by job category

Job category	All participants	With LBP (score 3 or 4)	Without LBP (score 1 or 2)	With high stress	With LBP and high stress
Total	2,450	713 (29.1)	1,737 (70.9)	298 (12.2)	179 (60.1)
Doctor	235	26 (11.1)	209 (88.9)	15 (6.4)	3 (20.0)
Researcher	540	118 (21.9)	422 (78.1)	38 (7.0)	16 (42.1)
Dentist	93	27 (29.0)	66 (61.0)	13 (14.0)	7 (53.8)
Clerical staff	565	171 (30.3)	394 (69.7)	85 (15.0)	53 (62.4)
Allied health professional	356	111 (31.2)	245 (68.8)	45 (12.6)	26 (57.8)
Nurse	661	260 (39.3)	401 (60.7)	102 (15.4)	74 (72.5)

Note. Data are shown as the number (percentage). LBP, low back pain

Distribution of individuals with high stress

Next, we examined the proportion of employees classified as having high stress (i.e., having high risk of mental health issues) according to the Ministry of Health, Labor and Welfare criteria. The overall proportion of participants with high stress was 12.2%. Among those identified as having high stress, the

prevalence of LBP was lowest among doctors (20.0%) and highest among nurses (72.5%) (Table 1, Fig. 1).

Group comparisons based on presence of LBP

Respondents were stratified based on the presence or absence of LBP, and Mann-Whitney U test was performed to compare the proportion of participants with high stress and the mean stress scores in each group. The proportion of respondents who reported having high stress was significantly greater in the LBP group than in the non-LBP group (25.1% versus 6.9%, chi-squared tests, $p < 0.001$) (Fig. 2). This indicates that employees with LBP were more likely to be under a considerably high level of stress. Stress assessment scores for all subscales were significantly lower in the LBP group than in the non-LBP group (Mann-Whitney U test, $p < 0.001$, Fig. 3), indicating that employees with LBP were in higher stress states across multiple domains, including job stressors, stress reactions, social support, and work/life satisfaction. The findings for each domain were as follows.

Job stressor subscales

These subscales included A1 (psychological job demands), A3 (subjective physical workload), A4 (interpersonal stress in the workplace), and A6 (job control). Employees with LBP scored significantly lower for all these items, indicating greater physical and psychological burden, higher interpersonal stress, and lower perceived job control.

Physical and psychological stress reaction subscales

The LBP group had significantly lower scores on these subscales, which included B3 (physical fatigue) and B5 (depressive symptoms). These scores reflect not only greater physical fatigue but also higher levels of depressive symptoms.

Social support and satisfaction subscales

These subscales included C1 (support from supervisors), C3 (support from family and friends), and D (work/life satisfaction). Employees with LBP had significantly lower scores on all of these items, suggesting reduced perceived support from supervisors, family, and friends, as well as less overall satisfaction with work and daily life.

Logistic regression analysis for associated factors

A multivariable logistic regression analysis was performed to identify factors that were independently associated with the presence of LBP. LBP status was used as the dependent variable and age group, BMI, occupation, and stress subscale scores as independent variables. A backward stepwise selection procedure was applied using a criterion of $p > 0.10$ for removal to avoid overfitting and to retain variables most strongly associated with LBP. Variables that remained after stepwise selection were entered into

the final multivariable model (Table 2). Given that lower BJSQ subscale scores indicate higher levels of stress, ORs below < 1 indicate that higher stress levels are associated with increased odds of low back pain.

Table 2
Results of logistic regression analysis of factors associated with low back pain

Variable	**OR**	**95% CI**	***p*-value**
Age group	1.01	0.998–1.02	0.145
Body mass index	1.03	1.01–1.06	< 0.001**
Stress assessment scores			
A3 Subjective physical workload	0.80	0.72–0.88	< 0.001**
A4 Interpersonal stress in the workplace	0.87	0.78–0.98	0.023*
B3 Physical fatigue	0.61	0.54–0.70	< 0.001**
B5 Depressive symptoms	0.83	0.74–0.93	0.0012*
C1 Support from supervisors	1.10	1.00–1.24	0.049*
D Work/life satisfaction	0.87	0.76–0.99	0.032*
Job category			
Doctor	1.00 (reference)		
Researcher	2.16	1.33–3.51	0.002*
Dentist	2.3	1.22–4.35	0.010*
Clerical staff	3.38	2.11–5.42	< 0.001**
Allied health professional	2.81	1.73–4.57	< 0.001**
Nurse	3.54	2.22–5.63	< 0.001**
Note. *p < 0.05. **p < 0.001. CI, confidence interval; OR, odds ratio			

The final analysis identified BMI, occupation, and several stress-related factors, namely, A3 (subjective physical workload), A4 (interpersonal stress in the workplace), B3 (physical fatigue), B5 (depressive symptoms), C1 (support from supervisors), and D (work/life satisfaction), as independent factors that were significantly associated with LBP. The results were as follows:

- subjective physical workload (A3), OR 0.80, 95% CI 0.72–0.88, $p < 0.001$;
- interpersonal stress in the workplace (A4), OR 0.87, 95% CI 0.78–0.98, $p = 0.023$;
- physical fatigue (B3), OR 0.61, 95% CI 0.54–0.70, $p < 0.001$;
- depressive symptoms (B5), OR 0.83, 95% CI 0.74–0.93, $p = 0.0012$;

- support from supervisors (C1). OR 1.1, 95% CI 1.00–1.24, $p = 0.049$;
- work/life satisfaction (D), OR 0.87, 95% CI 0.76–0.99, $p = 0.032$;
- BMI, OR 1.03, 95% CI 1.01–1.06, $p < 0.001$.

For occupational categories, using doctors (OR 1.0) as the reference group, the following results were obtained:

- nurses, OR 3.54, 95% CI 2.22–5.63, $p < 0.001$;
- allied health professionals, OR 2.81, 95% CI 1.73–4.57, $p < 0.001$;
- dentists, OR 2.30, 95% CI 1.22–4.35, $p = 0.010$;
- researchers, OR 2.16. 95% CI 1.33–3.51, $p = 0.002$;
- clerical staff, OR 3.38, 95% CI 2.11–5.42, $p < 0.001$.

Both physical factors (including self-perceived physical workload and BMI) and psychosocial factors (such as interpersonal stress, fatigue, depressive symptoms, support from supervisors, and work/life satisfaction) were identified to be independent risk factors for LBP. Moreover, occupation itself was an independent factor, with the odds of experiencing LBP being significantly higher in nurses and clerical staff than in doctors.

Discussion

This study investigated the relationship between stress factors and LBP among healthcare workers at a university hospital, using a cross-occupational approach and data from a legally mandated stress check system. Its findings revealed a clear trend whereby employees with LBP consistently had poorer stress-related indicators across multiple domains. These findings indicate that hospital employees with LBP tend to experience heightened physical and psychological stress and are likely to have negative perceptions of their workplace environment, including interpersonal relationships. Multiple stress-related factors, including self-perceived physical workload, interpersonal stress at work, fatigue, depressive symptoms, support from supervisors, and work/life satisfaction, along with BMI and occupational category, were identified as independent factors associated with LBP. These results suggested that psychosocial stress, in addition to physical factors, plays a significant role in the onset and exacerbation of LBP. LBP is inherently a multifactorial condition and closely associated with daily lifestyle habits and working posture. A cross-sectional study in Japanese adults found that smoking, alcohol consumption, BMI, and dyslipidemia were significantly associated with the prevalence of LBP [(9)]. In a study of manufacturing workers, the prevalence of LBP was 20.0% among those engaged in standing work and 15.1% among those engaged in sedentary work. Moreover, the distribution of Roland–Morris Disability Questionnaire scores among standing workers was found to be different from that in the general population, suggesting an association between tasks that require prolonged standing and LBP [(10, 11)].

Several previous studies have investigated the association of stress with LBP in healthcare workers. Sembajwe et al. performed a cross-sectional survey of more than 1,500 employees at two hospitals in the United States in 2013 and found that those engaged in highly psychologically demanding work reported a higher prevalence of musculoskeletal pain in multiple body regions, including LBP [12]. Other researchers have found that a wide range of social and psychological factors have a strong influence on the development of chronic LBP, with occupational factors such as employment type, job dissatisfaction, work attitudes, and lack of social support in the workplace being associated with chronic pain [13, 14, 15, 16]. A prospective cohort study by Vinstrup et al. [17], which followed 1,944 healthcare workers in Denmark over one year, demonstrated that individuals with higher baseline stress levels had significantly greater odds of reporting LBP one year later. Using the Perceived Stress Scale, the odds of experiencing LBP increased by 1.4-fold in the moderate stress group and by approximately two-fold in the high stress group when compared with the low stress group. Notably, even among individuals without LBP at baseline, high stress levels were associated with a significantly increased risk of new-onset LBP, suggesting a bidirectional relationship between stress and LBP. In terms of the association with psychological status, Tetsunaga et al. found that approximately 80% of patients with LBP reported depressive symptoms and that there were significant associations of more severe depression with increased pain intensity and higher levels of disability [18]. The findings of our present study also highlight the significant role of psychosocial factors in the development and persistence of LBP.

A noteworthy finding in our study was the high burden of LBP among nurses. Nurses have long been recognized as a high-risk occupational group for LBP. Approximately 40% of our nurses reported frequent LBP, having a 3.5-fold higher risk compared with physicians. Several factors may explain this higher risk. A cohort study by Hoogendoorn et al. demonstrated that frequent trunk flexion and rotation and lifting of heavy objects more than doubled the risk of needing sick leave because of LBP [19, 20]. Nurses routinely engage in physically demanding tasks such as patient transfers and repositioning, and these activities likely serve as direct physical stressors contributing to LBP. Psychosocial factors related to the work environment may also play a critical role. The hierarchical structure and power imbalance within healthcare settings often deprive nurses of sufficient authority in terms of decision-making regarding patient care and treatment, creating a sense of limited personal and professional autonomy. According to the demand–control–support model, a combination of high job demands and low job control has been shown to adversely affect workers' health [21, 22]. A lack of control has also been reported to predict harmful outcomes such as disability-related job loss, suicide attempts, and even mortality [23, 24]. According to Siegrist's effort–reward imbalance model, an imbalance between high effort and insufficient reward, whether in terms of recognition, support, or career advancement, has been associated with chronic stress responses and musculoskeletal disorders [25]. In an occupational analysis of healthcare workers, nurses were found to have the highest effort–reward imbalance, whereas psychotherapists and doctors tended to report lower levels of effort–reward imbalance [26]. Xie et al. reported that approximately 74.8% of nurses had a demand/control ratio greater than 1, and 27.4% had an effort/reward ratio greater than 1, indicating that nurses are frequently exposed to environments

characterized by high demands, low control, and an imbalance between effort and reward [27]. Choobineh et al. similarly reported that nurses experience high psychological demands in the workplace with limited latitude regarding decision-making and inadequate social support and that this effort–reward imbalance significantly increased the risk of LBP [28]. These findings suggest that nursing tends to be characterized by higher demands and lower control in comparison with the work of doctors, which may in turn place nurses at greater risk for stress-related conditions and health problems such as LBP. Furthermore, shift work with night duties, irregular rest periods, and chronic understaffing often lead to excessive workloads and significant occupational stress, predisposing nurses to mental exhaustion [20]. Increasing attention is being focused on circadian rhythms related to work schedules. Chronotype, which reflects an individual's optimal period of physiological and behavioral activity within the circadian cycle, has been reported to be closely associated with sleep and mental health [29, 30]. In a large-scale study of Japanese civil servants, the prevalence of LBP was higher among individuals with an evening chronotype than with those with a morning chronotype, with a significantly elevated adjusted OR of 1.46 [31]. Night shifts and rotating schedules have been strongly associated with poor sleep quality in nurses, and an evening chronotype has been independently associated with an increased risk of sleep disorders [32]. These findings suggest that nurses are particularly prone to disruptions in sleep–wake rhythms as a consequence of night work, which may contribute to increased stress levels and a higher likelihood of developing LBP. Overall, these findings suggest that, in addition to physical workload, limited scope for decision-making, inadequate social support, and stressful working conditions act synergistically as psychosocial stressors, thereby increasing the risk of LBP among nurses.

Previous studies across various countries have consistently reported high prevalence rates of LBP among nurses, identifying both job-related physical factors (e.g., posture and workload) and psychological factors (e.g., mental fatigue and stress) as significant contributors [2, 20, 33, 34]. The present findings similarly highlight that nurses working in university hospitals in Japan have a markedly elevated risk of LBP.

Among the other occupational groups, sedentary roles such as clerical and research positions are also significant risk factors for LBP, primarily because of prolonged sitting and insufficient physical activity. A study by Bin Ahmed et al. in Saudi Arabia found that the prevalence of LBP among office workers reached approximately 60%, with obesity, sleep disturbances, years of desk work, and frequent work-related stress identified as independent risk factors [35]. For other allied health professionals, such as physical therapists and radiology technologists, researchers have identified the risk of LBP to be high because of physically demanding tasks, including assisting with rehabilitation exercises and handling heavy equipment [36]. In our study, the prevalence of LBP was high among allied health and clerical staff, with rates exceeding 30%.

Overall, the results of this study underscore the close relationship between occupational LBP and stress and highlight the importance of workplace stress assessments, such as the stress check system, not

only for identifying individuals at risk of LBP but also for monitoring and addressing broader stress-related health concerns among healthcare workers.

Limitations

This study had a cross-sectional in design and included healthcare workers who completed the stress check questionnaire. Among 3,856 eligible participants, valid responses were obtained from 2,883 (response rate, 74.8%), which provided a sufficiently large sample for analysis. However, we could not establish a causal relationship between LBP and stress. The participation rate varied depending on the job category. For example, the participation rate among doctors was low. It has been pointed out that the low participation rate may be related to stress issues, which may reduce the clarity of its association with LBP [37]. In addition, stress check assessment is based on a self-reported questionnaire, which has the potential for underestimation or overestimation of stress levels because of individual response biases. Additionally, low back pain was assessed using a single self-reported item, which may not fully capture pain severity or clinical diagnosis. Furthermore, because the questionnaire item regarding LBP inquires only about the frequency of subjective pain symptoms, information on the intensity, nature, and underlying etiology of the pain could not be obtained. For confidentiality reasons, detailed individual-level data (e.g., years of employment, medical history) were not available for analysis. Therefore, other potential risk factors for LBP, such as exercise habits and detailed job responsibilities, could not be fully adjusted for. Therefore, the observed association between LBP and stress may be influenced by residual confounding factors.

Future studies should aim to integrate stress check data with health examination and medical records, enabling multicenter longitudinal analyses that capture more detailed aspects of LBP, including its severity, characteristics, and associated diagnoses. However, a major strength of this study is the use of institution-wide mandatory stress check data, which minimizes sampling bias and enables cross-occupational comparison in a real-world clinical setting.

Conclusion

Occupational low back pain among healthcare workers is independently associated with both physical workload and psychosocial stressors after adjustment for occupation and body mass index. These findings highlight the need for preventive strategies that incorporate stress management and organizational interventions alongside conventional ergonomic approaches, particularly for high-risk occupational groups at higher risk, such as nurses and clerical staff.

Declarations

Competing interests

The authors declare no competing interests

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Author Contribution

T.Ni., T.H., M.K., R.T., T.T., T.Na., M.M., and H.N. contributed to conceptualization.T.Ni., T.H., N.K., M.K., M.H., N.H., and R.T. contributed to formal analysis.T.Ni., T.H., M.H., and Y.T. contributed to investigation.T.Ni., T.H., T.T., and T.Nk. contributed to methodology.T.Y., N.F., and S.O. contributed to supervision.T.Ni. and T.H. drafted the original manuscript.All authors contributed to writing, reviewing, and editing, and approved the final manuscript.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Figures

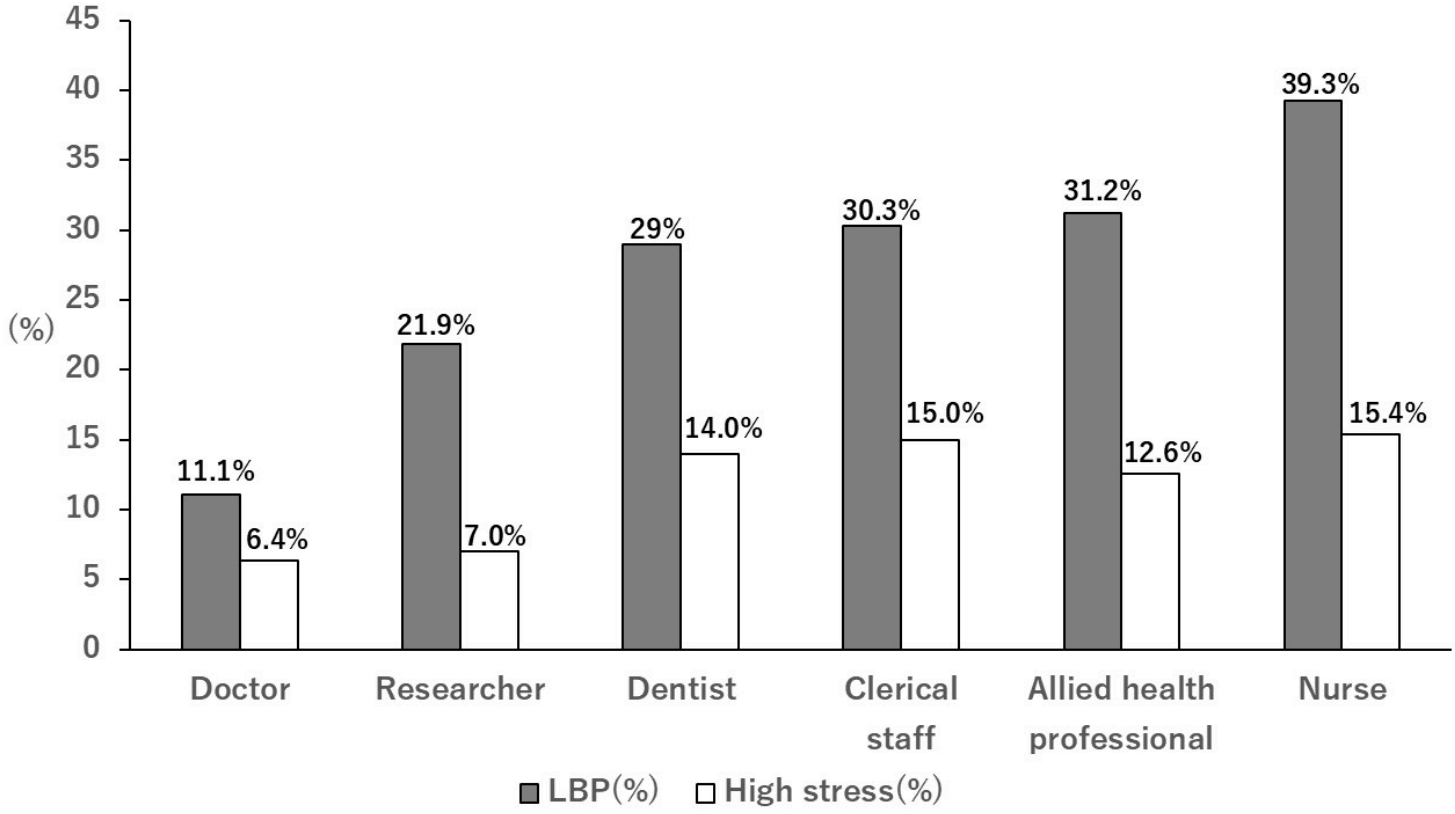


Figure 1

Prevalence of low back pain and of high stress by job category

Note. LBP, low back pain

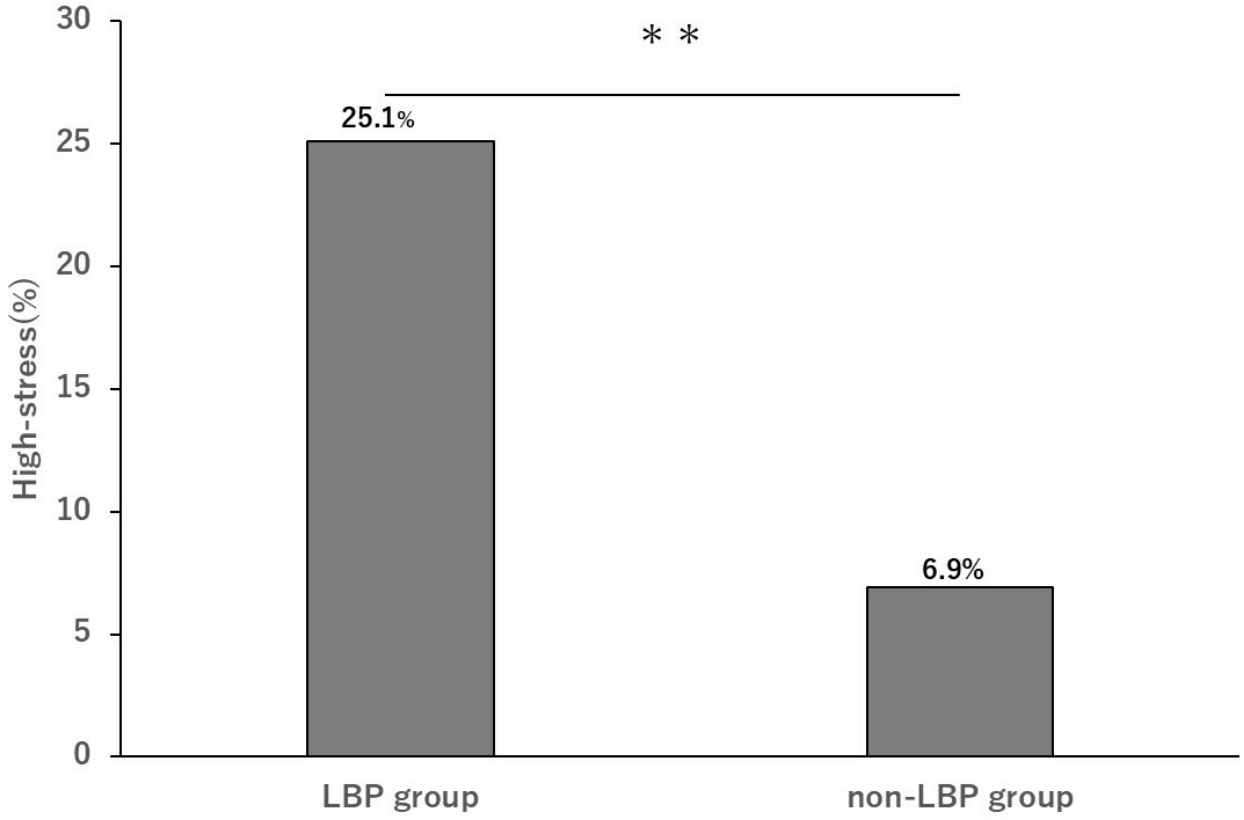


Figure 2

Prevalence of high stress in respondents according to LBP status

Note. ***p*< 0.001. LBP, low back pain

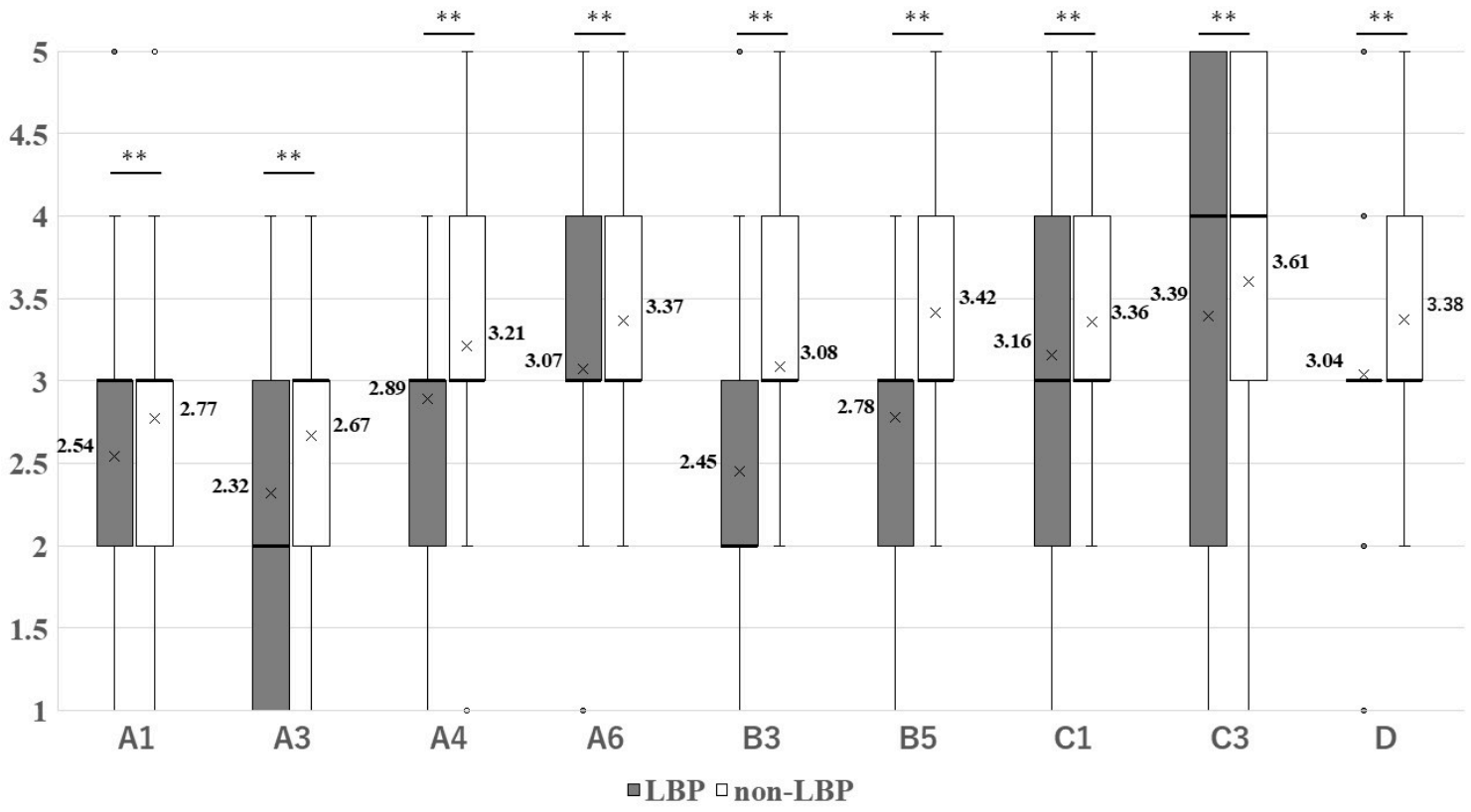


Figure 3

Comparison of stress assessment scores according to LBP status

Note. Mann-Whitney U test, ***p*< 0.001. LBP, low back pain

Supplementary Files

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