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Cross-sectional study of the association of menopausal symptoms with presenteeism among female employees of a Japanese company

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Specific Author Contributions of every Author listed

The contributions of the authors are as follows: The contributions of the authors are as follows: TK: preparation of original draft, formal analysis. MO, NO, and TI: review and editing of draft. ST, SH, and TY: review and editing of draft, funding acquisition. YF: review and editing of draft, conceptualization, data management, funding acquisition, and supervision.

Data Availability

Data are available from the authors on reasonable request.

EQUATER Network checklist utilized

We conducted this study in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines as in the Supplementary Digital Content (SDC) submitted separately.

AI Disclosure

The authors declare that ChatGPT (OpenAI, San Francisco, CA, USA, version GPT-4o, accessed on 15 October 2024) was used in this paper. AI was used to perform some English editing and word count adjustments in the abstract. All original sentences and

drafts of this paper were originally prepared by the authors, and the authors checked and the content of the paper. The draft was subsequently checked by a professional English editing service and finalized by the authors. No AI tools were used for concept development, study design, data collection, analysis, or interpretation of the results.

Ethical Considerations & Disclosures:

This study was approved by the Ethical Review Board of the University of Occupational and Environmental Health, Japan (Approval No. R5-002)

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Abstract

Objective: This study examined the impact of menopausal symptoms on presenteeism among middle-aged female workers.

Methods: A cross-sectional study was conducted in 2023 among 553 female employees of a Japanese manufacturing company. Menopausal symptoms were assessed using the Menopause Rating Scale (MRS). Logistic regression analysis was performed to assess the association between menopausal symptoms and presenteeism.

Results: Menopausal symptoms were significantly associated with presenteeism. The odds ratio (OR) for severe total MRS scores was 19.71 (95% CI: 5.23–74.35). Psychological symptoms had the highest OR, at 94.50 (95% CI: 12.22–730.67), followed by somatic (OR = 3.80, 95% CI: 1.04–13.88) and urogenital symptoms (OR = 4.48, 95% CI: 1.64–12.25).

Conclusion: Menopausal symptoms are a significant workplace health issue that should be addressed through targeted policies and support to maintain employee performance.

Keywords:

Menopause, Climacteric, Women's health, Presenteeism, Workplace, Occupational health, Japan

Learning outcomes

After accomplishing this educational activity, learners will be able to:

- *Understand the association between menopausal symptoms and presenteeism among middle-aged female workers in Japan.*
- *Recognize the need for workplace support, focusing on mental health and clear communication about available resources.*
- *Discuss the importance of workplace support in helping employees manage menopausal symptoms to maintain work performance.*

Introduction

Menopausal symptoms are a major cause of decreased quality of life in women. Menopausal symptoms arise from hormonal changes during the transition to menopause, a phase when a woman's reproductive function ceases. [1] This transition is associated with various symptoms, including physical symptoms such as hot flashes and joint or muscle problems, psychological symptoms such as depression and irritability, and urogenital symptoms such as urinary problems and vaginal dryness. [2] For most women, these menopausal symptoms occur at a time in life when they play significant roles in their households and society.[3] The Menopause Epidemiology Study found that 80% of women aged 40 to 65 who experienced hot flashes reported that their symptoms affected their sleep; 69% reported a negative impact on their overall quality of life; and greater severity of hot flashes was associated with greater impact. [4]

Menopausal symptoms significantly affect the work performance of female workers. According to a survey in the UK, 15% of female workers have experienced absence from work due to menopausal symptoms, and those who were absent from work had more severe symptoms. [5] Menopausal symptoms affect work in various ways. For example, somatic symptoms such as joint and muscle pain are often reported as menopausal symptoms[6], and have been reported to be associated with a decline in work performance. [7] Psychological symptoms such as depression and anxiety are common menopausal symptoms; these can lead to a decrease in concentration and consequent

increase in the likelihood of errors at work. [8] Urogenital symptoms, such as frequent urination and vaginal dryness, also occur during menopause transition, hindering the performance of tasks that require prolonged concentration or long working hours.[9, 10] The European Menopause and Andropause Society also recognizes that menopausal symptoms can negatively affect women's ability to work.[11]

Women who continue to work while experiencing menopausal symptoms are considered to be in a state of "presenteeism." Presenteeism refers to the impairment of work performance that can occur when an employee works despite being unwell. [12] Presenteeism is associated with lower work quality, increased errors, and reduced workplace productivity.[13] Common causes of presenteeism include sleep disturbances, mental health problems, and pain,[14] all of which are common symptoms of perimenopause. Working women with menopausal symptoms can be said to be likely to work performance impairment.

The type, frequency, and severity of menopausal symptoms vary by race and region. For example, *A systematic review by Fang et al. identified regional differences, with hot flashes reported in 49% of Japanese women compared to 51–64% in Western populations. However, Japanese women exhibited higher rates of psychological symptoms (47% vs. 25–36%) and urogenital symptoms (73% vs. 35–46%) than their Western populations.* [6]Moreover, the impact of menopausal symptoms on female

employees can also be influenced by social background, work culture, and access to treatment. [11]

However, most studies on the impact of menopausal symptoms on presenteeism to date have been conducted in Western countries, [1, 15] *with limited research focusing on Japanese female workers. Ishimaru et al. reported an association between menopausal symptoms and presenteeism in Japanese women [16]; however, the study relied on internet monitors, limiting population definition, symptom prevalence assessment, and generalizability.* Here, we evaluated the impact of the type and severity of menopausal symptoms on presenteeism, based on the hypothesis that menopausal symptoms affect presenteeism in middle-aged female workers at a large Japanese company. Examining employees in real workplace settings may strengthen evidence for this association among Japanese female workers by enhancing consistency with Hill's criteria . [17]

Method

Study Design and Subjects

This study was conducted under a cross-sectional design in February 2023 and targeted *only formal* female employees at a large manufacturing company in Japan. Data was collected using a self-administered online questionnaire. Of the 5,878 employees across 78 business units in the company, all 1,465 female employees were invited to participate in the survey. Responses were obtained from 1,125 women, giving a response

rate of 77%. Among these, women aged 40 years or older (n=624) were included in the analysis. Participants were excluded if they had missing data for the Menopause Rating Scale (MRS) (n=70) or an unclear educational background (n=1), resulting in a final analysis sample of 553 women (Figure).

This study was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. [18] All participants provided informed consent, and ethical approval was obtained from *the Ethical Review Board of the University of Occupational and Environmental Health, Japan (Approval No. R5-002)*

Assessment of Menopausal Symptoms

Menopausal symptoms were assessed using the Menopause Rating Scale (MRS), a self-report tool used to evaluate the presence and severity of menopausal symptoms. [19] The 11 items are divided into the following three subscales: 1. psychological symptoms (including four items: depressed mood such as depression and sad feelings, irritability such as feeling nervous, anxiety symptoms such as restlessness, and mental fatigue such as loss of concentration and impaired memory); 2. physical symptoms (including four items: symptoms such as hot flashes and night sweats, heart discomfort such as palpitations and chest tightness, sleep disorders such as difficulty falling asleep and waking up after a short time, and muscle and joint discomfort and pain); and 3. genitourinary symptoms (including three items: sexual problems such as

decreased libido, bladder symptoms such as dysuria, and vaginal symptoms such as vaginal dryness and burning). Total MRS score was calculated by summing the scores of the 11 items. The severity of menopausal symptoms was then classified into the four categories of none, mild, moderate, and severe. [20] The MRS was originally developed in German and has been translated into many languages. [21] In this study, the participants answered a questionnaire that was translated into Japanese from the English version of the MRS following established translation procedures. [22] The Japanese version of the MRS is available on the original developer's website (https://zeg-berlin.de/wp-content/uploads/2023/05/MRS_Japanese.pdf).

Assessment of Presenteeism

Presenteeism was assessed using the Work Functioning Impairment Scale (WFun), a Japanese-developed scale that evaluates the extent to which presenteeism affects work performance based on seven unique items. [23]For each question, respondents answer on a scale of 1 to 5, from 1 (never) to 5 (almost every day), and the total score of 7 to 35 for the seven questions is calculated to evaluate the degree of impairment of work function. In this study, a total Wfun score of 21 or more was considered to indicate presenteeism, with reference to previous studies. [24, 25]

Other Covariates

The following variables related to individual characteristics were selected as covariates: age (40–44 years, 45–49 years, 50–54 years, 55 years and over), education

status (high school or technical school, junior college or vocational school, university or graduate school), marital status (not married, married), drinking frequency (less than 3 days per week, more than 4 days per week), smoking status (not smoking, currently smoking), and body mass index (BMI <25, BMI ≥25). *We also assessed the status of visiting hospital for menopausal symptoms (never visited, past visit, currently visiting).* Additionally, the following work-related covariates were selected: job type (desk work, communication-requiring work, manual work), length of overtime work (almost no overtime, less than 2 hours/day, more than 2 hours/day, and workplace support (not needed, need support but not available, support available). *This workplace support item was assessed by asking participants, "Do you need any consideration or support from your company to continue working in your current health condition?".* These covariates were selected with reference to previous studies. [26, 27]

Statistical Analysis

Descriptive statistics were used to calculate the number and proportion of participants based on age, education status, marriage status, drinking frequency, smoking status, BMI, status of visiting hospital, job type, length of overtime work, and workplace support. The number and proportion of female employees in a state of presenteeism were also calculated. Logistic regression analysis was performed to estimate the odds ratios (ORs) of experiencing presenteeism based on the severity of

menopausal symptoms. The multivariate model included covariates such as age, education status, marriage status, drinking frequency, smoking status, BMI, status of visiting hospital, job type, length of overtime work, and workplace support. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using Stata 18.0 SE (Stata Corp LLC, College Station, TX, USA).

Results

Table 1 shows the characteristics and rate of presenteeism among the study participants. With regard to age, more participants were in their 40s than in their 50s or older. By education status, over half of the participants had at least a university degree. More than half were married. For job type, more than half of the participants were desk workers. Most participants reported drinking 'three days a week or less,' and there were very few smokers. Most participants had a BMI below 25. In terms of workplace support, most participants responded that they did not need support, and those who did need support were more likely to be “no available support” than “support available” (13% vs. 10%). Ten percent of the participants indicated that they were in a state of presenteeism.

Table 2 shows the distribution of total scores and scores for the three subscales of the MRS, as well as ORs for the association between menopausal symptoms and presenteeism. In the multivariate model, the ORs for presenteeism relative to total score was calculated based on a score of 0 to 4 (none). The ORs for participants classified as

mild were 5.93 (95% CI: 1.89-18.66, p=0.002), while those for participants classified as moderate or severe were 14.92 (95% CI: 4.94-45.03, p<0.001) and 19.71 (95% CI: 5.23-74.35, p<0.001). For psychological symptoms, results of multivariate analysis for ORs using 0-1 (none) as reference were mild symptoms, 15.81 (95% CI: 1.99-125.42, p=0.009); moderate symptoms, 28.18 (95% CI: 3.63-218.68, p=0.001); and severe symptoms, 94.50 (95% CI: 12.22-730.67, p<0.001). For somatic symptoms, results of multivariate analysis for ORs using 0-2 points (none) as reference were mild symptoms, 2.07 (95% CI: 1.01-4.23, p=0.045); moderate symptoms, 2.12 (95% CI: 0.94-4.79, p=0.071); and severe symptoms, 3.80 (95% CI: 1.04-13.88, p=0.044). For urogenital symptoms, results of multivariate analysis for ORs using 0 points (none) as reference were mild symptoms, 2.03 (95% CI: 0.97-4.23, p=0.059); moderate symptoms, 2.50 (95% CI: 1.10-5.65, p=0.028); and severe symptoms, 4.48 (95% CI: 1.64-12.25, p=0.003).

Discussion

In this study, we found that middle-aged female workers with menopausal symptoms tended to experience presenteeism more frequently. In addition, a significant association was found between presenteeism and each of psychological, somatic, and urogenital symptoms, with a particularly strong association found for psychological symptoms.

This study demonstrated that Japanese female employees with more severe menopausal symptoms were more likely to experience presenteeism. These results are consistent with those of a previous study. [16] The main complaints of menopausal symptoms are joint and muscle pain, depression, irritability, and urogenital discomfort .[2] These symptoms can overlap with the key symptoms of presenteeism, such as pain, mental health disorders, and insomnia [14, 28]. Nevertheless, awareness of the association between menopausal symptoms and presenteeism is poor. [29] In a survey of Japanese workers, while 81% of women experienced at least one menopausal symptom, many women considered menopausal symptoms to be a normal part of aging and were hesitant to seek professional treatment for their symptoms. The survey also showed that there was a lack of awareness of menopausal symptoms in the workplace, and that many middle-aged female workers were unable to consult with superior about their symptoms.[30] The findings of this study suggest that menopausal symptoms are a health issue that needs to be addressed in the workplace.

In this study, each of the subscales of the MRS, which consists of mental, physical, and urogenital symptoms, was found to be associated with presenteeism. First, there was a strong association between mental symptoms and presenteeism. This result was also observed in a previous study.[16] Mental symptoms of menopausal symptoms include depression, emotional lability, and anxiety. The relationship between depression and presenteeism has been well-examined.[31] Emotional disturbances such as irritability

can interfere with interpersonal relationships and communication with others, hampering the performance of work. [32] Second, we found a significant relationship between physical symptoms and presenteeism. The physical symptoms of MRS include hot flashes, palpitations, insomnia, and muscle and joint problems. For example, hot flushes and palpitations that occur suddenly can force people to stop working and eventually become a barrier to going to work or participating in the workplace.[33] Insomnia can cause daytime dysfunction and reduce work performance. [34] Third, it was found that genitourinary symptoms affect presenteeism. Symptoms such as urgency to urinate and urinary incontinence can lead to a decrease in concentration, feelings of anxiety and an increase in work interruptions. [9]Pain caused by vaginal dryness symptoms can make it difficult to maintain a seated or standing position for long periods of time. [10] Vaginal dryness symptoms have been reported to reduce work productivity and quality of life. [35]

The results of this study suggest that menopausal symptoms are a health issue that should be actively addressed in the workplace. Many women consider that menopausal symptoms are a natural phenomenon associated with aging and are therefore perceived to be outside the scope of health and safety initiatives.[36, 37] The results demonstrated a significant association between menopausal symptoms and presenteeism among female employees. The strongest association was observed with psychological symptoms, while 13% of employees reported needing but not receiving workplace support. These findings suggest that menopausal symptoms, particularly

psychological symptoms, constitute an important occupational health issue. Based on these findings, greater attention to mental health care for middle-aged female workers and clearer workplace communication on available support services and how to access them may help maintain work performance.

Several limitations of our study warrant mention. First, the menopausal symptoms were evaluated by self-reporting using the MRS. Clinically, the state of menopausal transition can be more accurately determined by measuring follicle-stimulating hormone and monitoring the menstrual cycle.[38] *Additionally, while the Japanese version of the MRS used in this study was properly translated from English version, the translation process has not yet been published.* Nevertheless, the MRS has been confirmed valid for assessing menopausal symptoms and has been widely used in previous studies. Using the MRS allowed us to ensure comparability with the results of other studies. Second, in this study, the duration of menopausal symptoms is unknown. Menopausal symptoms are symptoms that continue for several years, and the duration of symptoms is thought to affect the way people work. [39] We assume, however, that the degree of menopausal symptoms assessed by MRS at the time of response is related to impairment of work function. Third, the study did not include a representative sample of Japanese female workers but was rather a survey of Japanese employees at a certain company. The company surveyed is relatively large, with more than 5,000 employees, and is considered to have a good health management system, including a management

system with full-time occupational health staff.[40] *A total of 68% of participants had completed university or graduate education, a higher proportion than among general female workers in Japan, which may have introduced selection bias. This high educational level and relatively well-established workplace health support, compared with general female workers [41], may have influenced the MRS and WFun results.* On the other hand, it is also possible that the workload and stress in this company are high. The impact of these characteristics on the results is uncertain. Fourth, it remains possible that the results were affected by *unmeasured* confounders, although no established factors related to the onset of menopausal symptoms were identified in previous studies. *While we adjusted for various potential confounding factors in this study, other factors such as comorbidities and economic status may influence both menopausal symptoms and presenteeism. However, as this study is based on formal workers in a single large company, age is generally considered a proxy indicator for income. Overall, the impact of these unmeasured factors on the results of this study remains unknown. Fifth, this study focused on presenteeism and did not assess the relationship between menopausal symptoms on absenteeism. Therefore, the findings do not capture the overall impact of menopausal symptoms on work productivity.*

Conclusion

This study revealed that female workers with severe menopausal symptoms were more likely to experience presenteeism. Among the psychological, somatic, and urogenital complaints that are characteristic of menopausal symptoms, we found that psychological symptoms were more strongly associated with presenteeism. These findings suggest that it is important for female workers to correctly recognize the impact of menopausal symptoms on their physical condition to maintain their work functions, and that it is important to understand and consider the needs of female workers experiencing menopausal symptoms in the workplace, such as the preparation of a working environment that enables female employees to work more comfortably.

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Figure Legends

Figure. Flow chart of participants selection.

Flowchart represents the process of selecting the participants for analysis.

Figure 1

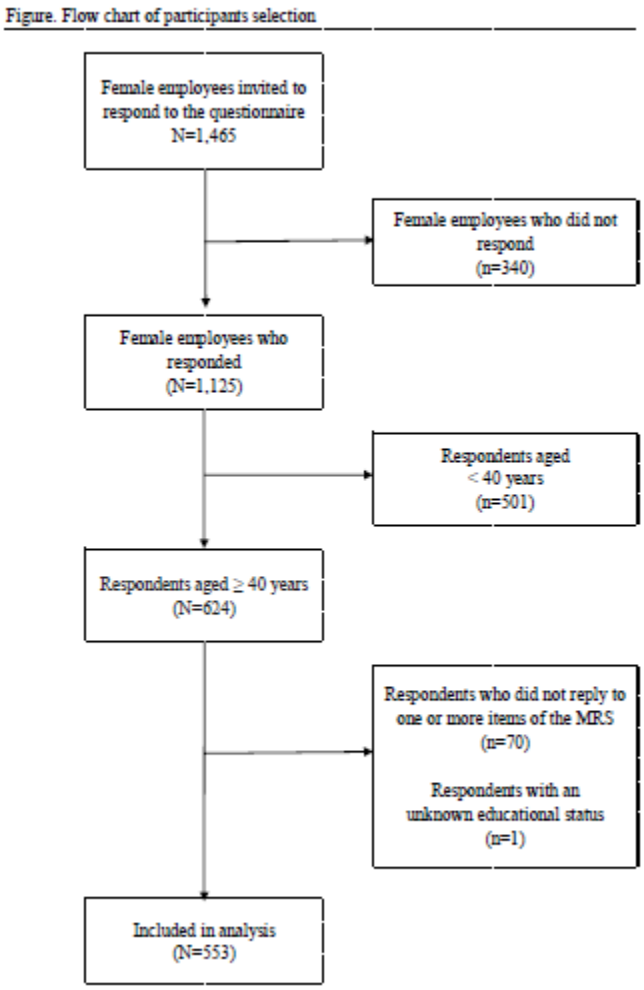

Table 1. Participant characteristics and rate of presenteeism

	Total N=553	Category of the Menopausal Symptom Rating Scale			
		None (0–4) n=229	Mild (5–8) n=147	Moderate (9–16) n=141	Severe (17+) n=36
Age					
40–44 years	155 (28%)	74 (32%)	44 (30%)	33 (23%)	4 (11%)
45–49 years	141 (25%)	54 (24%)	40 (27%)	42 (30%)	5 (14%)
50–54 years	136 (25%)	51 (22%)	31 (21%)	35 (25%)	19 (53%)
≥ 55 years	121 (22%)	50 (22%)	32 (22%)	31 (22%)	8 (22%)
Educational status					
High school or vocational school	91 (17%)	32 (14%)	30 (20%)	24 (17%)	5 (14%)
Junior college or technical college	83 (15%)	32 (14%)	22 (15%)	23 (16%)	6 (17%)
University or graduate school	379 (68%)	165 (72%)	95 (65%)	94 (67%)	25 (69%)
Marriage status					
Not married	219 (40%)	83 (36%)	66 (45%)	56 (40%)	14 (39%)
Married	334 (60%)	146 (64%)	81 (55%)	85 (60%)	22 (61%)
Drinking frequency					
Less than 3 days per week	420 (76%)	183 (80%)	110 (75%)	101 (72%)	26 (72%)
More than 4 days per week	133 (24%)	46 (20%)	37 (25%)	40 (28%)	10 (28%)
Smoking status					
Non-smoking	533 (96%)	220 (96%)	139 (95%)	140 (99.3%)	34 (94%)
Currently smoking	20 (4%)	9 (4%)	8 (5%)	1 (0.7%)	2 (6%)
BMI					
BMI < 25	488 (88%)	211 (92%)	131 (89%)	119 (84%)	27 (75%)
BMI ≥ 25	65 (12%)	18 (8%)	16 (11%)	22 (16%)	9 (25%)
Status of visiting hospital for menopausal symptoms					
Never visited	491 (89%)	226 (98.7%)	131 (89%)	108 (77%)	26 (72%)
Past visit	34 (6%)	2 (0.9%)	12 (8%)	17 (12%)	3 (8%)
Currently visiting	28 (5%)	1 (0.4%)	4 (3%)	16 (11%)	7 (19%)
Job type					
Desk work	428 (77%)	168 (73%)	118 (80%)	114 (81%)	28 (78%)
Communication-requiring work	58 (11%)	29 (13%)	12 (8%)	13 (9%)	4 (11%)
Manual work	67 (12%)	32 (14%)	17 (12%)	14 (10%)	4 (11%)
Length of overtime work					
Almost no overtime	222 (40%)	99 (43%)	59 (40%)	58 (41%)	6 (17%)
Less than 2 hours	244 (44%)	100 (44%)	60 (41%)	62 (44%)	22 (61%)
More than 2 hours	87 (16%)	30 (13%)	28 (19%)	21 (15%)	8 (22%)

Workplace support					
Not needed	429 (77%)	205 (89%)	116 (79%)	91 (64%)	17 (47%)
Need support but not available	70 (13%)	11 (5%)	16 (11%)	28 (20%)	15 (42%)
Support available	54 (10%)	13 (6%)	15 (10%)	22 (16%)	4 (11%)
Presenteeism*	60 (10%)	4 (2%)	15 (10%)	31 (22%)	10 (28%)

BMI: Body Mass Index *Presenteeism: Defined as a score of ≥21 on the Work Functioning Impairment Scale (Wfun)

Table 2. Relationship between menopausal symptoms and presenteeism* (logistic regression analysis)

Menopausal Rating Scale	Total N (%)	Wfun ≥ 21 n(%)	Age-adjusted				Multivariate†			
			OR	95 % CI		*p*–value	OR	95 % CI		*p*–value
overall										
None (0–4)	229(41)	4(2)	reference				reference			
Mild (5–8)	147(27)	15(10)	6.41	2.08	19.74	0.001	5.93	1.89	18.66	0.002
Moderate (9–16)	141(25)	31(22)	16.29	5.59	47.49	<0.001	14.92	4.94	45.03	<0.001
Severe (17+)	36(7)	10(28)	24.57	7.00	86.21	<0.001	19.71	5.23	74.35	<0.001
Psychological symptom										
None (0-1)	191 (34)	1 (0.5)	reference				reference			
Mild (2–3)	149 (27)	11 (7)	14.88	1.90	116.75	0.010	15.81	1.99	125.42	0.009
Moderate (4–6)	127 (23)	18 (14)	30.76	4.05	233.93	0.001	28.18	3.63	218.68	0.001
Severe (7+)	86 (16)	30 (35)	105.72	14.04	795.92	<0.001	94.50	12.22	730.67	<0.001
Somatic symptom										
None (0-2)	301 (55)	21 (7)	reference				reference			
Mild (3–4)	132 (24)	18 (14)	2.23	1.13	4.41	0.021	2.07	1.01	4.23	0.045
Moderate (5–8)	102 (18)	16 (16)	2.71	1.32	5.53	0.006	2.12	0.94	4.79	0.071
Severe (9+)	18 (3)	5 (28)	5.95	1.87	18.93	0.003	3.80	1.04	13.88	0.044
Urogenital symptom										
None (0)	361 (65)	27 (7)	reference				reference			
Mild (1)	93 (17)	14 (15)	2.2	1.11	4.42	0.024	2.03	0.97	4.23	0.059
Moderate (2–3)	68 (12)	11 (16)	2.3	1.10	5.00	0.028	2.50	1.10	5.65	0.028

Severe (4+)	31 (6)	8 (26)	4.4	1.78	10.84	0.001	4.48	1.64	12.25	0.003

OR: Odds Ratio CI: Confidence Interval

* Presenteeism was defined as a score of ≥21 on the Work Functioning Impairment Scale (Wfun)

†: Adjusted for age, educational status, marriage status, frequency of drinking alcohol, smoking status, body mass index, state of hospital visits, job type, length of overtime work, and status of workplace support.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3,4,5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6,7,8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	8,9
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8,9
		(*b*) Describe any methods used to examine subgroups and interactions	8,9
		(*c*) Explain how missing data were addressed	6
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A

		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6, F
		(b) Give reasons for non-participation at each stage	6, F
		(c) Consider use of a flow diagram	F
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10, T1
		(b) Indicate number of participants with missing data for each variable of interest	6, F
Outcome data	15*	Report numbers of outcome events or summary measures	T1, T2
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8, T2
		(*b*) Report category boundaries when continuous variables were categorized	6, T1
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	10,11, T2
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	T2
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14,15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14,15
Generalisability	21	Discuss the generalisability (external validity) of the study results	13,14
Other information			

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Title page

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.