Somatic Symptoms as Stress Responses among Japanese Workers Measured by the Brief Job Stress Questionnaire

メタデータ	言語: English 出版者: OSAKA CITY MEDICAL ASSOCIATION 公開日: 2022-08-29 キーワード (Ja): キーワード (En): Physiological stress response, Psychological stress response, Occupational stress, Somatic symptom, Brief Job Stress Questionnaire 作成者: 門脇, 彩, 岩崎, 進一, 出口, 裕彦, 三武, 友絵, 奥田, 優香子, 仁木, 晃大, 広田, 知行, 白濱, 嘉樹, 中道, 陽子, 井上, 幸紀 メールアドレス: 所属: Osaka City University, Osaka City University, Osaka City University, Osaka City University, Osaka City University, Osaka City University, Osaka City University, Osaka City University, Osaka City University, Osaka City University
URL	https://ocu-omu.repo.nii.ac.jp/records/2020374

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Citation	Osaka City Medical Journal. 68(1); 11-18
Issue Date	2022-06
Type	Journal Article
Textversion	Publisher
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Placed on: Osaka City University

AYA KADOWAKI, SHINICHI IWASAKI, YASUHIKO DEGUCHI et al. Somatic Symptoms as Stress Responses among Japanese Workers Measured by the Brief Job Stress Questionnaire. *Osaka City Medical Journal*. 2022, 68, 1, 11-18.

Osaka City Med. J. Vol. 68, 11-18, 2022

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Abstract

Background

Occupational stressors cause physiological stress responses representing somatic symptoms and psychological stress responses such as a depressive mood and anxiety. However, few studies have investigated factors related to workers' physiological stress responses. Thus, this study examined the factors associated with stress-related somatic symptoms among Japanese workers.

Methods

Data were collected from 18513 Japanese public servants through the Brief Job Stress Questionnaire (BJSQ) in 2017, which was developed based on the National Institute for Occupational Safety and Health (NIOSH) stress model. Factors predicting higher physiological stress responses among demographic variables (sex and age), work-related variables (job title and job category), psychological stress responses, and two BJSQ factors (occupational stressors and social support) were identified using multiple linear regression analysis.

Results

After adjusting for demographic and work-related variables, higher psychological stress responses, being female, and being older were associated with having higher physiological stress responses. A higher score on psychological stress responses was the most potent factor. Neither greater occupational stressor nor lower social support was associated with a higher score of physiological stress responses when confounding was reduced.

Conclusions

Efforts should be made to identify employees' psychological stress responses in order to reduce workers' stress-related somatic symptoms.

Key Words: Physiological stress response; Psychological stress response; Occupational stress; Somatic symptom; Brief Job Stress Questionnaire

Received September 1, 2021; accepted November 30, 2021.

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Introduction

Work-related stressors are widely known as major risk factors for physical and mental health problems among workers. For instance, burnout[1] is a well-known syndrome of exhaustion and disinterest typically in the work context, which can result in various negative effects such as anxiety, depression, and increased health problems[2]. In the meta-analysis by Alarcon[3], several studies have showed an association between workload and negative physical and psychological health outcomes. Other prospective studies suggested that high job demands, low job control, low co-worker support, low supervisor support, low procedural justice, low relational justice, and a high effort-reward imbalance predicted the incidence of stress-related diseases[4]. Limited to physical symptoms, research showed that most psychosocial stressors had small but significant lagged effects on the development of musculoskeletal problems, especially highly monotonous work and lower back pain[5]. The longitudinal and cross-sectional results from another meta-analysis provided some evidence of temporal consistency of the occupational stressor and physical symptom relationship[6].

According to the occupational stress model proposed by the National Institute for Occupational Safety and Health (NIOSH)[7], occupational stressors bring physiological stress responses which constitute somatic symptoms and psychological stress responses such as a depressive mood and anxiety. These stress responses are influenced by several factors such as individual (e.g., age, sex, and personality), non-work (e.g., domestic and family demands), and buffer factors (e.g., social support from supervisors, co-workers). Above all, somatic symptoms such as abdominal discomfort and musculoskeletal pain are frequent among the working population, as past studies have shown that nearly 80% of people have complaints about their health[8,9]. Somatic symptoms have a significantly negative impact on individuals and companies in the long term. They are a substantial cause for physician visits, multiple medical examinations, working disability, and other consequences with considerable socioeconomic impact[10]. Regarding occupational outcomes, high somatic symptom severity was a determinant of prolonged sick leave, prolonged disability, and health-related job loss[11]. In addition, compared to psychological stress responses such as depressive mood and anxiety, research on physiological stress response is scant, and there is no standard coping method that can be prescribed to both companies and individuals[12], which may make coping with it more difficult.

Despite the increasing number of workers in Japan who suffer from somatic symptoms[13], few studies have investigated the factors related to workers' somatic symptoms. Many questionnaires were developed to evaluate workers' occupational stress, including the Brief Job Stress Questionnaire (BJSQ)[14]. This questionnaire was based on the NIOSH occupational stress model mentioned above[7] and the job content questionnaire (JCQ)[15]. These occupational stress models and the validity of questionnaire categories and evaluation methods have already been established. Additionally, BJSQ is widely-used in Japan, known for the main component of the Stress Check Program[16], launched in 2015 as a Japanese annual survey aimed at identifying employees who experience high psychosocial stress in the workplace. Thus, this study aimed to examine the factors related to workers' somatic symptoms using the BJSQ among Japanese participants. According to the NIOSH occupational stress model[7], both of occupational stressors and social supports affect physiological and psychological stress response. Besides, occupational stressors is the only factor which directly affect physiological and psychological stress responses. Hence, it was hypothesized that workers' somatic symptoms were potently affected by occupational stressors and social supports, and they were most potently affected by occupational stressors.

Methods

Participants

This study employed a cross-sectional design. Initially, 18513 public servants at the municipal or the ward office of City A, located in the Kinki region of Japan were approached. In 2015, the Japanese government launched an occupational health policy to screen for workers with high psychosocial stress in a workplace with 50 or more employees[17]. The researchers of this study requested the municipal government of City A for the relevant study data in 2017. After acquiring the secondary data (already anonymized by the office staff), questionnaires with incomplete responses (n=1223) were excluded. Therefore, data from 17290 workers (93.4%) were analyzed for inclusion eligibility.

Demographic and work-related variables

The demographic variables were sex and age. Sex was included as a demographic variable as past studies have reported sex differences in the frequency of somatic symptoms[18,19]. The work-related variables were job title (non-manager and manager) and job category (clerical workers, technical workers, professional workers, and others). Clerical workers were defined as those who carried out clerical tasks related to construction, design, and management (among different roles) of buildings in the municipality; technical workers were those who carried out technical tasks requiring physical endeavors in the municipality; and professional workers comprised of nurses, care workers, public health nurses, and childcare workers, among others.

Brief Job Stress Questionnaire

The BJSQ[14] was originally created from the JCQ[15] and Generic Job Stress Questionnaire developed by the NIOSH[7]. It is a 57-item questionnaire that comprises four subscales and is responded to by using a 4-point Likert-type scale (1=disagree to 4=agree). Its factors are as follows: occupational stressors (17 items; score range: 17-68), which includes questions on work-related stressors (e.g., job demands; physical, psychological, social, or organizational aspects of the job that require sustained physical and/or psychological effort or skills and job control; the ability of a person to influence what happens in their work environment); stress responses (29 items; score range: 29-116) which has two subscales, namely psychological stress responses (PSY: 18 items; score range: 18-72) which includes 6 items for depression, 3 for anxiety, 3 for hostility, 3 for fatigue, and 3 for vigor; physiological stress responses (PHY: 11 items; score range: 11-44) which includes one item each for dizziness, body pain, headache, stiff shoulder, lower back pain, tired eyes, palpitation or shortness of breath, gastrointestinal symptoms, loss of appetite, constipation or diarrhea, and insomnia; social support (9 items; score range: 9-36), which includes questions on social support in the workplace (e.g., supervisor and co-worker support); and work and life satisfaction (2 items; score range: 2-8), which includes questions on employees' satisfaction with their work and personal lives. While calculating the BJSQ score, reversed scoring was used where necessary; higher scores indicated greater stress.

A large-scale investigation confirmed the reliability and validity of the BJSQ and its usefulness in assessing Japanese workers' mental health[20]. Another study conducted with a Japanese sample highlighted that the BJSQ is a well-established and widely used instrument for evaluating occupational stress. It has sufficient reliability and validity in the Japanese setting[21].

In the present study, the Cronbach's alpha coefficients for the factors and subscales were as follows: 0.80 for occupational stressors, 0.93 for psychological stress response (PSY), 0.85 for physiological stress response (PHY), 0.89 for social support, and 0.49 for work and life satisfaction. In

this study, the 2-item work and life satisfaction subscale were excluded because job dissatisfaction was regarded as a part of the stress response according to the occupational stress model by the NIOSH[7].

Statistical analysis

To examine whether demographic variables (sex and age), work-related variables (job title and job category), PSY, and the two BJSQ factors (occupational stressors and social support) predicted higher PHY, a multiple linear regression analysis was conducted. Differences were considered significant at $p<0.05$. All statistical analyses were performed using SPSS version 26 (SPSS Inc., Chicago, IL, USA).

As aforementioned, we acquired and utilized anonymous secondary data (i.e., workers' responses to the BJSQ, which had encrypted identification) in this study; this dataset had been previously collected by the healthcare center of City A through the Stress Check Program. Thus, given that the dataset already existed, the review committee waived the need to collect written informed consent from participants. Moreover, prior to data obtainment, the City A staff had already anonymized and de-identified the whole dataset. We provided a means to opt out of this study on the website. Finally, the Human Subjects Review Committee of Osaka City University approved the study protocol (authorization number: 2969), and this study conformed to the tenets of the Declaration of Helsinki.

Results

Table 1 shows the participants' characteristics and Brief Job Stress Questionnaire (BJSQ) scores (n=17290). In total, 64.5% (n=11145) were men and 35.5% (n=6145) were women. Participants' mean age (± standard deviation [SD]) was 45.6±10.3 years. Among the participants, 70.6% were non-managers (n=12215) and 29.4% were managers (n=5075). The most common job category was that of clerical workers (n=8584, 49.7%).

Table 1. Participants' characteristics and Brief Job Stress Questionnaire (BJSQ) scores (n=17290)

	Range	Total
n		17290
Age, years, mean (±SD)		45.6±10.3
Sex (n, %)		
Male		11145 (64.5)
Female		6145 (35.5)
Job Title (n, %)		
Non-manager		12215 (70.6)
Manager		5075 (29.4)
Job Category (n, %)		
Clerical worker		8584 (49.7)
Technical worker		3341 (19.3)
Professional worker		3328 (19.2)
Other categories		2037 (11.8)
Stress Response		
Psychological stress response	(18-72)	36.2±10.3
Physiological stress response	(11-44)	19.4±5.9
Occupational Stressor	(17-68)	41.9±6.9
Social Support	(9-36)	19.4±5.3

SD, standard deviation.

Table 2 shows the results of the hierarchical multiple linear regression analyses for higher PHY. Entering demographic and work-related variables, that is, age, sex, job title, and job category (Step 1) accounted for 3% of the variance. In Step 1, all variables were significant predictors. Namely, older age, female sex, a manager, and any job category predicted higher PHY. When the BJSQ subscales (PSY, occupational stressors and social support) were added (Step 2), PSY was the only significant predictor (explaining an additional 41% of the variance, $F=1512.440$, $p<0.05$). Namely, higher PSY predicted higher PHY (standard partial regression coefficient $\beta=0.661$: 95% confidence interval [CI], 0.37-0.39). For occupational stressors ($\beta=-0.01$; 95% CI, −0.03 to 0.01) and social support ($\beta=0.01$: 95% CI, −0.01 to 0.02), Step 2 of the model revealed no significant predictors.

Table 2. Related factors for higher physiological stress response by hierarchical multiple linear regression analyses (n=17290)

		Step 1		Step 2	
	Range	B	β	B	β
Age		0.02	0.0304***	0.04	0.061***
Sex		−1.89	−0.152***	−1.28	−0.103***
Job Title		−0.65	−0.05***	−0.20	−0.015*
Job Category					
Clerical worker					
Technical worker		2.38	0.201***	0.37	0.031**
Professional worker		2.40	0.16***	0.96	0.064***
Other categories		1.66	0.11***	−0.10	−0.01
Psychological Stress Response	(18-72)			0.38	0.661***
Occupational Stressor	(17-68)			−0.01	−0.01
Social Support	(9-36)			0.01	0.01
R		0.16		0.66	
R^2		0.03		0.44	
R^2 Change score		0.03		0.41	
F		76.591***		1512.440***	

Step 1: adjusted for age, sex (reference category: male), job title (reference category: non-manager), and job category (reference category: clerical worker).

Step 2: adjusted for the Brief Job Stress Questionnaire (BJSQ) subscales.

*p<0.05, **p<0.01, ***p<0.001.

Discussion

The present study aimed to examine the factors related to somatic symptoms as stress responses in an occupational context among Japanese workers. The results showed that a higher PSY, female sex, and higher age were related factors for a higher PHY (meaning somatic symptoms and subjective somatic complaints). Unexpectedly, neither greater occupational stressors nor lower social support were significantly associated with higher PHY. In the present study, a higher PSY was the most potent factor.

Physiological and psychological stress responses

The current study showed that neither higher occupational stressors nor lower social support was significantly associated with a higher PHY when confounding was reduced. This result seems contradictory to previous studies. Many studies have reported cross-sectional and longitudinal relationships between somatic symptoms and various occupational stressors. For instance, according

to Nixon's meta-analysis[6], somatic symptoms are related to a wide range of job stressors. This tendency was seen for both individual symptoms and composite symptom scales, and the effect sizes of these relationships varied by the stressor and the individual symptom. As for the social supports, studies examining the relationship between burnout[1] and Conservation of Resources theory[22] suggested work sources of support are strongly related to exhaustion, which is one of three main dimensions of burnout[2]. Non-work related sources of support are strongly related to depersonalization and personal accomplishment, the other two dimensions of burnout.

Unlike previous studies, this study measured PSY and PHY separately and simultaneously, and analyses were conducted to examine related factor of somatic symptoms, with confound factors including PSY. Previous studies have showed a close association between psychological symptoms such as depression and anxiety, and somatic symptoms. For instance, Löwe et al[23] found comorbidities between depression, anxiety, and somatization in over 50% of patients in primary care clinics. In a large study, Haug et al[18] showed that the number of somatic symptoms and the total score on the Hospital Anxiety and Depression Scale were linearly correlated. This finding corroborates the present study's finding that a higher PHY was associated with a higher PSY. Considering these past findings, there is the possibility that PSY act as mediators when somatic symptoms as stress responses (PHY) appear. In other words, when one confronted with occupational stressors, subjective somatic complaints appear secondarily. Indeed, past studies have indicated the possibility that depression and anxiety lowered the threshold for the perception of somatic symptoms[24], and depressive mood may foster illness-related memories and a negative view of one's health[25]. On the contrary, Rudy et al[26] suggested that chronic somatic symptoms may play a role in initiating or provoking depression and anxiety, indicating that somatic symptoms and somatic complaints can also contribute to psychological problems. Another possibility suggested by the current study is that PHY are more strongly affected by individual factors rather than occupational stressors or social supports. In any case, this study clarifies the importance of coping with workers' psychological problems to improve their somatic symptoms. Thus, the organizations should make an effort to care for workers' psychological stress responses such as depressive moods or anxiety. Efforts should be made to reduce somatic symptoms or complaints, and the necessary actions should be taken, such as referring workers to clinical doctors at the right time.

Sex and age

The present study also showed an association between a higher PHY and demographic variables such as female sex and older age. Regarding sex, many previous studies indicated that women report more somatic symptoms than men[18,19,27], which supports the results of the present study. There seem to be many reasons for the higher prevalence of somatic symptoms in women. First, previous studies have shown that compared to men, women have a higher prevalence of mental disorders associated with somatic symptoms, such as depression and anxiety disorders[18,28]. Participants in the present study did not have any active mental disorders; however, some psychological problems, which partially resembled depression symptoms and anxiety, may have increased their somatic symptoms. Sex differences in social roles and responsibilities, thresholds for healthcare, and the amplification of physical symptoms were considered[29,30].

Regarding age, several studies have suggested an association between age and somatic symptoms, but results are incoherent and difficult to interpret[19,28,31]. Although physiological functions change with age, somatic symptoms include medically explained symptoms as well as medically unexplained

symptoms or somatization, meaning the tendency to express psychological distress with somatic complaints, which results in inconsistent results caused by between-study differences in the definition of somatization problems, measurement instruments, and the setting of the research population. Several studies have reported somatization in older people, thereby concluding that clinically relevant somatization frequently occurring through somatization disorder in itself is rare among the aging population[32]. These studies can account for the current study's results, as medically explained and unexplained symptoms were not differentiated in this study.

Strengths and limitations

This study has several limitations. First, a cross-sectional design was employed and data were collected from self-reported questionnaires. Since this study used self-administered questionnaires, participants may have included people who exaggerated or diminished their actual degree of symptoms. Furthermore, the causal relationship between the two stress responses could not be determined because of the cross-sectional nature of the study design. A study using a structural equation modelling for two stress responses should be conducted to clarify these mechanisms. Second, as mentioned above, no information regarding the participants' medical history was collected in this study. This will likely increase the PHY in older people, although the participants of this study were clinically healthy enough to be engaged in full-time work. Third, this study's results may have been influenced by residual and unmeasured confounders such as personality[33], temperament[34], stress coping style, and length of employment. However, an understanding of the individual aspects of the stress response is limited. Thus, individual factors were not included in this study, except for age, sex, job title, and job category. Fourth, the data were obtained from public servants of one city in Japan, thus limiting the generalizability of these results to other jobs, regions, and countries. Last, PSY and PHY were not separately examined for their validity and reliability; though the validity and reliability of whole BJSQ and stress response was well established[14].

Despite the limitations, several strengths for our study deserve attention. To the best of authors' knowledge, this is the first investigation on the relationship between occupational stress and stress response dominance, and no previous study has simultaneously examined these two stress responses together. Though somatic symptoms as stress responses remain unclear and still difficult to deal with, our findings may be beneficial for individuals, supporters, and organizations to reduce workers' somatic symptoms. Additionally, few studies on occupational stress targeted for this large sample size in Japan. Moreover, this study utilized the BJSQ, widely-used in Japan as an assessment of workers' subjective stress response, known for the use of government's Stress Check Program. Since it is widely used in Japan, results of the current study is highly versatile for the future studies.

Acknowledgements

All authors have no COI to declare regarding the present study.

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