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ORIGINAL ARTICLE

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Developing a global occupational health and safety management system model for Japanese companies

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Abstract

Objectives: To develop and validate a global occupational health and safety management system (OHSMS) model for Japanese companies.

Methods: In cooperation with a Japanese company, we established a research team and gathered information on occupational health and safety (OHS) practices in nine countries where the target company operated manufacturing sites. We then developed a model hypothesis via research team meeting. The model hypothesis was introduced to local factories in Indonesia and Thailand as trial sites. We evaluated the roles of the company headquarters, the implementation process, and any improvements in OHS practices at the sites. Based on the results, a global OHSMS model was formalized for global introduction.

Results: The model consisted of both headquarters and site roles. These roles were well-functioning, and OHS at the sites improved. Two issues concerning the functioning of the headquarters were identified: the need to establish a reporting system to the headquarters and the need to support the improvement of specialized human resources. By improving the model hypothesis to address these issues, the model was formalized for global introduction.

Conclusions: The global OHSMS model was based on the use of methods and specialized human resources relevant to each region and their common objectives, as well as evaluation indicators based on the minimum requirements of the company headquarters. To verify the effectiveness of this model, the experiment should be extended to other countries.

KEYWORDS

global OHSMS, Japanese companies, performance audit, reporting system, specialized human resources

1 | INTRODUCTION

The globalization of economic activities has also seen the expansion of Japanese companies abroad. A survey of Japanese companies and their overseas subsidiaries and business activities found that there were 24 959 overseas subsidiaries of Japanese companies as of July 2017.[1] Regarding occupational health and safety (OHS) for workers in Japan, staff in charge of OHS generally provide the necessary services in compliance with local laws and regulations. However,

developing and emerging countries often lag far behind developed countries in terms of OHS training for professionals, and practices in these countries do not always keep pace with the development of laws and regulations of their home country.

Large companies in Europe and the United States typically apply global standards, which usually have stricter requirements than local regulations, to local sites, as well as complying with local OHS laws and regulations.[2,3] They often establish a unified OHS management system (OHSMS) whereby each site is required to meet common requirements, and this system is typically controlled and managed by the company's OHS department located at its headquarters.[4] Furthermore, most OHSMSs also include international standards or company standards that reflect the laws and practices of the area in which the company's headquarters is located.[4]

In addition to considering the requirements in the location of the company's headquarters, which is involved in personnel allocation and investment decision-making through capital relationships, as part of risk management and corporate social responsibility strategies, Japanese companies, as well as Western companies, need to improve their OHS standards at their subsidiaries, regardless of location.[4,5]

When considering OHS practices based on Japanese regulations, it should be noted that Japanese OHSMSs are based on minimizing requirements and assume that the resources and personnel are adjusted to the actual situation in each region as much as possible to achieve the same objective. Thus, we call our system a "global OHSMS for Japanese companies."

In developing a global OHSMS for Japanese companies, it is necessary to gather information on the OHS environments in the target countries and regions where overseas subsidiaries are located and to establish a system that enables both the involvement of the company headquarters and the autonomous efforts of local sites. Thus, we developed an "Information Collection Check Sheet for OHSMSs at Overseas Plants" as a tool for efficient information gathering,[6] and investigated the actual conditions regarding, for example, OHS regulations and human resource development in a number of countries.[7-10]

In this study, we developed a global OHSMS model for Japanese companies and confirmed its validity via cooperation with the headquarters of a global Japanese manufacturing company that produces construction equipment.

2 | METHOD

2.1 | Research team

We established a research team that consisted of two experienced occupational physicians (OPs: SK, KM) working at a Japanese branch of a US-based global company, two chief OPs (YK, MS) with Japanese-based global enterprises, and the chief OP (SN) and two in-house OPs (KH, NF) from the target company, which is described below.

2.2 | Target company

The target company is a manufacturer of construction and mining equipment that has 12 production sites in Japan and 31 overseas sites. Of the overseas sites, 18 are located in five Asian countries, including China, seven are located in five European countries, including Russia, five are located in the United States, and one is located in Brazil. The company has approximately 60 000 employees worldwide, of which 60% are non-Japanese employees working at the overseas sites.

The company produces a diverse range of products, and total sales in the 2016 fiscal year were approximately 1.8 trillion yen. The possible health hazards for workers include noise, heat, dust, organic solvents, and bad posture. Company management displayed a clear willingness to promote both OHS and OHS investment in all workplaces, including its overseas sites.

2.3 | Model development process

The model was developed in four steps: (a) information gathering; (b) establishing the model hypothesis and developing evaluation indicators; (c) introducing the model hypothesis at test sites and evaluating the roles of the company headquarters; and (d) improvement of the model hypothesis based on the results of the pilot implementation and completion of the global OHSMS model.

2.3.1 | Information gathering

Because most European sites exist in countries that are members of the European Union, the OHS requirements are considered to be similar across these sites. Therefore, to better understand the overall picture of the similarities and differences among the overseas sites, we surveyed nine countries from various continents, including Japan.

To conduct the survey, we visited each of the nine countries following a literature and Internet search and gathered information using the "Information Collection Check Sheet for OHSMS at Overseas Plants".[6] Members of the research team visited the Japanese Embassy, local administrative agencies such as the Ministry of Health, Labor and Welfare, ISO (International Organization for Standardization) accreditation bodies, and institutions that train OHS experts, such as universities, in each country. We conducted interviews with representatives in each location that lasted for about 2–3 hours. If sufficient information was not obtained during the initial visit, we returned to the site as many times as necessary. A flow chart of the survey procedure is shown in Figure 1.

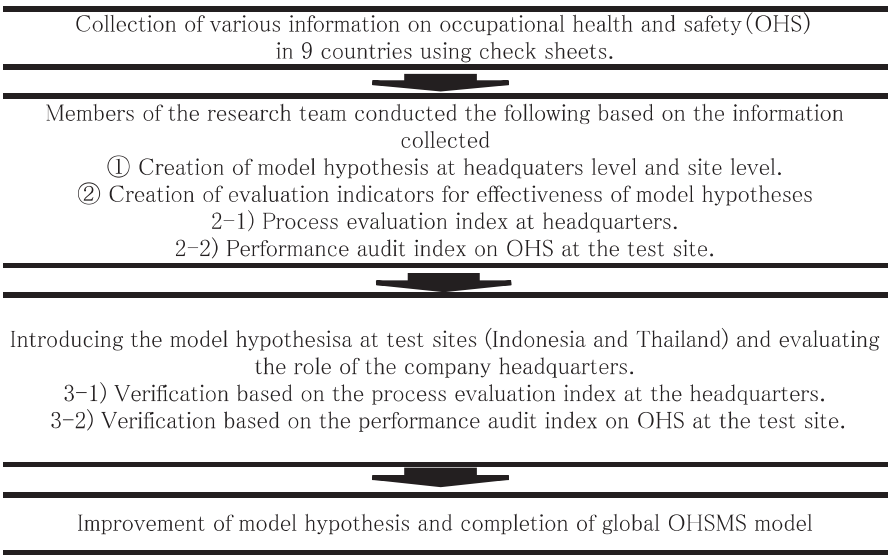

FIGURE 1 This figure shows the flow of this research for about 6 years

2.3.2 | Establishing the model hypothesis and developing evaluation indicators

We conducted a meeting of the research team to establish a model hypothesis based on the information obtained. Following a brainstorming session with members of the research team, we created the categories at headquarters level and site level respectively. To establish a hypothesis based on a global OHSMS perspective, we clarified that it will be implemented at the headquarters and sites on the premise of utilizing the basic policy and OHSMS.

Then, we created evaluation indicators for headquarters and test sites to confirm the validity of the model hypothesis. Evaluation indicators were also developed based on the ideas presented by the research team members during the discussion. The evaluation indicators made it possible to evaluate the level of improvement in detail and to describe what kind of reach (state) each criterion is specifically. Headquarters adopted process evaluation and test sites created performance audit on OHS.

2.3.3 | Introducing the model hypothesis at test sites and evaluating the roles of the company headquarters

We conducted a pilot implementation of the global OHSMS for Japanese companies in Indonesia and Thailand based on the model hypothesis. While the sites in these countries had already introduced a number of OHS initiatives, there was considerable room for improvement, mainly in the field of occupational health. For example, neither the established OHS practices based on laws and regulations nor the risk management system addressing hazardous factors not covered by laws and regulations were satisfactory. The training system in these two countries was relatively clear, and it was easy to obtain specialized human resources from major universities and administrative agencies. Furthermore, these countries were selected because local management was committed to introducing the OHSMS.

Based on the hypothesis, we gained an understanding of the OHS conditions at the sites in these countries through an interview and field patrol with local health and safety personnel. Then, the research team presented proposals to the site management teams regarding the measures necessary to address OHS issues that had been identified. In cases where the site personnel required assistance from OHS experts, we introduced local experts to management, and also recommended the use of OHS experts when it was necessary to provide education and training for workers.

Then, we evaluated the effects of our intervention after a period of time. The research team examined the functions and roles of the company headquarters and evaluated after developing efforts to test sites. The evaluation result of the company headquarters was determined by the members of the research team. Evaluation of the local sites was based on previously determined evaluation indicators (performance audit consists of evaluation items and criteria). Members of the survey team discussed the audit results with the top management and safety and health managers of the target factory and discussed until the audit team and the audited organization were satisfied.

2.3.4 | Improvement of model hypothesis based on the results of the pilot implementation and completion of the global OHSMS model

We reviewed the results of the performance audit and evaluation following the pilot implementation. Then, we reviewed the model hypothesis, discussed any necessary improvements, and completed the global OHSMS model.

3 | RESULTS

3.1 | Information gathering

The results of the survey of OHS systems in nine countries, including Japan, are as follows.

3.1.1 | Laws on OHSMS and status of specialized human resources

Regarding presence of laws and guidelines on OHSMS, Japan, Thailand, and China welcomed the introduction of an OHSMS.

Regarding professionals mainly responsible for OHS activities, OPs were active in Japan, Indonesia, Germany, and Brazil. Safety Officers are active in Thailand and China. In the United Kingdom, family physicians, and in the United States, Safety Professionals and Industrial Hygienists have been the main activities.

Regarding legal requirements concerning the appointment and utilization of expert personnel in OHS, Japan, Indonesia, Germany, and Brazil are all legally required to appoint OPs. Japan, Thailand, China, and Germany have legal obligations regarding the appointment of safety managers or safety officers.

Regarding status of training specialized human resources on OHS, OPs in Japan and Indonesia were able to obtain qualifications by receiving more than 50 hours (Japan) and 56 hours (Indonesia) of training. Different levels of SOs were developed in Thailand and China. OP specialists were trained in Germany, the United Kingdom, the United States, and Brazil. Although there is no requirement to employ specialist staff such as OPs and safety officers, the responsibilities of businesses are stipulated, and specialist personnel are employed in the United Kingdom and the United States (see Table 1).

3.1.2 | Status of major programs related to occupational health

Regarding presence of law of risk assessment for harmful factors, Japan, Germany, the United Kingdom and Brazil have to conduct and personal exposure monitoring for hazardous work is conducted in the United States.

Regarding evaluation of health effects by hazardous work, employers are obliged to carry out evaluation of health effects by hazardous work in all countries except for Myanmar. There are those in which health checks and laboratory standards are regulated by law (eg, China) and those where they are selected by specialized personnel (eg, Indonesia, Thailand, and Germany).

Regarding fit for work programs, all countries except for Myanmar have laws and regulations prescribing pre-deployment health checks for workers engaged in hazardous work. The United States is only required when a worker returns to work after injury.

Regarding management of personal information, personal health information is only shared between the workers and medical professionals, and only health-related information that is relevant to the workers' employment is conveyed to employers. In Myanmar, OHS legislation is not well-developed, and there is no clear provision for any of the above practices (see Table 2).

3.2 | Establishing the model hypothesis and developing evaluation indicators

3.2.1 | Model hypothesis

We assumed a model consisting of two levels of practices at the company headquarters and at each manufacturing site. In the headquarters, the following eight practices were implemented at the headquarters level: "formulation and dissemination of health and safety policies by the CEO (Chief Executive Officer)," "establishment of a global safety and health conference," "determination of OHSMS standards," "formulation and notification of global standards," "formulation and notification of performance audit standards," "training of auditors and conduct performance audit," "support for securing and fostering appropriate human resources at each site," and "technical support in the case of a shortage of specialized resources."

Of these, the global standards issued by the headquarters of Japanese companies included those used to promote the autonomous activities of the organization and to acquire budget funding. To facilitate verification of the introduction of global standards, we developed the following global standards: "risk assessment," "chemical substance management," and "facilities and personal protective equipment standards."

The components of an OHSMS that were developed and applied at each site are as follows: "formulation of the basic policy," "specialized human resources in OHS or utilization of external resources," "companies' global standards and regulations compliance," "promotion of autonomous activities," and "internal audit and continuous improvement."

The OHSMS at each site was based on the Occupational Health and Safety Assessment Series (OHSAS) 18001 in consideration of an integrated review with ISO 14001 and the possibility of future global integrated authentication. At the time of the development of the model hypothesis, ISO 45001 (which is similar to OHSAS 18001) was expected to become an ISO standard in the near future. Therefore, it was decided to replace OHSAS 18001 with ISO 45001 when it was made official.

3.2.2 | Evaluation indicators

To evaluate the global OHSMSs of Japanese companies, we decided to use process evaluations at the headquarters level and performance audits at the test sites. Process evaluation

TABLE 1 Laws on OHSMS and status of specialized human resources of nine countries using the information collection check sheet

No	Country name	Presence of laws and guidelines on OHSMS	Professionals mainly responsible for OHS activities	Legal requirements concerning the appointment and utilization of expert personnel in OHS	Status of training specialized human resources on OHS
1	Japan	Yes	OPs	The obligation to appoint an OP and the establishment of SM, HM, etc. are stipulated by laws and regulations at business establishments of a certain size or more.	OP qualifications can be obtained by taking education of 50 hours or more based on the standards of laws and ordinances.
2	Indonesia	No	OPs	There is an obligation to provide therapeutic medical services by an OP who directly employed in workplaces of a certain size or more.	OP qualifications can be acquired by taking education of 56 hours or more based on the standards of laws and ordinances. Certified specialist OPs are cultivated at several domestic universities.
3	Thailand	No There is a management system standard called TIS 18001, but there is no obligation to certify.	SOs	OHS activities are structured to focus mainly on SOs. There are five levels of SO. Specialized OPs perform special health examination.	The number of certified OPs being trained is not large. SO has been trained in 86 facilities as of February 2015.
4	China	No Safety production standardization exists as a framework for promoting OHS activities, and applicable business sites need to comply with these requirements.	SOs	Establishment standards for SOs are determined. Only institutions that have qualified doctors who are certified by the government can conduct special health checkups.	SOs can be in charge of graduation above the vocational school or those who received a certain training. There are no certified OPs, but public health doctors (medical departments) are being trained at universities throughout the country.
5	Myanmar	No	None	None	None
6	Germany	No	OPs	There is an obligation to appoint an OP, a SO. Those persons in charge can be an employee or an external expert.	OPs and SOs are trained.
7	United Kingdom	No	Family Doctor	There is no obligation to appoint an OP. There are cases where external consultants are utilized to satisfy the requirements specified by laws and ordinances.	Family doctor is playing the role of OP. There are qualified OPs.
8	United State of America	No	SPs His	There is no obligation to appoint a person in charge of OHS experts.	CSP (Certified SP) and CIH (Certified IH) are cultivated. Specialized OPs are cultivated at several domestic universities, and there is a specialist medical system certified by academic societies.
9	Brazil	No	OPs External experts	There is an obligation to appoint safety engineers, occupational health nurses, OPs.	Training of specialist OP is being conducted.

Abbreviations: HM, hygiene manager; IH, industrial hygienist.; OHS, occupational health and safety; OHSMS, occupational health and safety management system; OP, occupational physician; SM:safety manager; SO, safety officer; SP, safety professional.

TABLE 2 Status of major programs related to Occupational Health of nine countries using the information collection check sheet

No	Country name	Presence of Law of RA for harmful factors	Evaluation of health effects by hazardous work	Fit for work program	Management of personal information
1	Japan	Yes There are RA and chemical substance RA guidelines.	There is an obligation for SME. For each harmful factor, inspection items are stipulated by law.	There is an obligation of GME (before deployment, regular, special worker). There are guidelines on support for returning to mental health disabled people. Efforts are under way to support work and treatment compatibility at the same time.	The results of GME are obliged to be preserved by the operator for 5 years. Personal information is provided to business operators after processing by OPs and other.
2	Indonesia	No	There is an obligation for SME. Details of inspection items are not stipulated by laws and regulations.	There is a judgment classification of GME. More concrete judgment criteria and post correspondence according to health condition are defined for each employment classification.	No regulations concerning Personal information are stipulated.
3	Thailand	No	There is an obligation for SME at the time of employment and change of workplace. The details of inspection items are not stipulated in laws and ordinances.	If there is a finding on the result of SME by workers, arrange for the workers to receive medical treatment immediately and investigate the cause for prevention.	The employer shall record the results of all SME of workers engaged in hazardous work in the personal medical examination notebook.
4	China	No	SME must be carried out for workers engaged in hazardous work at the time of employment and at the time of changing workplaces. Inspection items are stipulated for each harmful factor by law. Standards of the executing agency are stipulated.	If a company finds a health hazard resulting from that job, it is necessary to relocate the workplace of that worker properly.	It is necessary to prepare and preserve health management records including data on health aspects concerning individuals such as worker's work history, past records that touched on occupational disease harm.
5	Myanmar	No	None	None	None
6	Germany	Yes There is an obligation to conduct RA.	There is an obligation to conduct SME.	There is an obligation to conduct GME(before deployment, regular, special worker). A list of OI and WRD exists and OP advises.	Individual medical information and health information can be confirmed only by OPs.
7	United Kingdom	Yes There is an obligation to conduct RA. Management itself places emphasis on self-management of business operators.	There is an obligation to conduct SME. Details of inspection items are not stipulated by law.	Fit note, which is the application form for official leave of compensation, is used at the time of reinstatement from sick leave. Workers first consult with their superiors and employers, and consideration is often given to employment on that basis.	The results of SME are to be managed by the business operator. Results of health examination will be notified to individual workers as well.

(Continues)

TABLE 2 (Continued)

No	Country name	Presence of Law of RA for harmful factors	Evaluation of health effects by hazardous work	Fit for work program	Management of personal information
8	United State of America	No Using the results of PEM, voluntary RA and measures based on the results are required.	There is an obligation to conduct SME for special work obtained by law.	At the time of reinstatement after occupational accidents or labor diseases, it is required to prepare a workplace where businesses can arrange by referring to the opinion written on the doctor's medical certificate at the time of reinstatement.	The results of SME are managed by the company (in-house personnel in charge). The results of GME (voluntary implementation) are managed only by individual workers and are not notified to business operators.
9	Brazil	Yes The risk of hazardous work inside the workplace is identified by experts in occupational health and safety outside the company.	There is an obligation to conduct SME.	OPs conduct assessment of job aptitude and state opinions to companies.	Only workers and OPs can view the results of SME and GME.

Abbreviations: GME, general medical examination; MH, mental health; OI, occupational injury; OP, occupational physician; PEM, personal exposure monitoring; PI, personal information; RA, risk assessment; SME, specific medical examination; WRD, work-related disease.

items at the headquarters level were "expression of company-wide basic policy on health and safety," "development and dissemination of company-wide global standards required to be implemented at each site," "opportunities for information sharing among staffs in charge of OHS at each site," and "establishment of indicators for performance audits conducted from the headquarters standpoint and training of auditors."

The performance audits at the test sites were conducted over 2 days by four researchers at each site. The audit team proposed the scoring system in relation to the performance audit evaluation (evaluation items and criteria) to top management and the OHS manager at the test site, and the scores were determined based on mutual agreement. Evaluation items at the test site were based on the following 12 items after discussion among research team members: (1) introduction of management systems, (2) appointment of personnel in charge of safety and health, organizational positioning, and job authority, (3) competency of personnel in charge of safety and health, (4) description in the management system of specialized resources (people/organizations) in relation to safety and health, (5) compliance, (6) risk assessment, (7) risk reduction measures, (8) evaluation of health of workers exposed to harmful factors, (9) evaluation of job aptitude and suitability for employment (fit for work), (10) management of personal information, (11) emergency preparedness in relation to OHS functions, and (12) prevention of recurrence of work-related illnesses. Each evaluation criteria was scored on a 10-point Likert scale ranging from "0: Procedure (criterion) does not exist" to "9: Procedure (criterion) is executed reliably and continuously until it reaches a level that is a model both inside and outside the company" (see Table 3).

3.3 | Introducing the model hypothesis at test sites and evaluating the roles of the company headquarters

3.3.1 | Test site in Indonesia

Problems before introduction of model hypothesis

We conducted the first performance audit at the Indonesian test site in August 2013. The audit showed that this site complied with laws and regulations, that an OHSMS had not been introduced, and that there were problems regarding a number of occupational health practices including risk assessment, chemical substance management, and health checks.

Specific activities to improve (September 2013 to May 2016)

After being introduced to global policies and draft global standards, professional staff from the company's headquarters provided education and training for workers. We also assisted site personnel in obtaining advice from local OHS experts.

TABLE 3 Trends in evaluation indicators before and after interventions in Indonesia and Thailand (test sites)

	Site in Indonesia		Site in Thailand	
Evaluation item	**Aug.2013**	**Jun.2016**	**Jun.2013**	**Aug.2016**
(1) Introduction of management system	2	5	2	3
(2) Appointment of the persons in charge of safety and health, organizational positioning, job authority	3	5	3	4
(3) Competency of person in charge of safety and health,	3	5	3	5
(4) Description in the management system of specialized resources (people/organization) for safety and health	2	5	2	3
(5) Compliance	4	5	4	5
(6) Risk assessment	3	4	0	3
(7) Risk reduction measures	2	3	0	3
(8) Evaluation of health effects of workers exposed to harmful factors	2	4	2	4
(9) Evaluation of job aptitude and consideration of employment (fit for work)	0	4	0	3
(10) Management of personal information	4	4	0	5
(11) Labor during crisis management function that takes safety and health into consideration	4	5	3	5
(12)Prevention of recurrence after occurrence of work-related illness	4	4	2	4

Definition of numbers: 0: Procedure (criteria) does not exist. 1: There is a procedure (criteria) but it has not been introduced. 2: There are procedures (criteria) and some have been introduced. 3: There is a procedure (criteria) but there is a significant issue that needs to be addressed before it can be introduced. 4: There is a procedure (criteria) but there is a minor issue that needs to be addressed before it can be introduced. 5: Procedure (criteria) is clearly executed. 6: Evaluation of effectiveness of procedure (criteria) is continually performed (there is a mechanism). 7: Procedures (criteria) are executed (reliably and continually) and have achieved consistent results. 8: The procedure (criteria) has been (reliably and continually) executed and has achieved high results. 9: Procedure (criteria) is (reliably and continually) executed, and it is at a level whereby it is a model inside and outside the company.

Improvements after implementation and evaluation

We conducted a second performance audit in June 2016, and the results from before and after the implementation of the model hypothesis were compared. OHSAS 18001 certification, which is an international standard for OHS management, was acquired in January 2014, and practices from the Japanese-based sites such as "Safety Dojo," KY (danger prediction), and 5S (Sorting, Setting-in-Order, Shining, Standardizing, and Sustaining the Discipline) activities were implemented at the Indonesian site. The test site entered into a consultancy contract with the Department of community medicine, University of Indonesia, and under the guidance of an occupational medicine expert, hazard identification was performed and a hazard list (eg, the creation of a noise map) was compiled. Then, risk assessment was undertaken based on the hazard list. The relevant aspects of the health-check process for workers engaged in hazardous work were also reviewed. Selection and education in the use of personal protective equipment was carried out and a professional OP was hired.

As a result of these efforts, the following six evaluation items improved by 2 points or more. (1) introduction of management systems, (2) appointment of personnel in charge of safety and health, organizational positioning, and job authority, (3) competency of personnel in charge of safety and health, (4) description in the management system of specialized resources (people/organizations) in relation to safety and health, (8) evaluation of health of workers exposed to harmful factors and (9) evaluation of job aptitude and suitability for employment (fit for work).These efforts resulted in changes in the site's scores, as shown in Table 3.

3.3.2 | Test site in Thailand

Problems before introduction of model hypothesis

We conducted the first performance audit at the site in Thailand in June 2013. The audit showed that safety and health management was being carried out under ISO 14001, and that there was compliance with the relevant laws and regulations. However, we found some problems regarding the development of risk management processes based on risk assessment and occupational health practices such as chemical substance management and health checks. A safety officer was hired and provided with appropriate training, including training in occupational health.

Specific activities to improve (July 2013 to July 2016)

We did not seek support for the expert personnel, but we did explain the global policy and the global standard plan, and the specialist staff at the company headquarters continued to implement risk assessment training. Because the safety officer who was hired did not have sufficient knowledge and experience, we recommended external training.

Improvements after implementation and evaluation

We conducted a second performance audit in August 2016. OHSAS 18001 certification was obtained in April 2015, and existing practices from the Japanese-based factories were implemented. Furthermore, a health and safety officer was placed in the manufacturing department, and existing workplace hazards were identified and a hazard list was created. Health checks for workers engaged in hazardous work were reviewed by the new safety officer. The health-check procedure was amended based on recommendations from an external OP. The in-house safety officer worked with external labor health agencies and began to use the results of the health checks to determine fit for work.

As a result of these efforts, the following eight evaluation items improved by 2 points or more. (1) Competency of personnel in charge of safety and health, (2) risk assessment, (3) risk reduction measures, (4) evaluation of health of workers exposed to harmful factors, (5) evaluation of job aptitude and suitability for employment (fit for work), (6) management of personal information, (7) emergency preparedness in relation to OHS functions and (8) prevention of recurrence of work-related illnesses. These efforts resulted in changes in the site's scores, as shown in Table 3.

3.3.3 | Evaluation of the company headquarters

The Japanese headquarters published global safety and health policies from April 2011 to August 2016. These outlined the company's behavioral standards, and global safety and health policies were transmitted to domestic and overseas business sites. It was decided that annual global health and safety meetings would be held and that OHSAS 18001 (now ISO 45001) or equivalent management system standards would be introduced. Performance audit related to OHS were also formulated, and initiatives to systematically audit a number of domestic and overseas business sites each year in accordance with the appropriate standards were implemented. Regarding the training of auditors, staff with relevant knowledge and experience were selected from within the company, and on-the-job training was provided. Efforts were made to secure and nurture specialized talent in each country to fulfill contracts between local institutions and overseas affiliates. If difficulties arose in dealings with a specific country, an OHS expert from Japan was dispatched to the site. Regarding global standards, guidelines for risk assessment, personal protective equipment, and chemical substance management were formulated and communicated.

The eight practices included in the model hypothesis at the company headquarters level were discussed and examined by the research team, who evaluated the degree to which each item had been achieved. Discussion continued until a unanimous decision was reached in relation to each item. As a result, the following nine practices were identified as the roles of headquarters. To establish and disseminate basic policy on health and safety by CEO. To establish global safety and health conference. To determine OHSMS standard. To formulate and notify global standards for OHS. To formulate and notify performance audit standards. To train auditors and conduct performance audits. To evaluate the competence and expertise of employed professionals and provide support to secure and develop specialized human resources as necessary. To provide technical support in the case of shortage of specialized resources. To clarify the reporting route to the headquarters of activities related to OHS at the site.

3.4 | Improvement of model hypothesis based on the results of the pilot implementation and completion of the global OHSMS model

As a result of the pilot implementation, the effectiveness of the model hypothesis was generally confirmed, with two issues being identified by the research team. First, it was deemed necessary to clarify the reporting mechanism to enable the company headquarters to better understand and compare the situation at each site. Second, the local professionals who were appointed lacked sufficient knowledge and experience in relation to the hygiene and health sectors.

As mentioned previously, safety awareness processes that are unique to Japanese companies, such as “Safety Dojo” and KY, were also introduced to overseas sites. However, when the research team first developed the model hypothesis and evaluation indicators, we did not see the need to evaluate these activities. Therefore, they were excluded from the evaluation in the pilot implementation. After these issues were addressed, the global OHSMS model for Japanese companies was completed, as shown in Figure 2.

The global OHSMS model included the following features: the inclusion of OHSAS 18001 (now ISO 45001), which is an international management system standard, the announcement of the policy by the CEO, the establishment of a coordination system between the company headquarters and local sites, the use of local expertise to collaborate with universities and other institutions, education and training of personnel, compliance with laws and regulations, preparation of in-house global OHS standards, and performance audits. After obtaining approval from management at the headquarters in Japan, the company finalized the global OHSMS model and decided to implement it globally.

4 | DISCUSSION

We developed a global OHSMS model in four steps to enable a common standard of OHS practice at all of a company's sites, including overseas sites.

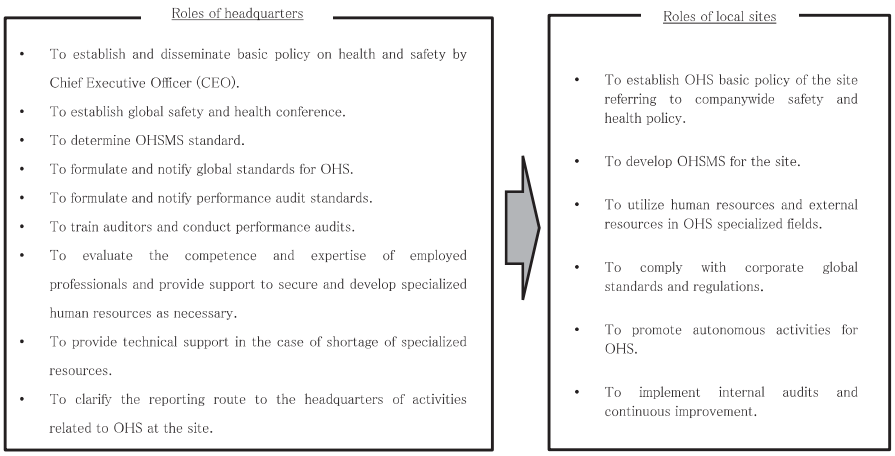

FIGURE 2 This figure shows the global OHSMS model for Japanese companies newly developed by this research group

In the first step, based on a previous study,[6] it was necessary to gather detailed information on OHS activities, which are conducted in accordance with each country's laws and regulations and the available human resources in terms of OHS professionals. Therefore, the research team gathered information in advance using the Internet, visited each country selected in the study sample, and gathered information on site by conducting interviews with various stakeholders.[7-9]

In the second step, it was necessary to develop and verify a model for an OHS system that could be used at overseas sites. Therefore, the research team discussed the information that had been compiled and developed a model hypothesis based on the results. In addition, evaluation indicators were developed. Furthermore, we emphasized the promotion of autonomous practice and human resource development at each site.

In the third step, it was necessary to select overseas sites to test the model hypothesis and verify the effects, and to undertake pilot implementations. In addition, it was necessary to enumerate the efforts that were necessary on the part of the Japanese headquarters. Therefore, based on the information relating to each country gathered during the first step,[7-9] and with the cooperation of the management of the company, two countries, Indonesia and Thailand, were selected for pilot implementations.

In the fourth step, based on the results obtained from the pilot implementations, the research team verified the validity of the model hypothesis and evaluation indicators. Finally, we improved the model based on our findings following the above process.

4.1 | Pilot implementation in two countries (Indonesia and Thailand)

Based on the theory assumed at the research team meeting, we conducted pilot implementation in Indonesia and Thailand. In the results using the evaluation indicator, the six and eight items have significantly improved in Indonesia and Thailand, respectively.

The common weakness was observed in occupational health programs, such as evaluation of health of workers exposed to harmful factors and evaluation of job aptitude and suitability for employment (fit for work) before implementation. One of the success factors at the pilot sites was evaluating the existing OHS expertise and improving it by obtaining advice external experts or enhancing skills of internal experts with training.[5] In addition, the implementation of risk assessment and risk reduction was not sufficiently implemented at the sites. Therefore, when introducing the global OHSMS, it was considered important to strengthen risk assessment education,[5] provide company-wide guidelines,[4] and secure experts who completed comprehensive OHS training.[5]

4.2 | Headquarters functions and roles promoting the global OHSMS model

In order to support the introduction of the global OHS model, the headquarters played several significant roles.[5] Among them, OHS policies by CEO and the OHS global conference, which brings together representatives from around the world, show the direction of the company and it is presumed that it was effective for information sharing and network construction.[4,5] It is also speculated that the common safety and health system was established at sites around the world by recommendation of obtaining the certification of the international standard of OHSMS (ISO45001[11]).

Performance audit that evaluates OHS activities with common items clarifies the characteristics and issues of each business site, and it offers opportunities for improvement of OHS activities.[3,12] The process and report of the performance audit should be accepted not only by the headquarters of Japan but also by the management of local business sites. The performance audit team was composed mainly of members of the research team who had auditor experience in the past.[12] Since audits require conversations in English, they may need to have certain language skills as well as OHS knowledge.

Since the performance audit was extremely important for the operation of the global OHSMS model and verification of the effects,[5,12] it should be considered to secure competent auditors by training inside resources contracting with outside ones.

4.3 | Reporting system to the health and safety department in headquarters regarding performance audit results

The evaluation of the performance audit identified two issues regarding the model hypothesis. In relation to the company headquarters' reporting system, each site currently reports to the manufacturing department, but not to the health and safety department. To enable an understanding of the OHS situation at each site and an evaluation of the effectiveness of the global standards, it is necessary to build a regular business reporting line to the company headquarters' health and safety department.

4.4 | Need for utilization of occupational health experts

To promote autonomous practices based on the minimum standards contained in the model hypothesis, it is essential to use specialized OHS resources.[2] While such specialized resources are used in Europe and the United States,[13,14] most Asian countries only have access to limited resources. The legal obligations in relation to the appointment of specialized staff also vary widely among countries.

Of the countries in which the model was introduced, Indonesia is required to appoint a doctor who has undergone a short period of training.[7] This legal requirement already existed at the time of the pilot implementation. However, the level of expertise was not considered sufficient, and was greatly improved by using an OP who undertook systematic training to obtain a professional qualification.

Meanwhile, in Thailand, the placement of a safety officer with an undergraduate degree from a faculty of public health is mandatory,[8] and this was already in place at the time of the pilot implementation. However, this requirement did not provide the officer with sufficient experience, and therefore the existing occupational health programs need further improvement.

Thus, in this model, it is desirable to select experts who are familiar with the local situation (eg, OPs and certified experts) in each country. This means that this need will be secured as a special resource in the occupational health field, and its effect will be clarified by recognizing it as a requirement. In developing countries, where it is difficult to obtain specialized resources, it is necessary to consider support from company headquarters and/or neighboring countries.

4.5 | Necessity of evaluation of practices to increase workers' awareness

Some practices were not subject to evaluation in the performance audits. These included Safety Dojo and KY[15] activities. In Japan, major safety practices must comply with various laws and regulations, and until risk assessment becomes mandatory,[16,17] measures must be developed to increase safety awareness. Thus, many overseas sites are making significant efforts in areas other than risk management. It is necessary to promote risk assessment, prioritize risks in the workplace, and strategically promote risk reduction. In addition, voluntary efforts to raise awareness of the health and safety of workers are also important.[18] A performance audit evaluates such efforts, and therefore improvements are essential, and are also a feature of the proposed management system.[3]

4.6 | Necessity of management leadership

Managing a global OHSMS requires leadership from top management[19] and this initiative was implemented with strong support from top management. They recognized that OHS issues at their overseas sites involved numerous risky practices. Thus, recognition and cooperation from top management at the company headquarters is indispensable for successful implementation at the local sites.

4.7 | Characteristics of a global OHSMS model for Japanese companies

Our global OHSMS model has the following features: (a) it introduces ISO 45001 as the framework for the OHSMS[11]; (b) the standard issued by the company headquarters is the minimum standard, including the basic global policy for OHS; (c) it uses the most appropriate professionals in the area; and (d) it includes a performance audit to confirm the effectiveness of the system and to provide opportunities for improvement.

To enable Japanese companies to establish consistently sound OHS practices at all sites, including overseas sites, we propose to introduce a management system that serves as an overall framework. ISO 45001 is a global standard,[11] and each country has appropriate resources such as a certification body. Furthermore, from the viewpoint of the company, it is advantageous if it possesses the possibility of integrated authentication with other ISO systems (eg, ISO 14001 and ISO 9001). However, by only introducing ISO 45001, we do not believe that OHS practices at overseas sites will improve to the level required. The introduction of ISO 45001 by Japanese companies is considered to be merely a "necessary condition" for the development of global OHS activities, including at overseas sites.[4,5]

Regarding the items issued by the company headquarters, these are limited to understanding the situation at each site and enabling comparisons, and by the need to secure OHS budget allocations. In countries where detailed requirements are already set out in various laws and ordinance,[17] there may be discrepancies and duplications between the company headquarters' standards and local laws and customs. For example, if health checks are mandatory in Japan, inconsistencies will arise in Western countries where health-check results are not used to determine a worker's ability to perform certain tasks because of privacy concerns. In addition, if measurement of the working environment is mandated, duplication occurs (such as requiring both practices in the country of management) based on personal exposure measurements. Thus, the company headquarters needs to act consistently in accordance with the global OHSMS model.

Under the proposed model, it is necessary to conduct performance audits on a regular basis, for example, every three years. This will ensure that conformity with standards is monitored, as well as the degree of conformity. Continuous improvement can also be evaluated. Therefore, it is essential that quality is maintained via performance audits conducted by internally trained auditors. If a global OHSMS model for Japanese companies is introduced and the understanding of the necessary internal standards by experts and staff in charge of OHS at each site is improved, then it will also be possible for them to act as auditors.

4.8 | Limitations

This model was established in relation to a specific company, and its validity was only confirmed in two emerging countries. Therefore, it is necessary to verify its effectiveness via full implementation throughout all of the company's overseas sites and through its application in other industries.

5 | CONCLUSION

The validity of our global OHSMS model was confirmed by the fact that company headquarters' roles functioned properly under the model, while OHS practices at the test sites were improved as a result of the intervention. We will further evaluate the effectiveness of the model by introducing it to all of the major manufacturing sites of the target company and by extending it to other companies in the near future.

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DISCLOSURE

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AUTHOR CONTRIBUTIONS

SK, KM, YK, and MU conceived the ideas, KH and NF collected the data, NP analysed the data and advised the revision of idea, and KM and SN led the writing.

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ORIGINAL ARTICLE

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Validation of the Job Content Questionnaire among hospital nurses in Vietnam

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Abstract

Objectives: The aim of this study was to examine the reliability and validity of the Job Content Questionnaire (JCQ) in Vietnamese among hospital nursing staff.

Methods: The 22-items version of the JCQ was used. This includes four scales: (a) psychological demands (5 items); (b) job control (9 items); (c) supervisor support (4 items); and (d) coworker support (4 items). All 1258 nurses in a general hospital in Vietnam, excluding 11 who were due to retire, were invited to complete the cross-sectional survey. The internal consistency reliability was estimated using Cronbach's α. Construct validity was examined using exploratory factor analysis (EFA). Convergent validity was evaluated by calculating correlations between the JCQ scores and DASS 21 and overtime work.

Results: In total, 949 (75%) of the 1258 eligible nurses completed the survey. Cronbach's α values demonstrated acceptable internal consistency in two scales (supervisor support α = .87; coworker support α = .86), while Cronbach's α was below the acceptable threshold of 0.70 for job control (α = .45) and job demand (α = .50). EFA assuming a four-factor structure showed a factor structure that was almost identical to the original JCQ, with two items loading on other scales. The subscales of

depression, anxiety, and stress response of DASS 21 and the subscales of JCQ were significantly correlated, as expected.

Conclusion: The results suggest that the JCQ in Vietnamese can be used with some reliability and validity for examining psychosocial work environment among nurses. Further studies should be done to confirm and expand our findings in a variety of occupational groups and in other Asian low- and middle-income countries.

KEYWORDS

job contents questionnaire, job strain, psychometric properties, reliability, validity

1 | INTRODUCTION

Recent changes in the work environment in medical settings in South-East Asia have led to new problems. The increased medical needs due to rapid aging of the population have caused a severe deficit in the nursing workforce in South-East Asia including low- and middle-income countries (LMICs).[1] In South-East Asian countries, including in Vietnam,[2] work-related stress among nurses has increased. Burnout and depression in the context of work-related stress among health-care professionals has become an important occupational health problem in this occupational group.[3] In a recent study, more than 45% of hospital nurses in Vietnam reported at least one mental symptom (ie, depression, anxiety, and stress).[4] An adverse psychosocial work environment could contribute to poor mental health of nurses. This issue has been studied extensively under several theoretical models of job stress in developed countries.[5] It is important to know what psychosocial work environment would be most associated with poor mental health among nurses in these LMICs of South-East Asia and to develop an appropriate theory-based intervention that can improve the mental health and well-being of nurses in these countries. Karasek's Job Demands-Control (DC) Model[6] and its extended version, the Demand-Control-Support (DCS) Model,[7] developed in the 1980s, are among the most well-known theories of how the psychosocial work environment can affect health of workers.[8] This theory emphasizes that job strain (the combination of high demand and low control) and the combination of job strain with low workplace support are the important factors in deteriorating worker health. The DC/DCS models have been tested and found to predict stress symptoms and poor mental health among nurses in high-income countries.[9] Among nurses, research in Taiwan showed that about 17% of nurses were categorized in the "high job strain" group (eg, high job demand and low control).[10] The components of job strain (eg, high demand, low control and low levels of social support) were associated with lower well-being,[11] higher physical symptoms,[12] higher stress-related symptoms,[13] higher catecholamine excretion and higher blood pressure more than other workers in different occupation.[14] In addition, continuing to work despite such physical/psychological reactions was correlated with supervisor support among the nurses with high strain.[15] Although DC/CDS model is a potentially useful explanatory framework for nurses' work environment, research on the DC/DCS models among nurses in LMICs is still limited.

The Job Content Questionnaire (JCQ) is a well-established and widely used self-report instrument that measures the work dimensions based on the DC/DCS model in the workplace.[16]. The core scales of JCQ consist of (a) decision latitude (ie, job control) composed of skill discretion and decision authority; (b) psychological job demands; and (c) social support (ie, supervisor/coworker support). For over 40 years, occupational health studies using the JCQ have shown evidence that high levels of job strain has negative effects on many health outcomes, including cardiovascular, musculoskeletal, and psychiatric disease[17,18] in various working populations, including in medical settings. Validation studies for the JCQ in some countries, such as Malaysia, the Islamic Republic of Iran, China, and Spain, were conducted with nurses as study participants.[19-22] Korean and Greek versions were developed for hospital medical staff, but not restricted to nurses.[23,24] While JCQ has been widely used internationally in medical settings, research using JCQ is still limited LMICs in South-East Asia, especially low- and lower middle-income countries.

Among the over 29 JCQ translated versions currently available, most were developed in American and Western European countries. Although several language versions have been developed and validated in Asian countries, only Thai and Malay versions are available in LMICs in South-East Asia to date.[19,25] Thailand and Malaysia are upper middle-income countries, and it remains uncertain whether the JCQ is applicable to nurses in low- and lower middle-income countries in South-East Asia. Although a DC/DCS model-based questionnaire, the Demand-Control Questionnaire (DCQ), was translated into Vietnamese,[26] it was criticized because a job strain category defined by the DCQ showed only moderate concordance with that defined by the JCQ.[27] It is important to develop the JCQ and test its reliability and validity among nurses in a LMIC in South-East Asia, such as Vietnam.

The purpose of this study was to examine the internal consistency reliability and construct validity of the Vietnamese version of the core 22-item JCQ among nurses in Vietnam. The study would permit extending the use of the JCQ among nurses, which is currently limited in high-income and upper middle-income countries, to a lower middle-income country in South-East Asia,

2 | SUBJECTS AND METHODS

2.1 | Study design

With permission from Professor Robert Karasek, the developer of the JCQ, we translated 22 core items of the JCQ into Vietnamese. A baseline survey was conducted for a stress management intervention study in a large general hospital in Hanoi, Vietnam,[28] from August to September 2018. The aims and procedures of the study were explained through the head nurse of each department and a written consent form was obtained with the baseline questionnaire. Participants were assured that the survey was anonymous, and no individual would be identified in analyzing and reporting the data. The Research Ethics Committee of the Graduate School of Medicine/Faculty of Medicine, The University of Tokyo (no. 11991-(1)), and the Ethical Review Board for Biomedical Research, Hanoi University of Public Health (no 346/2018/YTCC-HD3) reviewed and approved this study.

The study conformed to the Consensus-based Standards for the Selection of the Health Measurement Instrument (COSMIN) guideline, which is used to improve the quality of developing health-related self-reporting measurement instruments.[29] Each characteristic of the measure was reported according to the COSMIN checklist.

2.2 | Participants

An invitation to participate in the study, information about the study, an informed consent form, the questionnaires and a numbered envelope in which to anonymously return the completed questionnaire were distributed to all registered nurses (n = 1258) in the hospital, excluding those who were going to retire within 7 months (n = 11). Nurses individually returned the completed questionnaires in a sealed envelope into a box. The staff of Hanoi University of Public Health (HUPH) collected the completed questionnaires and numbered envelopes and information was entered into a database by HUPH staff.

2.3 | Measurements

2.3.1 | The job content questionnaire

The JCQ originally comprised 49 items.[16] We used four core scales of the JCQ (JCQ-22) that included 22 items of the following scales: a five-item psychological demand scale, a nine-item decision latitude scale, a four-item supervisor support scale, and a four-item coworker support scale. Response categories for these items are on a four-point scale: "Strongly disagree," "Disagree," "Agree," and "Strongly agree"(range, 1-4). A sum of weighted item scores was used as a scaled score according to the following calculation formula:[30]

$$\text{Skill Discretion} = (Q3 + Q5 + Q7 + Q9 + Q11 + (5 - Q4)) * 2$$

$$\text{Decision Authority} = (Q6 + Q10 + (5 - Q8)) * 4$$

$$\text{Decision Latitude} = (\text{Skill Discretion}) + (\text{Decision Authority})$$

$$\text{Psychological Demand} = (Q19 + Q20) * 3 + (15 - (Q22 + Q23 + Q26)) * 2$$

$$\text{Supervisor Support} = Q27 + Q28 + Q30 + Q31$$

$$\text{Coworker Support} = Q32 + Q33 + Q35 + Q37$$

The authors complied with the ISPOR taskforce guideline,[31] which is the standard procedure for translation and adaptation of self-reporting scales in other languages. The Vietnamese translation of JCQ22 items was prepared by the Vietnamese co-authors who are fluent in English and knowledgeable about occupational stress theory. The forward translation was reviewed and adjusted by collaborators in HUPH. A pilot test and discussion of the questionnaire items were conducted with 30 nurses to ensure that the items were relevant and meaningful to this population. Nurses were asked whether questionnaire items were easy to understand and applicable in the context of their work environment to determine whether alternative wording might be more appropriate and to check interpretation and cultural relevance of the Vietnamese translation. After these consultations with nurses, the wording of only a few items was revised, while ensuring that the original meaning was not altered, the (slightly) amended version was back-translated into English by an independent translator and reviewed by research members of the University of Tokyo, including the researcher who developed the Japanese version of JCQ22.[30] A pilot study was then conducted, with 150 nurse participants, in June 2018. As no problematic issues were identified in the pilot study, this was accepted as the final Vietnamese version of the JCQ.

2.3.2 | Overtime work

Respondents were asked to rate their overtime work in the prior 4 weeks (28 days). Overtime work was measured in two ways; extra work in addition to their regular working hours

TABLE 1 Demographic characteristics of the study participants from hospital nurses in Vietnam (N = 949)

	% (n)
Gender	
Men	15.1 (143)
Women	84.9 (806)
Age, mean (SD)	6.8 (33.1)
Education	
Vocation school	46.7 (443)
Colleges	14.4 (137)
University undergraduate	36.7 (348)
Postgraduate	1.8 (17)
Unknown	0.4 (4)
Marital status	
Single	14.4 (137)
Married	83.6 (793)
Divorced/widowed	1.7 (16)
Unknown	0.3 (3)
Employment contract	
Fixed-term, ≦1 y	23.2 (220)
Fixed-term, >1 y	3.2 (30)
No fixed-term	20.4 (194)
Permanent	53.2 (505)

Abbreviation: SD, standard deviation.

and holiday work, by asking "How many days did you come in early, go home late?" and "How many days did you work on your day off?," respectively.

2.3.3 | Depression, anxiety, and stress

The 21-item version of DASS measures symptoms of depression, anxiety, and stress with seven items for each of the three subscales.[32] All items were rated on a 4-point Likert-type scale, ranging from 0 "did not apply to me at all" to 3 "applied to me very much, or most of the time," accordingly. Each of the three subscale scores ranged from 0 to 21. The Vietnamese version of DASS 21 has previously been validated and confirmed.[33]

2.3.4 | Demographic variables

Demographic and occupational variables were assessed by a questionnaire, including gender (male or female), age, education status (vocational school, college, university undergraduate or postgraduate), marital status (single, married or divorced/widowed), and employment contract (fixed-term contract for <1 year, fixed-term contract for more than 1 year, unspecified-term contract, permanent contract, or others). Age was calculated based on the year of birth.

2.4 | Statistical analysis

Statistical significance was defined as $P < .05$. All the statistical analyses were performed using SPSS 25.0, Japanese version (SPSS Inc).

To assess the internal consistency, Cronbach's alpha (α) coefficients were calculated for each of four-factor scores (ie, psychological demand, decision latitude, supervisor support, and coworker support) of JCQ in Vietnamese. Cronbach's $\alpha > .7$ was the criterion for acceptability.

In the exploratory factor analysis (EFA), factors with eigenvalues of more than 1.0 were extracted and the Promax rotation method was used to obtain factor structures, using a robust maximum likelihood estimation. Based on the previous research, authors hypothesized a four-factor structure. Before conducting EFA, the scores of five items were reversed as recommended in the JCQ guidelines:[34] two items for decision authority (Q4: "repetitive work" and Q8: "little decision freedom") and three items for psychological demand (Q22: "no excessive work," Q23: "enough time," and Q26: "no conflicting demands").

As a hypothesis test for construct validity, Pearson's correlation coefficients (rs) were calculated between the total score of the JCQ and two groups of variables: indicators of overtime working and DASS 21. This construct approach corresponded to convergent validity; comparison with other outcome measurement instruments. In addition, a one-way factorial ANOVA was performed to compare the scores of JCQ four scales among demographic and occupational variables.

3 | RESULTS

3.1 | Characteristics of participants

We received responses from 949 (75%) of the target sample. Female 85%, average age 33.1 years old. The demographic characteristics of the participants are shown in Table 1. Many of the participants had graduated from vocational school (46.7%) and were married (83.6%). Employment contracts of most nurses were permanent (53.1%).

3.2 | Internal consistency reliability

Table 2 shows mean scores and Cronbach's alphas (α) for all JCQ scales. The Cronbach's α coefficients were below the acceptability threshold ($\alpha > .7$) for psychological demands ($\alpha = .50$) and decision latitude ($\alpha = .45$), but well above for supervisor support ($\alpha = .87$) and coworker support ($\alpha = .86$).

3.3 | Factor structure of JCQ in Vietnamese

The results of EFA are shown in Table 3. The EFA yielded four factors: all items of, two factors—Decision Latitude and

TABLE 2 Average, standard deviation (SD) of JCQ scores in a sample of hospital nurses in Vietnam (total N = 949)

Scales (Number of items) [possible range]	Mean	SD	Cronbach's α
Decision latitude (9) [24-96]	71.0	6.4	.45
Skill discretion (6) [12-48]	34.5	3.4	.43
Decision authority (3) [12-48]	33.5	4.1	−.04
Psychological job demands (5) [12-48]	31.6	4.4	.50
Social Support			
Supervisor (4) [4-16]	12.0	1.9	.87
Coworkers (4) [4-16]	12.2	1.5	.86

Note: Participants who had missing data were excluded from each analysis.
Abbreviation: SD, standard deviation.

Coworker Support—loaded most on the corresponding factors as expected. However, one item related to psychological demands (Q26: "no conflicting demands") was loaded most on a factor representing the Supervisor Support; an item related to decision latitude (Q9: "variety") loaded most on a factor of Psychological Demands.

3.4 | Convergent validity

Table 4 shows correlations between JCQ scores and overwork and DASS21. In the convergent validity, both of the two types of overwork and three subscales of DASS 21 were significantly but weakly correlated with high psychological demands ($0.11 \leq r \leq 0.22$). Supervisor and coworker support negatively correlated with all variables ($-0.04 \leq r \leq -0.20$). Most correlation coefficients, except the correlation between overwork and decision latitude, indicated good convergent validity.

Table 5 shows the results of variance analysis to examine the difference between each category of demographic characteristics. One-way ANOVA revealed some significant differences among variables (eg, associations between high education status (postgraduate) and higher psychological demands, short employment contract (fixed term below 1 year) and lower psychological demands and higher supervisor/coworker support).

4 | DISCUSSION

As far as we know, this is the first study to develop and test the JCQ in a South-East Asian lower middle-income country. Among scales of the newly translated Vietnamese version of the JCQ, supervisor and coworker support scales showed an acceptable level of internal consistency reliability, while it was lower for scales of psychological demands and decision latitude. In EFA, the four-factor model was well-adjusted for the JCQ in Vietnamese, except for two items. Most of the JCQ scale correlated highly with workload and stress symptoms measured by other scales in the theoretically expected directions, supporting the convergent validity of the scale. As shown by ANOVA, there were some significant differences in JCQ scores by demographic characteristics. The findings support that the Vietnamese version of supervisor and coworker support scales of the JCQ are a reliable and valid measures of these psychosocial job characteristics among Vietnamese nurses; however, a careful consideration is needed to apply the scales of psychological demands and decision latitude in this occupation in Vietnam, as other studies previously indicated.[19-21,23]

The strength of this study is the careful process of translating the scales, including consulting professionals and users on all contents (eg, items, tasks and parameters) in a qualitative way. Content validity, considered to be the most important measurement property by COSMIN, ensures that all contents of an outcome measurement instrument is relevant, comprehensive, and comprehensible with respect to the construct of interest and target population.[29] Therefore, the Vietnamese version of the JCQ was properly developed and tested, following the evidence-based guideline.

Cronbach's alpha coefficients were high for supervisor and coworker support (0.87 and 0.86, respectively), indicating that these scales are acceptably reliable. However, Cronbach's alpha coefficients of psychological demands ($\alpha = .50$) and decision latitude ($\alpha = .45$) were below the acceptability criterion ($\alpha > .7$). Reliability for psychological demands has often been reported as low to moderate in Asian studies, ranging from 0.41 to 0.58 among nurses[19-21,23] and 0.23 to 0.65 among general workers.[25,30,35] The result of this study is consistent with previous research in Asia. Authors of previous research studies suggested that five questions in this scale might too few for various psychological demands encountered at the workplace in Asian countries, particularly those experiencing rapid changes. Medical employees have been required to learn new technologies, which they have found psychologically demanding.[23] For the nurses, some studies have also demonstrated similarly low internal consistency for decision latitude; ranging from 0.54 to 0.72 among nurses[19-21,23] and 0.68 to 0.84 among general workers[25,30,35] in Asia, while the result of this study was lowest. In this study, two items; Q4: "repetitive work" and Q8: "little decision freedom" which must be reversed, correlated with other scales of decision latitude (data available upon request) even before reversing, contrary to theory. After dropping these two items, the alpha coefficients increased to an almost acceptable value ($\alpha = .67$). This indicated that these two items correlated poorly with other items in the decision latitude scale. These items thus would be inappropriate to the context of medical settings in Vietnam.

TABLE 3 Exploratory factor analysis assuming a four-factor structure by using maximum likelihood with Promax rotation

Item†		Factor 1	2	3	4
Factor 1 Supervisor support					
Q49 (SS)	Supervisor pays attention	**.973**	−.127	−.038	.010
Q51 (SS)	Helpful supervisor	**.844**	.052	−.122	.073
Q52 (SS)	Supervisor good organizer	**.742**	.124	−.102	.086
Q48 (SS)	Supervisor is concerned	**.705**	−.029	.063	−.053
Q26R (PD)	No conflicting demands	**−.291**	−.043	−.041	.101
Factor 2 Coworker support					
Q56 (CS)	Friendly coworkers	−.109	**.851**	−.017	.025
Q58 (CS)	Coworkers helpful	.001	**.804**	.022	.021
Q54 (CS)	Coworker interest in me	.065	**.767**	−.047	−.026
Q53 (CS)	Coworkers competent	.129	**.642**	.017	−.031
Factor 3 Decision latitude					
Q5 (SD)	Requires creative	.016	−.079	**.680**	−.078
Q3 (SD)	Learn new things	.022	.013	**.570**	−.010
Q7 (SD)	High skill level	.049	−.011	**.538**	.135
Q6 (DA)	Allows own decisions	.029	.041	**.361**	.093
Q4R (SD)	Repetitive work	.104	−.007	**−.325**	−.120
Q11 (SD)	Develop own abilities	.265	.066	**.306**	−.130
Q10 (DA)	Lot of say	.179	.221	**.241**	−.030
Q8R (DA)	Little decision freedom.	.148	−.051	**−.174**	−.073
Factor 4 Psychological job demand					
Q20 (PD)	Work hard	.002	−.029	.094	**.724**
Q19 (PD)	Work fast	.025	.087	.091	**.510**
Q9 (SD)	Variety	−.035	−.046	.254	**.417**
Q23R (PD)	Enough time	−.240	−.002	−.144	**.262**
Q22R (PD)	No excessive work	−.152	−.046	−.079	**.257**

Primary loadings for each items are in bold.

Abbreviation: R, reversed items.

†The items are abbreviated. Letters in the parentheses indicate a scale that the item originally belong to: SS, supervisor support; CS, coworker support; SD, skill discretion. DA, decision authority; PD, psychological job demand. SD and DA are subscales of decision latitude.

From the EFA of the 22-item JCQ, the factor patterns for decision latitude, psychological job demand, and social support clearly corresponded to the theoretical construct of the DCS model. However, there were two exceptions: the item Q26: "no conflicting demands" was negatively loaded on supervisor support, instead of psychological demands. It might be possible that nurses considered this question as the process of decision-making with supervisors, as opposed to with doctors or patients. The item of Q26: "no conflicting demands" has been criticized in other studies,[16,25,30,35,36] being likely to have low loading values and sometimes belonging to the margin of other factors. The authors of the Taiwan-JCQ study noted that language and terminology occasionally influence the answers to this question, leading to misunderstanding in interpretation.[35] Meanwhile, the item Q9: "variety" was positively loaded on psychological demand. A previous study of hospital staff in Korea also reported a similar finding.[23] Among nurses, the degree of job variety could be perceived as a workload. In addition, the internal consistency was negative for the decision authority

TABLE 4 Pearson's correlation coefficients† between the total score of JCQ and overtime work (morning or night, or holiday) and depressive, anxiety, and stress symptoms among nurses in Vietnam

Variables (possible range)	N	Mean	SD	Psychological demands	Decision latitude	Supervisor support	Coworker support
Overwork							
Morning or Night (0-28 d/mo)	936	5.8	8.8	0.22**	0.04	−0.14**	−0.04
Holiday (0-28 d/mo)	941	2.1	1.7	0.11**	0.07*	−0.07*	−0.05
DASS21							
Depressive symptom (0-21)	933	3.0	2.9	0.17**	−0.15**	−0.20**	−0.20**
Anxiety symptom (0-21)	936	3.9	3.1	0.19**	−0.07*	−0.16**	−0.11**
Stress reaction (0-21)	936	5.6	3.6	0.18**	−0.07*	−0.16**	−0.16**

Abbreviation: SD, standard deviation.
†Participants who had missing data were excluded from each analysis.
**$P < .01$,
*<.05.

subscale ($\alpha = -.04$). This is partly because Q8: "little freedom of decision" (reversed) was independent of the other items of the subscale, Q6: "allows own decisions" and Q10: "lot of say," as indicated by the EFA. Actually, the Q8 asks the decision on how to work. Nurses usually work on allocated tasks in a team. They may not have the freedom of decision on how to work, while they still have a chance to make own decision and lot of say on their allocated tasks. The decision latitude scale of the JCQ could be revised or reorganized considering specific characteristic of nursing job. Removing Q9: "variety" and separating task-level (eg, Q6 and Q10) and team-level (eg, Q8) decision authority may improve the measurement of decision latitude among nurses using the JCQ.

As expected, most of the scores on the JCQ correlated with the indicators of overtime work (morning or night, or holiday) and depressive, anxiety, and stress symptoms, except for the association between overwork and decision latitude. However, this may be reasonable because health-care workers are likely to have longer working time and higher job control than other occupations.[37] Nurses with high control in the hospital in Vietnam might be likely to work actively with authority, which would lead to a longer work hours. Long working hours, even with high control, are associated with lower self-rated health, compared with short working hours.[38] This association has suggested a possible target population among nurses for intervention.

One-way ANOVA showed statistically significant differences among each variable; high education status (postgraduate) and high psychological demand, short job contract (fixed-term, ≦1 year) and low psychological demand and high supervisor/coworker support, marital status (divorced/widowed) and low supervisor support, and women scored higher on coworker support than did men. In a Vietnam hospital, nurses with short-term jobs are more likely to be involved in a low-pressure environment, low demand and high support. Previous research with nurses, however, has not shown the length of tenure to be associated with psychosocial job environment as a common antecedent of job stress.[39] In the hospital in which this study was conducted, nurses might be assigned different work according to their education, history, and contract tenure.

5 | LIMITATIONS

Finally, some possible limitations should be noted. First, the repetitive stability of the scale is uncertain because test-retest reliability was not examined. In the JCQ validation studies, test-retest reliability has rarely been tested, except for a few studies,[23,35,40] because work conditions change easily, which could cause an underestimation of true stability. Second, as an important form of construct validity, cross-cultural validity has not been examined in this study. However, structural validity and hypotheses testing were conducted and well-evaluated, indicating sufficient construct validity. Third, participants were all nurses. It is unclear whether the Vietnamese version of JCQ can be applicable for other occupations. Fourth, this study has validated only the core 22-item JCQ, not the recommended format of 49 items.[34] However, because workplaces in LMICs such as Vietnam are so busy and complicated, especially in medical settings, the shorter form of the scale is likely to be more feasible.

6 | CONCLUSION

In conclusion, the findings of this study indicate that the Vietnamese version of the JCQ has acceptable in reliability and validity for assessing psychosocial work conditions among Vietnamese nurses, in spite of relatively low internal consistency

TABLE 5 Comparison with the participant characteristics for four scales of JCQ in Vietnamese (One-way ANOVA)

	Psychological demands			Decision latitude			Supervisor support			Coworker support		
Category (number)	Mean (SD)	*F*	*P*	Mean (SD)	*F*	*P*	Mean (SD)	*F*	*P*	Mean (SD)	*F*	*P*
Gender												
Men (143)	31.2 (4.6)	0.86	.35	71.5 (7.1)	0.79	.38	12.0 (2.0)	0.09	.77	12.0 (1.9)	4.21	.04
Women (806)	31.6 (4.4)			71.0 (6.3)			12.0 (1.8)			12.2 (1.4)		
Age												
20-29 (349)	31.3 (4.4)	0.92	.40	70.7 (6.5)	1.36	.26	12.1 (1.9)	1.12	.33	12.3 (1.5)	2.57	.08
30-39 (428)	31.5 (4.4)			71.4 (6.4)			11.9 (1.9)			12.1 (1.5)		
>40 (172)	31.9 (4.5)			70.9 (6.4)			11.9 (1.8)			12.1 (1.3)		
Education												
Vocation school (443)	31.7 (4.5)	3.50	.02	71.3 (6.4)	1.19	.31	12.1 (1.9)	2.46	.06	12.3 (1.4)	1.06	.37
Colleges (137)	30.5 (4.5)			70.2 (6.8)			12.2 (2.0)			12.3 (1.6)		
University (348) undergraduate	31.7 (4.2)			71.1 (6.4)			11.8 (1.8)			12.1 (1.4)		
Postgraduate (17)	33.2 (4.2)			72.0 (5.9)			11.6 (2.3)			12.4 (1.9)		
Marital status												
Single (137)	31.1 (4.6)	0.84	.43	70.7 (5.8)	1.71	.18	12.4 (1.9)	10.0	<.01	12.5 (1.7)	2.67	.07
Married (793)	31.6 (4.4)			71.2 (6.5)			12.0 (1.8)			12.2 (1.5)		
Divorced/widowed (16)	31.3 (3.5)			68.4 (8.2)			10.3 (2.3)			12.0 (0.5)		
Employment contract												
Fixed-term, ≦1 y (220)	30.7 (4.5)	3.36	.02	70.8 (6.0)	0.46	.71	12.4 (1.9)	4.04	<.01	12.6 (1.5)	6.93	<.01
Fixed-term, >1 y (30)	32.5 (4.2)			70.4 (5.3)			11.8 (1.9)			11.9 (2.1)		
No fixed-term (194)	31.9 (4.4)			71.4 (7.2)			11.9 (1.9)			12.0 (1.5)		
Permanent (505)	31.6 (4.4)			71.1 (6.3)			11.9 (1.8)			12.1 (1.4)		

Abbreviation: SD, standard deviation.

reliability of psychological demand and decision latitude. The structure of the Vietnamese JCQ by factor analysis was slightly different from the original instrument. A careful consideration is needed to apply the JCQ scales of psychological demands and decision latitude in this occupation in Vietnam, as in other countries, because few items may not correctly address these psychosocial factors at work. Further research needs to test the Vietnamese JCQ in a variety of occupational groups.

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DISCLOSURE

Approval of the research protocol: This study was approved by The Research Ethics Committee of the Graduate School of Medicine/Faculty of Medicine, The University of Tokyo (no. 11991-(1)), and the Ethical Review Board for Biomedical Research, Hanoi University of Public Health (no 346/2018/YTCC-HD3) regarding research protocol. *Informed consent*: Written informed consent was obtained from all participants with full disclosure and explanation of the purpose and procedures of this study. We explained that their participation was voluntary, and they can withdraw from the study at any time even after voluntarily participating without any reason. *Registry and the registration no. of the study/trial*: N/A. *Animal studies*: N/A. *Conflict of interest*: None declared.

AUTHOR CONTRIBUTION

NK was in charge of this study, of supervising the process and of providing his expert opinion on the subject. The members of The University of Tokyo (NS, KI, KW, KK, AS, NK) organized the study design and analyzed the data. Collaborators in Vietnam (TTT, NTH, BMT, NTQ, NTK, NTN, NHG, TQT) conducted the survey to collect data and interpreted it. HM, MZ, and AT ensured that questions related to the accuracy or integrity of any part of the work were appropriately investigated and resolved. All authors contributed to the process of developing and evaluating JCQ in Vietnamese. NS wrote the first draft of the manuscript, and all other authors revised the manuscript critically. All authors approved the final version of the manuscript.

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Implementation and effectiveness of the Stress Check Program, a national program to monitor and control workplace psychosocial factors in Japan: a systematic review. Translated secondary publication

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Abstract

Purpose – The purpose of this paper is to conduct a comprehensive review on the implementation and the effect of Japan's Stress Check Program, a national program to monitor and control workplace psychosocial factors that was initiated in December 2015.

Design/methodology/approach – We comprehensively reviewed articles published in Japanese and English, assessed the performance of the Stress Check Program and summarized future challenges. We also discussed the implications for practice.

Findings – The available literature presented a scientific basis for the efficiency and validity of predictions using the Brief Job Stress Questionnaire, which is the instrument recommended to screen workers with high stress in the program. No study has verified the effect of the program on workers' mental health by using group analysis of stress check results. There is room for improvement in tools that contribute to identifying workers with high stress and in measures for improving the work environment. The Stress Check Program contrasts with risk management of psychosocial factors at work, widely adopted in European countries as a strategy for improving workers' mental health by focussing on the psychosocial work environment.

Practical implications – Although the effectiveness of the Japanese program needs further evaluation, future developments of the program would provide insight for national policies on psychosocial risks/psychosocial stress at work.

Originality/value – This paper is the first systematic review on the implementation and effects of Japan's Stress Check Program.

Keywords The stress check program, Brief job stress questionnaire, Occupational health system, Work environment improvement, Japan

Paper type Literature review

Introduction

Workers' mental health has been one of the biggest issues in Japan as is often the case in many other developed countries. As of 2014, a total of 1,456 claims were submitted requesting worker compensation for work-related mental disorders, and among these, 213 were suicide-related. The number of claims for mental disorders had steadily increased almost five times during the previous 14 years. Japanese government came up with several remedies to address the growing problem of work-related mental disorders, including the amendments of Industrial Health and Safety Law and the release of guidelines to enhance effectiveness of the law. In sheer numbers of claims requesting compensation, however, it appeared that the remedies had only limited effects in improving workers' mental health. In 2014, this law was extended to include a Stress Check Program – the first mandated policy in the history of mental health in workplaces in Japan (Kawakami and Tsutsumi, 2016; Tsutsumi, 2016).

The Stress Check Program requires enterprises to implement an annual test (stress check) to gain understanding of the psychological burdens placed on their workers. Enterprises with fewer than 50 workers (small-scale enterprises) are only obligated to make reasonable efforts in this regard. Currently, the Stress Check Program is implemented in two ways. First, following preparation for implementation, a stress check is performed for all workers within an enterprise, and each worker is notified of their results. Based on these results, an interview with a physician is offered for those under high levels of stress (mandatory). Second, personal results are summarized and analysed for groups of a certain size, and group analysis used to improve the work environment (referred to as "reasonable efforts"). The Stress Check Program is the primary preventative measure for mental health issues among workers in Japan. Specifically, key functions of the Stress Check Program are: building awareness of workers' stress; providing support for self-care and improvement of the work environment based on test results. The stress checks mean that workers under high stress can be identified, including those who require professional support; this allows for secondary preventative measures to identify and respond to mental health issues (regarded as secondary objectives).

The Stress Check Program is part of a series of measures for workplace mental health in Japan (Kawakami and Tsutsumi, 2016; Tsutsumi, 2016). These measures must be enacted holistically to ensure maximum returns from implementation of the Stress Check Program. However, verifying evidence from individual activities within the Stress Check

Program will be useful to inform efforts to further improve the program. These activities include: verifying test tools to identify high level of stress (the recommended tool is the Brief Job Stress Questionnaire [BJSQ]); implementing a routine survey for workers to reduce mental health risks through sharing results with each worker; screening for workers under high levels of stress to prevent mental health issues through interviews with physicians and reduction in psychological stress responses by improving work environments based on group analysis (including education for managers and supervisors) (Tsutsumi *et al.*, 2018).

We comprehensively reviewed articles published in Japanese and English that focussed on the implementation and effects of the Stress Check Program, assessed the performance of the Stress Check Program for the first three years after initiation and summarized future challenges. The present study is the first systematic review focussed on the implementation and effects of the Stress Check Program. In this review, we examined the evidence on: (1) implementation of the Stress Check Program, (2) utility and validity of tools for stress checks and (3) effects of the Stress Check Program. We also discussed what the relevance of the Stress Check Program as implemented in Japan is to other countries, by comparing the policy and the components of the program with the trends in the management of psychosocial factors at work according to the policies and guidelines of international bodies and other countries. This evaluation and recent development of the national program may provide useful information for international readers who are interested in national policies on psychosocial risks/psychosocial stress in the workplace.

Methods

A search of Japanese language papers was performed using Ichushi Web (Japan Medial Abstracts Society) on 17 April 2019. Papers published in English were searched using MEDLINE (PubMed) on 27 March 2019. The target publication dates were within five years before initiation of the present study (2019), giving a start date of 1 January 2014. Japanese language papers were searched using the key search term "*sutoresuchekkuseido*" (stress check program), with types of papers limited to original articles and case reports using an Ichushi web filter function. English language papers were searched using the formula "((stress AND check) OR stress-check) AND Japan*." Titles, abstracts and full texts of returned papers were read by the authors and papers that met the following criteria were included. Eligibility criteria for Japanese language papers were as follows: (1) published in Japanese; (2) covered legislated content of the Stress Check Program (content in accordance with the Stress Check Program for those that used data before the legislation); (3) included stress checks as content and used a questionnaire that measured job stressors, stress responses and social support (program requirement) and (4) were not review articles, conference abstracts, commissioned reports, or papers not peer-reviewed. Eligibility criteria for English language papers were as follows: (1) published in English; (2) conducted after the introduction of the Stress Check Program; (3) focussed on the implementation, impact or challenges of the Stress Check Program or on the scientific bases for the questionnaire used for the program, and based on quantitative or qualitative data and (4) were peer-reviewed. In cases where it was difficult to determine whether a paper was related to the legislated Stress Check Program, all of the present authors made a consensus judgement on whether to include or exclude that paper. Included papers were summarized based on: (1) implementation of the Stress Check Program; (2) utility and validity of Stress Check tools and (3) effects of the Stress Check Program.

Results

The literature search identified 114 papers from the two databases: 60 Japanese language papers and 54 English language papers, with 18 papers finally included in this review (Figure 1). Of the 60 Japanese language papers, we excluded: papers written in English

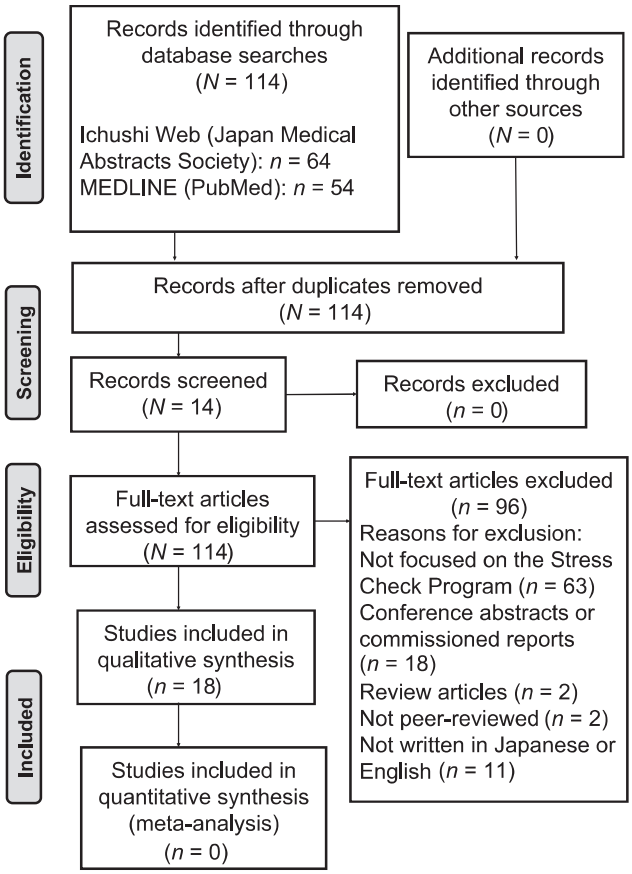

Figure 1.
PRISMA flow diagram

(n = 5); papers with inconsistent content (n = 18), including unrelated content (n = 12), preliminary tests before implementation of the program (n = 2) and studies without a questionnaire that measured job stressors, stress responses and social support (n = 4); conference abstracts (n = 12); commissioned reports (n = 6); papers that were not peer-reviewed (n = 2) and reviews (n = 2). This left 15 Japanese language papers for inclusion in our review. Of the 54 English language papers, we excluded papers written in Japanese (n = 6) and papers with inconsistent content (n = 45), including those with unrelated content (n = 42) and reviews without data (n = 3). Finally, three English language papers were included in this review.

Implementation of the stress check program

Among the 18 papers included in this review, nine examined the implementation of the Stress Check Program (Table 1). Of these nine papers (including duplicates), three papers reported on the implementation rate of the Stress Check Program, six on the examination rate of the Stress Check Program, five on the prevalence of those under high levels of stress, two on the implementation rate of interviews with physicians and two on group analysis and implementation rate of improvements in the workplace environment. In this paper, we used the term "implementation rate", to refer to the proportion of enterprises that actually implemented the Stress Check Program or parts of the program (e.g. physician interview and

Author(s) (year)	Study objectives	Methods	Participants	Main results
Tsutsumi *et al.* (2018)	Examine the ability of the BJSQ (recommended by the SC program) to predict workers needing long-term sick leave	Questionnaire (longitudinal)	14,178 workers (7,356 men, 7,362 women) at an independent financial services company (administrative employees, temporary transferred persons, overseas employees, absentees and dispatched employees were excluded)	*Implementation*: The prevalence of those identified as under high levels of stress by the BJSQ was 5.6% for men and 15.0% for women *Utility*: Workers who were identified as under high levels of stress by the BJSQ (based on SC program implementation manual assessment criteria) had a significantly high risk for long-term sick leave *Challenges*: Effects of three elements of the SC program need to be confirmed. 1. Reducing the risk for mental health issues through implementation of routine survey for workers and returning the results to workers. 2. Preventing mental health issues through screening for those under high levels of stress and providing interviews by physicians. 3. Reducing psychological stress reactions by improving the work environment (including education for management and supervisors). Because risk for sick leave in those under high levels of stress rapidly increased after 2–3 months, occupational health staff needs to consider measures for those under high levels of stress immediately after SC implementation

(*continued*)

Table 1.
Implementation and effects of the Stress Check Program: literature incorporated in this systematic review (18 papers)

Table 1.

Author(s) (year)	Study objectives	Methods	Participants	Main results
Asai *et al.* (2018)	Implementation of the SC program during its first year and investigation of the utility of each element with anticipated effects under the SC program	Questionnaire (cross-sectional)	3,891 full-time workers	*Implementation*: At workplaces with ≥50 workers, 52.5% reported they had been notified of the SC program implementation, and the examination rate was 92.0%. In addition, 14.2% were under high levels of stress, of which 18.6% requested an interview with a physician. Overall, 3.3% of workers that received the SC experienced improvements to their work environment
Takeishi *et al.* (2017)	Investigate implementation status of the SC in small-scale workplaces in Saitama Prefecture	Questionnaire (cross-sectional)	38 small-scale workplaces in Saitama Prefecture	*Implementation*: The SC implementation rate was low (34%). The most common reason for not implementing the SC was because of the "obligation to make efforts." In regard to scheduling group analysis, among 10 workplaces (after excluding those without a plan), eight workplaces (80%) indicated they would implement group analysis *Challenges*: Administrative complications, such as considerations regarding privacy and financial burden, were also cited as issues that inhibited implementation SC.

(*continued*)

Table 1.

Author(s) (year)	Study objectives	Methods	Participants	Main results
Saito *et al.* (2019)	Clarify mental health measures and implementation of SC in small-scale workplaces along with related factors and obtain suggestions for future promotion	Questionnaire (cross-sectional)	Workplaces with 30–50 workers in Aichi Prefecture (290 independent companies and 331 branches)	*Implementation*: The SC implementation rate was higher in branches (56%) compared with independent companies (15%) *Efforts*: In workplaces with mental health staff, SC implementation was more advanced compared with workplaces without such staff. Assigning dedicated staff in small-scale workplaces would be useful to promote SC
Ishimaru *et al.* (2018)	Examine if conducting SC simultaneously with the annual health examination improved the SC examination rate	Questionnaire (cross-sectional)	31,356 workers who used both the SC service and the annual health examination	*Implementation*: The total SC examination rate was 90.8%. The examination rates of workers aged ≥30 years, those with occupations such as transportation and postal services, and workplaces with 50–999 workers, were high. However, the examination rates for medical and welfare-related jobs and workplaces with ≥1,000 workers were low *Efforts*: If the SC date was close to the annual health examination, the examination rate increased by about 1.7–3.8 (odds ratio); implementing the SC close to the annual health examination may improve the examination rate
Muratani (2017)	Compare sex and age groups, and administrative/educational staff to clarify workplace stress	Questionnaire (cross-sectional)	683 workers at a school (university and junior college)	*Implementation*: 531 people underwent the SC (examination rate of 78%); 11% were under high levels of stress

(*continued*)

Table 1.

Author(s) (year)	Study objectives	Methods	Participants	Main results
Nakatani (2017)	Examine the necessity of improvements to the work environment through analysis of workers under high levels of workplace stress	Questionnaire (longitudinal)	1,009 full-time workers who received an SC two years in a row (830 men, 179 women)	*Implementation*: The SC examination rate was 100% in 2016 and 99.6% in 2017. Among 1,009 workers who completed the SC in both years, 5% were under high stress in both years, 6% in 2016, and 6% in 2017; 83% were not considered under high stress
Tsutsumi *et al.* (2017)	Examine the ability of the BJSQ recommended to identify workers who present psychological stress reactions equivalent to severe mental disorders	Questionnaire (cross-sectional)	1,650 workers registered with an online survey company	*Implementation*: In surveys that used the BJSQ based on the evaluation criteria of the SC Program implementation manual, the prevalence of those under high levels of stress was 16.7% with the 57-item version and 15.5% with the short version (23 items) *Utility*: High-stress screening using the cut-off values from the implementation manual had 60.5% sensitivity and 88.9% specificity when K6 score of ≥13 was used as the outcome indicator *Challenges*: Among those under high levels of stress, less than half presented psychological a stress reaction equivalent to a severe mental disorder
Wada *et al.* (2018)	Clarify the situation of occupational health activities for medical staff	Questionnaire (cross-sectional)	214 medical facilities in Kanto Region	*Implementation*: 92.5% of medical facilities had a system to implement occupational health interviews for those who were deemed under high-level stress and wanted an interview with a physician

(*continued*)

Table 1.

Author(s) (year)	Study objectives	Methods	Participants	Main results
Adachi *et al.* (2018)	Verify the correlation between screening criteria for an interview with a physician and psychological health	Questionnaire (cross-sectional)	368 workers (288 men, 80 women) at an independent company	*Utility*: Correlation between BJSQ stress reaction scale score (total of 29 items) and CES-D score was examined. There was strong correlation (Spearman's rank correlation coefficient = 0.800, $p < 0.001$)
Takahara (2018)	Examine concrete clues to improve workplaces by implementing a multivariate analysis including objective workplace indicators	Questionnaire (longitudinal)	1,895 workers including non-regular workers at an independent company	*Utility*: A survey that included BJSQ items was conducted and its relationship with voluntary retirement examined. Individual job satisfaction measured with the BJSQ, and satisfaction with work and life at the workplace level had a significant negative correlation with voluntary retirement
Adachi (2017)	Gain an understanding of situations in workplaces to achieve work engagement and prepare essential documents to examine approaches in occupational fields	Questionnaire (cross-sectional)	368 workers (288 men, 80 women) at an independent company	*Utility*: BJSQ items that are strongly correlated with job satisfaction were examined for each gender. For men, the significance of work, control at work, support from superiors, job aptitude and workload were significantly correlated with job satisfaction. For women, significant factors were job aptitude, significance of work and workload
Higuchi *et al.* (2015)	Analyse longitudinal BJSQ data and examine items that would impact on subsequent work	Questionnaire (longitudinal)	661 male workers at a machine manufacturing plant	*Utility*: Using the BJSQ items at the baseline, deterioration in job aptitude and related factors for the subsequent four years were examined. Levels of physical burden, job satisfaction and support from superiors were significantly correlated with deterioration in job aptitude

(*continued*)

Table 1.

Author(s) (year)	Study objectives	Methods	Participants	Main results
Shimura *et al.* (2018)	Examine the relationship between sleep-related issues and stress reaction in the SC	Questionnaire (cross-sectional)	884 workers at 10 workplaces	*Utility*: Using structural equation modelling that combined sleep-related issues (measured with the Pittsburgh Sleep Quality Index) with factors of stress at work and support from others in the BJSQ showed that 55.2% of psychological and physical stress reaction was explained by these factors
Ito (2017)	Develop a simple and convenient depression assessment scale (Ji test)	Questionnaire (cross-sectional)	91 new patients at a clinic	*Utility*: Physicians providing interviews may not be familiar with mental disorders; therefore, a support tool to accurately assess risk for mental health issues is necessary
Imamura *et al.* (2018)	Examine the link between implementation of SC based on the SC Program, improvements to the work environment, psychological stress reactions and work performance	Online survey (longitudinal)	3,891 workers registered with an online survey company (part-time workers were excluded)	*Effects*: Workers who reported both SC and improvements to their work environment had significantly lower psychological stress reactions compared with those who did not report either
Ito *et al.* (2016)	An online SC program that provided individual results and advice for decreasing stress, influencing factors and current measures was examined as to whether this approach promoted motivation to implement stress coping	Questionnaire (longitudinal)	371 workers voluntarily participated in a survey that used an online SC program and provided responses to three rounds of the survey	*Effects*: Immediate feedback was provided to participants using an online system that provided individual results and advice on stress, related factors and measures based on responses to the questionnaire Compared with before use of this system, motivation to implement stress coping and awareness of the features of stress management were improved. Motivation to implement stress coping was maintained for two months, which led to maintenance of psychological health

(*continued*)

Author(s) (year)	Study objectives	Methods	Participants	Main results
Shintani *et al.* (2018)	Interviews with all employees performed after SC, and training was provided based on its content, to verify whether this approach improved factors associated with stress and stress reactions	Questionnaire (longitudinal)	All 168 workers (134 men, 34 women) at a food manufacturing company	*Effects*: This study investigated if implementing interviews for all employees, stress self-care training for individual employees and training for management and supervisors after SC improved factors associated with stress and stress reactions. Factors associated with stress increased role-related conflict and reduced skill usage. Physical stress reactions were reduced but psychological stress reactions were not Efforts: It is important to provide mental health training for employees by offering interviews to all employees as a follow-up to the SC and by using the contents of the SC

Note(s): SC: stress check; BJSQ: Brief Job Stress Questionnaire; CES-D: Center for Epidemiologic Studies Depression Scale

Table 1.

workplace improvement), and "examination rate", to refer to the proportion of workers who underwent stress checks among those who were expected to do so.

Implementation rate of the Stress Check Program

Asai *et al.* (2018) conducted an online survey with 3,891 full-time workers across Japan to clarify the implementation status of the Stress Check Program in its first year. They found that among respondents working at enterprises with ≥50 workers, 52.5% had received notification of the implementation of the Stress Check Program. Stratified analyses based on respondents' demographics revealed that notification of program implementation was more common among workers aged 40–49 years and those in manufacturing positions. An analysis based on the scale of enterprises showed that larger enterprises had more workers who received notification. That study also reported that 12.1% of workers at small-scale enterprises had received a notification of the implementation of the Stress Check Program from their employer.

In addition, two reports examined small-scale enterprises. Takeishi *et al.* (2017) conducted a survey of 38 small-scale enterprises in Saitama Prefecture and reported a low implementation rate of stress checks (13 workplaces, 34%). The most common reason for not implementing the Stress Check Program in small-scale enterprises was because they were only obliged to make "reasonable efforts." Saito *et al.* (2019) examined the implementation rate of stress checks in small-scale enterprises in Aichi Prefecture by dividing them into independent companies (n = 290) and branches of companies with multiple locations (n = 331; e.g. offices, branches, sales offices). The results showed that the implementation rate of stress checks was 15% for independent enterprises and 56% for branches, which clearly showed a difference based on enterprise size. That study also reported that enterprises with mental health staff had significantly higher implementation rates of stress checks than enterprises without mental health staff.

Examination rate of stress checks

The nation-wide survey by Asai *et al.* (2018) showed that among workers who were notified of the Stress Check Program, 92.0% actually underwent stress checks at enterprises with 50 or more workers, and 84.7% underwent stress checks at small-scale enterprises. Ishimaru *et al.* (2018) used data for 31,156 workers who received both a stress check from an occupational health agency and a routine health checkup, and they reported that 90.8% of workers had received a stress check. In terms of the scale of enterprises, stress checks were reported by 91.1% of workers at enterprises with ≥50 workers and 87.3% of workers at small-scale enterprises. In addition, that study reported the examination rate varied based on workers' attributes. A higher examination rate was reported among workers aged ≥30 years, those with occupations such as construction, transportation and postal services and those in enterprises with 5–999 workers compared with workers aged 1–29 years, those in manufacturing jobs and those in enterprises with 1–49 workers. However, those in occupations such as medical and welfare services and who worked in enterprises with ≥1,000 employees had significantly lower examination rates compared with those in manufacturing jobs and enterprises with 1–49 workers. In addition, stress checks implemented on dates closer to routine health checkups had higher examination rates.

Muratani (2017) reported the stress check examination rate was 78% in an academic institution (a university and junior college) with 683 staff. Nakatani (2017) reported that the examination rate of stress checks implemented over two years at corporate groups that included multiple occupations (e.g., sales, manufacturing, and distribution) was 100% in 2016 and 99.6% in 2017. However, the examination rate for workers at each workplace was not reported in the two papers that examined small-scale enterprises (Saito *et al.*, 2019; Takeishi *et al.*, 2017).

Prevalence of workers under high levels of stress

Asai *et al.* (2018) reported that among workers who received a stress check, the prevalence of workers who were identified as under high levels of stress was 14.2% in enterprises with ≥50 workers and 14.4% at small-scale enterprises. Tsutsumi *et al.* (2017) conducted an online survey involving 1,650 workers. They reported that the prevalence of workers under high levels of stress as determined using the BJSQ (Shimomitsu, 2000) based on the assessment criteria indicated in the Stress Check Program Implementation Manual (Ministry of Health, Labour and Welfare, Japan, 2015) (referred to as the Manual) and according to the Industrial Safety and Health Act was 16.7% with the 57-item version and 15.5% with the 23-item (short) version. In addition, Tsutsumi *et al.* (2018) conducted a prospective cohort study with 14,718 workers at a financial service company (7,356 men, 7,362 women) and reported that the prevalence of workers under high levels of stress calculated with similar assessment criteria (57-item version of the BJSQ) was 5.6% for men and 15.0% for women. The survey of the academic institution (university and junior college) found that 11% of staff was under high stress (Muratani, 2017). In addition, the study focussed on stress checks among workers at corporate groups (sales, manufacturing and distribution) concluded that among 1,009 full-time workers who received stress checks in 2016 and 2017, 5% were under high stress in both years, whereas 6% were under high stress in 2016 and 6% reported high stress in 2017 (Nakatani, 2017). That study also reported that 83% of workers were not under high stress in either year.

Implementation rate of interviews with physicians

Asai *et al.* (2018) found that among workers who received a stress check, 2.6% requested an interview with a physician at enterprises with ≥50 workers, whereas no workers made such request at small-scale enterprises. That study also reported that among those who were identified as under high stress, 18.6% of those at enterprises with ≥50 workers requested physician interviews, whereas no workers small-scale enterprises made such a request.

In this study, workers were asked for the reasons why not they requested an interview with a physician at enterprises. The followings were the reasons that workers with high stress did not see a doctor: did not receive notice, 19%; forgot to request 1%; had no time, 20%; felt no need, 29%; did not know how useful the interview was, 36%; the problem was solved, 1%; did not think they had stress, 3%; thought they could cope with by themselves, 14%; felt no special need because they consulted on a regular basis, 4%; already saw a doctor, 4%; did not want to let the company know the results, 10%; were anxious about the fact that they saw a doctor being introduced to the company, 11%. Wada *et al.* (2018) surveyed 214 medical facilities in the Kanto region and examined implementation of interviews with physicians for those with high levels of stress. They found that 92.5% of medical facilities indicated they had a system ready to implement interviews with occupational physicians for those identified as under high stress that wished to have such a meeting.

Implementation rate of group analysis and work environment improvement

In the national survey by Asai *et al.* (2018), 3.3% of workers who received a stress check reported that their work environment was improved. The survey by Takeishi *et al.* (2017) that targeted small-scale enterprises found that eight of the 10 companies surveyed (80%) indicated that they would "implement" group analysis.

Utility and validity of tools for stress checks

Eight of the 18 reviewed papers examined the utility and validity of the BJSQ for the Stress Check Program (Table 1). Three papers examined the relationship between BJSQ scores and mental health indicators, three examined the relationship between the BJSQ and work-related factors and two discussed the necessity of supplementary tools.

Relationship between BJSQ scores and mental health indicators

Adachi and Inaba (2018) examined the relationship between scores on the BJSQ stress response scale (total of 29 items) and the Center for Epidemiological Studies-Depression scale (a depression self-assessment scale) in a cross-sectional study involving 368 workers at an enterprise (288 men, 80 women). That study revealed a strong correlation between the scores for the two scales (Spearman's rank correlation coefficient = 0.800, $p < 0.001$).

Tsutsumi *et al.* (2017) changed the assessment criteria (i.e., the cutoff value) to screen for high stress using the BJSQ as indicated in the Manual (Ministry of Health, Labour and Welfare, Japan, 2015) and examined the screening efficiency of the Kessler Screening Scale for Psychological Distress (Furukawa *et al.*, 2008; Kessler *et al.*, 2002), with a score of 13 or higher (equivalent to a severe mental disorder) being the outcome indicator. The results showed that when the cutoff value (stress responsescore of ≥77) in the Manual was used, the prevalence of those with high stress was 16.7%, with sensitivity of 60.5%, specificity of 88.9%, Youden index of 0.504, positive predictive value of 47.3% and negative predictive value of 93.8%. The highest screening efficiency (highest Youden index) was observed when the cutoff value was lowered to 65, where the prevalence of those with high stress increased to 32.3% and the positive predictive value dropped to 33.0%.

Similarly, Tsutsumi *et al.* (2018) examined the relationship between presence/absence of high stress at baseline (determined based on the assessment criteria in the Manual (Ministry of Health, Labour and Welfare, Japan, 2015) and long-term sick leave of ≥1 month during the following year (obtained from human resources data) using a Cox proportional hazards model. The results showed that compared with those who were not under high stress, those with high stress had a long-term sick leave risk due to subsequent mental health issues. The hazard ratios (adjusted for age, years of work, occupation, position, and receiving an interview with occupational health staff after the stress check) were 8.68 for men and 3.67 for women. The equivalent population-attributable risk proportion was 30.1% for men and 25.6% for women.

Relationship between BJSQ scores and work-related factors

Takahara (2018) conducted a survey that included items from the BJSQ with 1,895 temporary workers from a single company and examined the relationship between scores for these items and workers' voluntary retirement. They found that personal-level job satisfaction, workplace-level satisfaction and life satisfaction, as measured by the BJSQ, had a significant negative correlation with voluntary retirement.

Adachi (2017) examined BJSQ items that were strongly related to job satisfaction for 368 workers at a single company (288 men, 80 women) based on sex. The results showed that for men, factors that were significantly correlated with job satisfaction were the significance of work, control at work, support from superiors, aptitude in work and the amount of work. For women, aptitude at work, significance of work and the amount of work were significantly correlated with job satisfaction.

Higuchi *et al.* (2015) used BJSQ items at a baseline assessment for 661 male workers at a machine manufacturing factory to examine factors related to deterioration in respondents' job adaptability in the subsequent four years. They found that levels of physical burden, job satisfaction and support from superiors were significantly related to deterioration in job adaptability.

Necessity of supplementary tools

Shimura *et al.* (2018) used structural equation modelling, in which sleep-related issues (identified with the Pittsburgh Sleep Quality Index) were added to factors of stress and support at work drawn from the BJSQ. They showed that 55.2% of psychological and

physical stress could be explained through these factors. Those authors argued for the importance of also addressing sleep-related issues in stress checks. Ito (2017) noted that because the physicians that conduct interviews with those under high levels of work stress are not necessarily familiar with mental disorders, a support tool to accurately evaluate the risk for mental health issues is necessary. Therefore, that study proposed the use of a depression screening test (Ji test) that could be easily used in the Stress Check Program.

Effects of the Stress Check Program

Among the 18 papers reviewed, three examined the effects of the Stress Check Program (Table 1). One paper examined the effects of improvements in the work environment, one examined the effect of the method by which the stress check results were shared with individuals and the last paper examined the effects of other combined approaches.

Imamura *et al.* (2018) examined the links between implementation of improvements to the work environment through the Stress Check Program, stress responses and work performance. That study included data for 3,891 full-time workers that completed surveys before and after the Stress Check Program (November 2015 and February 2016) (the same subjects as used in the national survey by Asai *et al.* (2018)). A follow-up survey was conducted one year later, in which participants were interviewed about to whether they received a stress check at their workplace and if there had been any improvements to their work environment. Participants were divided into groups based on whether they had completed stress checks and experienced work environment improvements: "neither" (53.9%), "stress check only" (40.5%), "improvement to work environment only" (3.0%) and "both" (2.6%). Possible differences in changes to psychological stress responses and work performance scores were examined. The "both" group had significantly lower stress responses compared with the "neither" group. Imamura *et al.* (2018) concluded that implementation of the stress check as mandated by the Stress Check Program alone may not be effective in reducing the stress responses of workers and may be more effective in combination with improvements to the work environment.

In terms of sharing the stress check results with workers, Ito *et al.* (2016) reported on sharing the results of a questionnaire that involved 371 workers at an information technology (IT) company using an Internet-based system. Respondents' stress status, related factors, individual stress management results and related advice were immediately provided by the system based on their answers to a questionnaire. That study showed that when the stress check results were conveyed to respondents using this system, respondents were more aware of the characteristics of stress management and more motivated to implement measures compared with before the intervention. The desire to implement measures continued for two months, and this maintained motivation impacted the maintenance of psychological health. A reason for this result may be that it was effective to have information in the individual report such as: the importance of having repertoires of measures for coping with stress on a daily basis, meaning multiple measures could be used as appropriate when individuals faced various stress-related factors and stressful situations; advice on how changes in mood and perspective could be useful in reducing work-related stress and specific examples that could be incorporated to everyday situations.

In another combined approach, Shintani *et al.* (2018) examined improvements in stress-related factors and stress responses after implementing the stress check following several strategies: interviewing all workers, providing stress self-care training for individual workers and providing training for managers and supervisors. Participants were workers at a food manufacturing company (168 total: 134 men, 34 women). In terms of stress-related factors, they reported role-related conflicts increased and skill use declined. With regard to stress responses, there was improvement in physical stress responses but no improvement in

psychological stress responses. The reason for the lack of improvement in stress-related factors may have been related to insufficient sorting of detailed tasks, which could have led to inefficient use of workers' skills.

Discussion

Implementation of the Stress Check Program

This review showed the implementation rate of the Stress Check Program was 53% at enterprises with ≥50 workers and 12–56% at small-scale enterprises. However, the national survey by Asai *et al.* (2018) was conducted in the early December of 2016, and numbers from any subsequent surveys were not included. Therefore, implementation rates for the following three years (2017–2019) may be expected to be higher (Asai *et al.*, 2018). According to the report on the implementation of the Stress Check Program prepared by the Ministry of Health, Labour and Welfare based on the reports submitted by enterprises to labour standards inspection offices (2017) (Ministry of Health, Labour and Welfare, Japan, 2017a), the Stress Check Program was implemented at 82.9% of enterprises in which it was mandated. In a survey that included workers at small-scale enterprises, which are not legally mandated to implement the Stress Check Program, implementation rates tended to be underestimated (Imamura and Kawakami, 2017); therefore, caution is needed when evaluating the program implementation rate in small-scale enterprises. However, implementation rates tended to below in small-scale enterprises, especially small-scale independent enterprises (Saito *et al.*, 2019). The official report on the Stress Check Program implementation (2017) (Ministry of Health, Labour and Welfare, Japan, 2017a) presented implementation rates for each type of enterprise, which were particularly low in the hospitality and entertainment, cleaning and animal husbandry areas.

Within the scope of the survey, the examination rate of the stress check exceeded 90% in workplaces with≥50 or more workers and 80% in workplaces with <50 workers. In terms of occupation, the examination rate was particularly low for medical workers (Saito *et al.*, 2019) and educators (Muratani, 2017).

Although stress levels may depend on the individual workplace, 10–15% of workers on average were identified as under high levels of stress. However, only a limited number of workers received an interview with a physician. According to the 2017 Ministry of Health, Labour and Welfare report (Ministry of Health, Labour and Welfare, Japan, 2017a), among all those examined (examination rate of 78.0%), only 0.6% received an interview with a physician.

According to the survey by (Asai *et al.*, 2018), 3.3% of workers that received a stress check reported that their work environment had improved (Asai *et al.*, 2018). If workers were not involved in these changes to the work environment, it is likely that many workers may be unaware of improvements to their work environment, which could have resulted in underestimation of workplace improvements. In a subsequent national survey (Ministry of Health, Labour and Welfare, Japan, 2017b), the implementation rate was reported as 69% for enterprises with ≥50 workers and 58.3% overall. In the same survey, more than 70% of workplaces conducted group analyses using the stress check results, but specific details are unknown. In the survey of workplaces across Japan conducted by Kawakami (2012), the proportion of workplaces where any measures to improve the work environment were implemented after the stress checks increased from 37.0% in 2016 to 44.2% in 2017. However, many of these measures were "reporting and providing explanations to management," whereas only 4–7.5% of workplaces implemented "participatory improvements to the work environment" that were considered effective in reducing workers' stress.

Implementation rates, examination rates and use of results for group analysis (including those separated by the scale of enterprises and industry) are important indicators in the distribution of

the Stress Check Program, and a further detailed survey is necessary. The reviewed literature showed that to further promote the Stress Check Program among small-scale enterprises, it is important to increase implementation efforts, such as tackling projects by appointing someone in charge of promoting mental health (Saito *et al.*, 2019) and implementing a stress check with routine health checkups (Ishimaru *et al.*, 2018). The literature also showed the necessity of managing the financial burden and other complexities, such as privacy in implementing stress checks, while making sure that the subsidy system is well known (Takeishi *et al.*, 2017).

Utility and validity of tools used for stress checks

The BJSQ has a certain level of validity for mental health-related outcomes (Adachi and Inaba, 2018; Tsutsumi *et al.*, 2017; Tsutsumi *et al.*, 2018) and work-related outcomes (Adachi, 2017; Higuchi *et al.*, 2015; Takahara, 2018). Specifically, the fact that a high level of stress has over a 25% population-attributable risk for mental health-related sick leave (Tsutsumi *et al.*, 2018) indicated that the BJSQ is a valid measure to identify high-risk groups for mental health issues. Although there is no evidence since the Stress Check Program started, the "Job Stress Assessment Diagram" that was prepared based on BJSQ responses to visualize health risks associated with job stressors has shown positive effects on the improvement of work environments (Kobayashi *et al.*, 2008; Tsutsumi *et al.*, 2009), and was used as a tool for group analysis in many studies.

Overall, the effectiveness of the Stress Check Program has not been shown for stress-related factors that are not identified by the Job Stress Assessment Diagram (i.e. factors other than workload, control at work and support at work). It is therefore necessary to examine whether unused items could be useful to understand high stress and inform measures to improve work environments. Although they may differ between industries, "subjective physical burden," "job satisfaction," "significance of work," and "aptitude at work" (for which the link with work-related factors has been shown) may be items that could provide useful information for stress-related measures (Adachi, 2017; Higuchi *et al.*, 2015; Takahara, 2018). However, further empirical findings are needed.

Screening of those under high levels of stress by the BJSQ using assessment criteria as specified in the Manual (Ministry of Health, Labour and Welfare, Japan, 2015) is considered useful (Tsutsumi *et al.*, 2017). However, among those identified as under high stress, less than half presented psychological stress responses equivalent to a severe mental disorder; therefore the ability to screen individuals during implementation of the Stress Check Program has limitations. It is necessary to verify if it is useful to consider sleep-related issues (Shimura *et al.*, 2018), combining the BJSQ with supplementary tests (e.g. an assessment scale for depression (Ito, 2017)) and other related tools.

Effects of the stress check program

Reducing the risk for mental health issues through conducting routine surveys of workers and sharing the results. A previous randomized controlled trial did not support the idea that providing feedback from stress surveys to workers reduced the risk for mental health issues (Kawakami *et al.*, 1999; Ketelaar *et al.*, 2013). The present review found one study that showed that sharing individual results and providing advice to improve issues using an IT-based system improved awareness of stress management and motivation to implement measures (Ito *et al.*, 2016). However, that study was a before-and-after trial conducted without controls. Whether the immediacy of feedback from a stress check and the validity of advice can contribute to its effectiveness need to be verified in further studies.

Screening of those under high levels of stress and interviews with physicians. No available study investigated the effect of interviews with physicians for those under high levels of stress following a stress check. There are few studies worldwide that have shown the

effectiveness of screening for mental disorders such as depression following stress checks. Wang *et al.* (2007) reported that intensive care by trained social workers and experts following screening was effective (Wang *et al.*, 2007). Considering the low implementation rates of interviews with physicians in the Stress Check Program in Japan, interviews with physicians are unlikely to be effective in the present system that targets those under high levels of stress.

It is difficult to demonstrate the effectiveness of the secondary preventative functions of the Stress Check Program within current mandatory frameworks, but measures for managing those under high levels of stress at risk for mental health-related sick leave are necessary. The studies we reviewed recommended tools such as, self-care using existing points of contact with workers, preliminary interviews with public health nurses (Masuzawa *et al.*, 2018), frameworks for ex-post actions that could be passed onto experts and the creation of a simple manual that includes the previous options. In addition, re-examination of procedures for interviews with physicians including requests filed by workers was proposed to create a system where stress-related consultation was easy for workers.

Interviews with workers and self-care training related to the Stress Check Program (Shintani *et al.*, 2018) could be designed to fit the capacity of workplaces and occupational health staff within the framework of comprehensive mental health measures. The cost of measures for workplace stress is also being examined, which can be used as a further reference in reviewing the system (Yoshimura *et al.*, 2013).

Reducing psychological stress responses through improvement of the work environment based on group analysis (including education for management and supervisors). A combination of a stress checks and improvements in the work environment may reduce workers' psychological stress responses (Imamura *et al.*, 2018). As the Stress Check Program started, no study has verified the effect of the program on workers' mental health by using group analysis of stress check results. However, some studies verified the effects of improvements in the work environment implemented based on the stress check results using the occupational stress model within a similar framework (Egan *et al.*, 2007; Lamontagne *et al.*, 2005; Montano *et al.*, 2014). The present results are consistent with these reports.

What the relevance of the stress check program is as implemented in Japan to other countries

The Japanese Stress Check Program focuses on prevention of mental health problems by combining an annual stress survey that aims to decrease the risk for mental health problems by increasing workers' awareness of their own stress and allowing group analysis to improve the workplace psychosocial environment. The major strategy for improving worker mental health in European countries is risk assessment and management of psychosocial factors at work (e.g. Psychosocial Risk Management Excellence Framework: PRIMA-EF) (International Labour Organization, 2012; Leka *et al.*, 2011). This approach focuses on the psychosocial work environment. The ordinal procedure for the psychosocial risk assessment at work is conducted by using an anonymous survey, and the report is summarized based on the group. Compared with national policies and programs to prevent occupational stress conducted in other countries (Brookes *et al.*, 2013; Daniels *et al.*, 2012; Mackay *et al.*, 2004; Malachowski *et al.*, 2017), Japan's program is unique in that individual workers are identified (for screening purposes) and group analysis is not mandatory.

It may reflect a culture of paternalistic approach of Japanese occupational health system, in which employers are expected to protect employees' health and welfare (Kawakami and Tsutsumi, 2016). Such individualized approach could be easily adopted by the countries with similar cultural backgrounds and/or occupational health systems, such as general health examination at workplace (Kang *et al.*, 2017). It is also interesting to see the effects of the Stress Check System in the countries sharing common occupational health issues (Tsutsumi, 2019).

However, the effect of the program needs to wait for the future evaluation on the longer-term impact of the program.

Conclusions

The aim of the 13th Occupational Safety and Health Program (2018–2022) (Japan Ministry of Health, Labour and Welfare) is to increase the proportion of workplaces that perform group analysis using the results of stress checks and utilize the results to 60% or higher (Ministry of Health, Labourand Welfare, Japan, 2018). The results of group analysis can be used at various levels, such as comparisons of overall enterprises with the national average, comparisons between departments and improvements in the work environment based on the results. As discussed earlier, implementation of improvements in the work environment as part of the Stress Check Program was observed in a number of workplaces; however, few workplaces had made improvements based on stress check results. Improvements in the work environment that are linked with the Stress Check Program need to be further promoted. Further efforts are needed to narrow the gap between evidence and implementation, including improving guidance manuals and introducing different methods based on successful cases to increase the on-site implementation potential of the Stress Check Program.

The Japanese Stress Check Program contrasts with risk management of psychosocial factors at work as a strategy for improving workers' mental health proposed by international bodies such as the World Health Organization and the International Labor Organization. These strategies target the psychosocial work environment rather than psychosocial stress among individual workers. Although the effectiveness of the Japanese program needs further evaluation, future developments of the program would provide insight for national policies on psychosocial risks/psychosocial stress at work.

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Work functioning impairment in the course of pharmacotherapy treatment for depression

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This study investigated the association between the duration of pharmacotherapy treatment for depression, or discontinuation from treatment, and work functioning impairment. This was a retrospective cohort study examining 30,409 workers. Work functioning impairment was assessed using a questionnaire, and treatment status was assessed using medical claims data. Odds ratios (ORs) of workers with severe work functioning impairment compared with healthy workers (control group) were calculated using logistic regression analysis. Continuous medical treatment was associated with severely impaired work functioning regardless of treatment period [continuous medical treatment; 4 months <: OR = 3.2, 4 months ≥, 10 months <: OR = 2.6, 10 months ≥, 14 months <: OR = 2.3, 14 months ≥, 16 months <: OR = 2.3, which are all statistically significant ($p < 0.05$)]. Workers who initially received pharmacotherapy treatment but discontinued in < 11 months had a significantly higher OR (treatment discontinuation period; 3 months <: OR = 2.3, 3 months ≥, 8 months <; OR = 2.0, 8 months ≥, 11 months <; OR = 3.0), while those who discontinued at ≥ 11 months did not (OR = 1.4, 95% CI 0.6–3.5). The sensitivity analysis excluding participants with at least one psychiatric comorbidity other than depression did not change the final result. It is important for the occupational health practitioners and attending psychiatrists to follow up in cooperation with each other, paying attention to the decrease in work functioning in addition to the symptoms.

Patients with depression are likely to experience many years lived with disability (YLDs). This is a global health issue because major depressive disorder (MDD) is among the five leading causes of YLDs worldwide, contributing 34.1 million of the total YLDs (805 million) as of 2016[1]. Depression reduces quality of life and affects work performance quality[2,3]. Presenteeism, defined as working while sick, is associated with reduced productivity and is a topic gaining increasing attention. A study found 6.4% of workers met the criteria for 12-month MDD, which is associated with 27.2 lost work days per sick worker per year and, in the United States, an overall loss of 225 million work days and $36.6 billion[4]. Based on total health-related costs due to absenteeism, presenteeism, and medical and pharmaceutical expenses, mental health disorders, including depression, comprise the largest burden of disease in the United States[5] and Japan[6]. Our past study revealed that the presenteeism costs due to mental and behavioural disorders were $948 per 1000 full-time equivalent per year[6]. The other study revealed that sickness presence accounted for an average of 45.1 work days lost per employee per year[7].

Undiagnosed and untreated depression had caused enormous socio-economic losses such as a decrease in labor force and an increase in social security costs due to the severity and chronicity of depression[8]. It has been shown that mild depression should be an intervention target because it has a high risk of becoming severe[9,10]. It is important to detect and treat depression during its early stages. Proper treatment throughout the acute phase can relieve related symptoms, and achieve remission and a return to full functioning and quality of life[10–13]. It is also strongly recommended to continue pharmacotherapy after remission following successful acute phase

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treatment for preventing relapse[11,14]. American Psychiatric Association guidelines recommend treating patients with primary depression with the same dose of antidepressants as used in the acute phase, for 4–9 months or longer after remission, and assuming good and consistent control of depression symptoms[11,15]. Meanwhile, discontinuation and dose reduction of antidepressant drugs in the early phases can increase the risk of exacerbating symptoms; early discontinuation of antidepressants results in a 77% increase in the risk of relapse and recurrence of depression in two years [16]. In order to decide the treatment policy, it is important not only to monitor the patient's psychiatric status but also to evaluate functional impairment and quality of life[11].

Many depressed patients present with cognitive dysfunction such as slowed thoughts, poor concentration, distractibility, and reduce capacity to process information[11]. Understanding the type and extent of cognitive dysfunction is important in assessing the course of treatment. Attending physicians can evaluate functional impairment for their patients, and neuropsychological testing can be performed in the hospital[17]. However, it is difficult for the attending physician to intervene if the treatment is interrupted. If the patients were workers, the occupational health staff such as occupational physician and occupational health nurse can intervene with them in the workplace. Workers with depression tend to appear disabilities as work functions. Therefore, if the work functioning can be evaluated, it will be possible to find the timing of intervention by the occupational health staff. We previously developed and validated a self-administered questionnaire using the work functioning impairment scale (WFun) for assessment[18]. We also verified that the results of WFun assessments were correlated with the results of fit-to-work assessments conducted by occupational health nurses[19].

Clinical treatment aims not only to relieve related symptoms, but to help patients recover their social functioning. Work functioning is an important social function for workers with depression. Information on the degree of work functioning in each phase of the treatment process is useful when deciding the necessity of cooperation between the occupational health staff and the attending physician, and when the attending physician decides the treatment content. However, to the best of our knowledge, there are no reports on changes in work functioning impairment based on treatment duration and discontinuation.

The purpose of this study is to describe the degree of work functioning impairment according to the course of pharmacotherapy treatment for depression (Objective 1: the duration of pharmacotherapy treatment, and Objective 2: the duration of discontinuation from pharmacotherapy treatment).

Methods

This was a retrospective cohort study of 45,404 workers, from 13 companies in Japan. All 13 companies were manufacturers (five pharmaceutical, six automobile-related, one nonferrous metals, and one precision equipment).

Data collection and ethical approval. The participants completed the WFun questionnaire between July and October 2015. The objectives of the study were explained to the participants, who were informed that participation was voluntary and that only the researchers, who were unaffiliated with the companies, would have access to the data. Ultimately, of the 45,404 workers, 33,415 (73.6%) participated.

We obtained participants' medical claims data from the companies' health insurance unions retrospectively, back to 15 months before the WFun questionnaire was given. These claims contained information on the date of any visits to a medical institution (outpatient or inpatient), the name of the institution, the disease(s), treatment/medication(s), and medical expenditures. Because Japan has a universal health insurance system, these claims data contained complete records on services used by the participants and covered under the system.

All methods were carried out in accordance with relevant guidelines and regulations. All data were labelled with unique codes assigned to each participant for personal information protection. Informed consent including implied consent was obtained from all subjects. The study was approved by the Ethics Committee of University of Occupational and Environmental Health, Japan (H26-026).

Measurements for treatment of depression with pharmacotherapy. Medical claims data were used for determining whether the participants had visited medical institutions and received pharmacotherapy treatment for depression there each month within the 15 months prior to their completing the WFun questionnaire. Participants were determined to have received pharmacotherapy treatment if they satisfied both of the following two inclusion criteria and one exclusion criteria:

We included by two criteria as follow.

1. International Classification of Diseases 10 (ICD 10) codes F30–F39 (mood [affective] disorders) was given as the disease name.
2. Antidepressants and/or psychoneurotic drugs (therapeutic category of drugs in Japan: 117) were prescribed[20].

We excluded workers who had International Classification of Diseases 10 (ICD 10) codes F30 (Manic episode) or F31 (Bipolar affective disorder) given as the disease name of the claims data. A total of 126 participants had F30 (Manic episode) or F31 (Bipolar affective disorder), and we excluded their data in the final analysis.

Based on information obtained from medical claims data and WFun, the participants were divided into five categories in accordance with their duration of pharmacotherapy treatment (Objective 1) and duration of discontinuation from treatment (Objective 2). Detailed definitions are provided below and in Fig. 1.

Objective 1: Association between the duration of pharmacotherapy treatment for depression and work functioning impairment.

Objective 1: Relationship between the duration of pharmacotherapy treatment for depression and work functioning impairment

Months prior to completing the WFun questionnaire	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	*
WFun conducted in July 2015	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15
WFun conducted in August 2015	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15
WFun conducted in September 2015	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15
WFun conducted in October 2015	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15
Continuous pharmacotherapy treatment period																
(1) control group (healthy workers)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
(2) <4 months	-	-	-	-	-	-	-	-	-	-	-	-	-	○		
	-	-	-	-	-	-	-	-	-	-	-	-	○	○		
(3) 4 to <10 months	-	-	-	-	-	-	-	-	-	-	-	○	○	○		
	-	-	-	-	-	-	-	-	-	○	○	○	○	○		
	-	-	-	-	-	-	○	-	○	○	○	○	○	○		
(4) 10 to <14 months	-	-	-	○	○	○	○	○	○	○	○	○	○	○		
	-	-	○	○	○	○	○	○	○	○	○	○	○	○		
(5) 14 to <16 months	○	○	○	○	○	○	○	○	○	○	○	○	○	○		

WFun: work functioning impairment scale
* month in which WFun was conducted
○ pharmacotherapy treatment for depression
- no pharmacotherapy treatment for depression

Objective 2: Relationship between the duration of discontinuation of pharmacotherapy treatment for depression and work functioning impairment

Months prior to completing the WFun questionnaire	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	*
WFun conducted in July 2015	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15
WFun conducted in August 2015	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15
WFun conducted in September 2015	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15
WFun conducted in October 2015	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15
Discontinuation period after continuous pharmacotherapy treatmer																
(1) control group (healthy workers)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(2) <3 months													○	○	-	-
												○	○	-	-	-
(3) 3 to <8 months											○	○	-	-	-	-
										○	○	-	-	-	-	-
									○	○	-	-	-	-	-	-
								○	○	-	-	-	-	-	-	-
							○	○	-	-	-	-	-	-	-	-
						○	○	-	-	-	-	-	-	-	-	-
(4) 8 to <11 months					○	○	-	-	-	-	-	-	-	-	-	-
				○	○	-	-	-	-	-	-	-	-	-	-	-
(5) 11 to <14 months			○	○	-	-	-	-	-	-	-	-	-	-	-	-
		○	○	-	-	-	-	-	-	-	-	-	-	-	-	-
	○	○	-	-	-	-	-	-	-	-	-	-	-	-	-	-

WFun: work functioning impairment scale
* month in which WFun was conducted
○ pharmacotherapy treatment for depression
- no pharmacotherapy treatment for depression

Figure 1. Definitions of the five categories of the study objectives.

1. control group (healthy workers with no pharmacotherapy treatment): those who had received no related treatment within 15 months preceding the WFun
2. continuous pharmacotherapy treatment (< 4 months)
3. continuous pharmacotherapy treatment (4 to < 10 months)
4. continuous pharmacotherapy treatment (10 to < 14 months)
5. continuous pharmacotherapy treatment (14 to < 16 months).

A total of 315 participants were not classified under any of the above categories because they had received irregular pharmacotherapy treatment. Accordingly, we excluded their data in the final analysis.

Objective 2: Association between the duration of discontinuation of pharmacotherapy treatment for depression and work functioning impairment.

1. control group (healthy workers with no pharmacotherapy treatment): those who had received no related treatment within 15 months preceding the WFun
2. treatment discontinuation period (< 3 months)
3. treatment discontinuation period (3 to < 8 months)
4. treatment discontinuation period (8 to < 11 months)
5. treatment discontinuation period (11 to < 14 months).

A total of 546 participants were not classified under any of the above categories because they had received irregular pharmacotherapy treatment. Accordingly, we excluded their data in the final analysis.

Outcome measurements. WFun is a self-administered questionnaire developed using the Rasch model[18]. It assesses the severity of work functioning impairment and has been validated in accordance with the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN). Items of WFun and the scoring method was shown in Table 1. A higher total suggests greater work functioning impairment due

	Options and score of each option				
	Not at all	≥1 days a month	About 1 day a week	≥2 days a week	Almost every day
Items of Work Functioning Questionnaire (WFun)					
(1) I have not been able to behave socially	1	2	3	4	5
(2) I have not been able to maintain the quality of my work	1	2	3	4	5
(3) I have had trouble thinking clearly	1	2	3	4	5
(4) I have taken more rests during my work	1	2	3	4	5
(5) I have felt that my work is not going well	1	2	3	4	5
(6) I have not been able to make rational decisions	1	2	3	4	5
(7) I have not been proactive about my work	1	2	3	4	5

Table 1. Items of Work Functioning Questionnaire (WFun) and the scoring method. The total score is the sum of the scores of all items. The score range is 7 to 35 points. A high score means that the work impairment is large.

to health problems. A total of ≥21 points suggests severely impaired work functioning: a previous study found approximately 20% of employees had a WFun score of 21 points, and an assessment by occupational health nurses found these people were likely to have severely impaired work functioning and that they demonstrated high detectability with an area under the ROC curve of 0.83[19]. Cronbach's alpha coefficient for the seven items of WFun was 0.92 in this study.

Other measurements. We used a self-administered questionnaire to determine the participants' sex, age, job type and job title. Age in years was categorised into five groups (< 30, 30–39, 40–49, 50–59, and ≥ 60 years), as was job type (clerical and administrative support, sales, research and development, production line, and other), while job title was categorised as manager or rank-and-file employee.

Statistical analysis. In addressing each of the two objectives indicated above, we performed logistic regression analyses using each category as an explanatory variable and a total WFun score of ≥ 21 points as an outcome variable. Using the category of no pharmacotherapy treatment (healthy workers) as a reference, we calculated the OR (and 95% CI) for each category. Stata version 14.2 (StataCorp LLC; TX, USA) was used for analyses, with significance set at < 0.05.

Sensitivity analysis. Many patients can be expected to have at least one psychiatric comorbidity and this can quite significantly alter work functioning. Sensitivity analysis was performed in order to confirm that the results did not change even if these individuals were excluded. We excluded participants below (exclusion criteria) and performed logistic regression analyses in the same way.

Exclusion criteria.

1. International Classification of Diseases 10 (ICD 10) codes F00–F09 (organic, including symptomatic, mental disorders) was given as the disease name. F00-09 includes F00 (Dementia in Alzheimer disease) and F01 (Vascular dementia).
2. International Classification of Diseases 10 (ICD 10) codes F10–F19 (mental and behavioural disorders due to psychoactive substance use) was given as the disease name. F10–F19 includes F10 (mental and behavioural disorders due to use of alcohol) and F11 (mental and behavioural disorders due to use of opioids).
3. International Classification of Diseases 10 (ICD 10) codes F20–F29 (schizophrenia, schizotypal and delusional disorders).

Results

Participants' characteristics. Among the 33,415 participants, we were unable to obtain the medical claims data of 2,533 participants and 473 did not answer at least one of the seven WFun questions. After excluding them, we had data from 30,409 participants for analysis.

Table 2 shows the participants' characteristics. Male employees comprised 85% of the participants, and the largest proportion of participants (32%) were 40–49 years old, followed by 30–39 (24%), 50–59 (22%). Participants primarily worked in research and development (20%), clerical and administrative support (18%), and sales (18%).

Objective 1. Table 3 shows the association between the duration of pharmacotherapy treatment for depression and work functioning impairment.

	N	%
Sex		
Men	25,882	85
Women	4527	15
Age (years)		
≤ 29	5681	19
30–39	7448	24
40–49	9786	32
50–59	6621	22
≥ 60	873	3
Job type		
Clerical and administrative support	5423	18
Sales	5390	18
Research and development	5939	20
Production line	2845	9
Other	10,569	35
Missing	243	1
Job title		
Manager	5394	18
Rank-and-file employee	15,555	51
Missing	9460	31

Table 2. Participants' characteristics.

		WFun score		WFun score ≥ 21				
	N	Mean	SD	%	OR	95% CI		p value
(1) Control group (healthy workers)	29,564	14.7	6.4	20	Reference			
(2) Continuous medical treatment (4 months <)	63	19.1	8.1	44	3.2	1.9	5.2	< 0.001
(3) Continuous medical treatment (4 months ≥, 10 months <)	58	18.7	8.1	40	2.6	1.5	4.4	< 0.001
(4) Continuous medical treatment (10 months ≥, 14 months <)	33	18.5	7.8	36	2.3	1.1	4.6	0.024
(5) Continuous medical treatment (14 months ≥, 16 months <)	250	17.9	7.3	37	2.3	1.8	3.0	< 0.001

Table 3. Number of workers, mean WFun score, and proportion of workers with a high WFun score (21 points or more), and logistic regression analyses for Objective 1: association between the duration of medical treatment for depression and work functioning impairment. *OR* odds ratio, *CI* confidence interval.

Continuous medical treatment was associated with severely impaired work functioning regardless of treatment period [continuous medical treatment; 4 months <: OR = 3.2, 4 months ≥, 10 months <: OR = 2.6, 10 months ≥, 14 months <: OR = 2.3, 14 months ≥, 16 months <: OR = 2.3, which are all statistically significant ($p < 0.05$)].

Objective 2. Table 4 shows the association between the duration of discontinuation from pharmacotherapy treatment for depression and work functioning impairment.

Workers who initially received pharmacotherapy treatment but discontinued in < 11 months had a significantly higher OR (treatment discontinuation period; 3 months <: OR = 2.3, 3 months ≥, 8 months <; OR = 2.0, 8 months ≥, 11 months <; OR = 3.0), while those who discontinued at ≥ 11 months did not show a significantly higher risk of work functioning impairment (OR = 1.4, 95% CI 0.6–3.5).

A sensitivity analysis was performed on both objectives 1 and 2. The results excluding participants with at least one psychiatric comorbidity other than depression did not change (Supplementary Table S1, S2).

Discussion

This study investigated the association between the duration of pharmacotherapy treatment and work functioning impairment as well as the association between the duration of discontinuation from pharmacotherapy treatment and work functioning impairment. Continuous medical treatment was associated with severely impaired work functioning regardless of treatment period. Further, workers who initially received pharmacotherapy treatment but discontinued in < 11 months had a significantly higher OR compared to healthy workers (control group), while those who discontinued at ≥ 11 months did not (OR = 1.4, 95% CI 0.6–3.5).

	N	WFun score		WFun score ≥ 21	OR	95% CI		p value
		Mean	SD	%				
(1) Control group (healthy workers)	29,564	14.7	6.4	20	Reference			
(2) Treatment discontinuation period (3 months <)	81	17.9	6.8	37	2.3	1.5	3.7	< 0.001
(3) Treatment discontinuation period (3 months ≥, 8 months <)	48	19.1	5.8	33	2.0	1.1	3.6	0.026
(4) Treatment discontinuation period (8 months ≥, 11 months <)	21	19.2	6.8	43	3.0	1.3	7.1	0.014
(5) Treatment discontinuation period (11 months ≥, 14 months <)	23	16.2	6.7	26	1.4	0.6	3.5	0.481

Table 4. Number of workers, mean WFun score, and proportion of workers with a high WFun score (21 points or more), and logistic regression analyses for Objective 2: association between the duration of discontinuation from medical treatment for depression and work functioning impairment. *OR* odds ratio, *CI* confidence interval.

The present results have several implications for future interventions. First, in this study, the risk of experiencing severe work functioning impairment was higher even with ≥ 1 year of antidepressant treatment. While most recent systematic reviews have shown antidepressant treatment improves functional outcomes, one reported that 60% of patients had persistent functional impairment even 6 months after symptom remission[21]. Job performance is also improved over time following symptom amelioration[22]. These results are consistent with the present findings. Based on these findings, if the symptoms were recovered by the treatment of antidepressants but the work function was deteriorated, it may be necessary to consider a side effects of antidepressants or a cognitive impairment due to causes other than depression such as Alzheimer's disease.

Second, in addition to symptom amelioration, job-related functioning and performance are important for continued employment. Our study suggests the importance of monitoring patients for ≥ 1 year after finishing treatment (Table 4), assuming work performance is only restored after recovery from symptoms. The risk of work functioning impairment is markedly higher, particularly in the acute phase (< 4 months as shown in Table 3), wherein the risk is threefold that of healthy controls. It is therefore important to assess workers' degree of recovery from impairment after starting treatment, even if their symptoms have remitted. Additionally, given that severe work functioning impairment (WFun ≥ 21 points) can increase the risk of taking sick leave in the future, such assessments are important for preventing depression-related work leave[23].

Third, in the present study, the risk of severe work functioning impairment remained high for about 1 year after discontinuation of antidepressant treatment (Table 4). This is the first study to assess work functioning following treatment discontinuation. To deter workers impatience with their recovery, attending psychiatrists or occupational physicians should explain the likelihood of being at an increased risk of work functioning impairment for ≥ 1 year after discontinuing antidepressant treatment. This explanation may give motivation to seek medical assistance when experiencing a symptom relapse. Additionally, Japanese companies with > 50 employees are legally obliged to employ corporate healthcare professionals, mainly occupational physicians, in the workplace. In these companies, importance should be placed on collaboration between the attending psychiatrist and healthcare professionals via the patient, and these healthcare professionals should follow-up patients after the patients discontinue antidepressant treatment.

The present study has a number of strengths. It is the first study to investigate work functioning impairment in employees across several phases of antidepressant treatment for depression by comparing findings with healthy workers who have never received such treatment. The study also examined work functioning impairment across several phases after discontinuation of pharmacotherapy treatment for depression. Additionally, this study used a large-scale, workplace cohort and was based on mutually exclusive and collectively exhaustive medical claims data obtained via Japan's universal health insurance system.

The study does also have some limitations. First, we did not obtain information on the responsiveness of treatment for depression and the reason for discontinuation of treatment. We could not evaluate the effects of these situations on work functioning.

Second, we did not assess depression severity. We therefore did not account for its effect on work functioning impairment. However, a recent systematic review reported, based on several studies, that although antidepressant treatment ameliorates functional outcomes, the severity of depression at the start of treatment does not affect this amelioration[2]. We were also unable to examine non-pharmaceutical treatments, such as psychotherapy, concurrent with pharmacotherapy; therefore we did not evaluate the effects of such treatments. Additionally, we did not examine other aspects, such as the effects of job styles at certain workplaces, with relation to work performance. Finally, because the study population comprised employees from companies listed on the First Section of the Tokyo Stock Exchange, and thus generally representing those of higher socioeconomic status, care should be taken in generalising the findings. Furthermore, roughly half were pharmaceutical company employees and therefore likely have greater medical knowledge than the general public. People with higher socioeconomic attributes, such as higher education levels, are also more accepting of mental health services[24]. The proportion of participants who had depression but were not using such services was therefore likely lower than that in the general population. This limitation should be taken into account when interpreting the results. Those taking oral antidepressants accounted for 2.7% of all participants, which is similar to the proportion in

a large-scale survey on mood (emotional) disorders among general residents in Japan (in which the 12-month prevalence of depression was 2.1%)[25].

Conclusions

The present study showed an association between the duration of pharmacotherapy treatment and work functioning impairment as well as the relationship between the duration of discontinuation from treatment and such impairment. Patients were found to be at an increased risk of severe work functioning impairment for ≥ 1 year after discontinuing antidepressants. It is important for the occupational health practitioners and attending psychiatrists to follow up in cooperation with each other, paying attention to the decrease in work functioning in addition to the symptoms.

Data availability

The analysis presents clinical data of a large-scale workplace-based cohort with ongoing follow-up examinations. This project constitutes a major scientific effort, therefore data are not made available for the scientific community outside. Interested researchers make their requests to the leader of the Collabo-Health Study (Tomohisa Nagata; tomohisa@med.uoeh-u.ac.jp).

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Author contributions
T.N. played a lead role in the study design and the writing of the manuscript, and he contributed to the data interpretation and the data analysis. Y.F. conducted the data analysis, contributed to results interpretation and reviewed drafts of the manuscript. M.O. (Makoto Ohtani) contributed to the study design and data interpretation. K.F. conducted the analysis of receipt data. M.N., S.K., M.O. (Makoto Okawara) and K.M. reviewed drafts of the manuscript. All authors had final approval for submitted and published version of the paper.

Competing interests
The authors declare no competing interests.

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ORIGINAL ARTICLE

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Cardiovascular and cerebrovascular diseases risk associated with the incidence of presenteeism and the costs of presenteeism

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Abstract

Objectives: The objective of this study was to estimate a risk of cardiovascular and cerebrovascular diseases for each worker and to determine whether this risk is associated with the incidence and costs of presenteeism, absenteeism, and medical/drug treatments.

Methods: Established risk equations were used to estimate the 10-year probability of developing coronary artery disease and ischemic stroke in male workers aged 40-65 years who were recruited from four pharmaceutical companies in Japan. The incidence of presenteeism was defined as existence of presenteeism for the past a month, and the incidence of absenteeism was defined as existence of sick-leave for the past three months by a self-administered questionnaire. Each cost was calculated based on the human capital method. Data on medical/drug treatments were collected from health insurance claims.

Results: The risks were calculated for 6047 workers. Individuals at moderate and high risk of coronary artery disease had a significantly higher rate of presenteeism and absenteeism than workers at low risk. Workers at moderate and high risk of ischemic stroke also had a significantly higher rate of presenteeism and absenteeism than workers at low risk. Mean costs for absenteeism and medical/drug treatments increased with the risk of developing coronary artery disease or ischemic stroke, while costs for presenteeism did not.

Conclusions: To prevent the costs of presenteeism, workers not only at high risk but also at low and moderate risk of developing cardiovascular and cerebrovascular diseases should receive health care services.

KEYWORDS

absenteeism, coronary artery disease, cost, ischemic stroke, presenteeism, risk equation

Koki Kimura and Tomohisa Nagata contributed equally.

1 | INTRODUCTION

Employee illness results in both medical expenses and productivity loss from disability, absenteeism, and presenteeism. The role of health in productivity management has gradually garnered attention from government agencies and employers in Japan, where the working population is shrinking and aging.[1] Studies have shown that a detailed breakdown of costs by medical condition is required for decision-making in the field of employee health,[2,3] and we previously reported that the burden of presenteeism was greater than that of medical expenses and absenteeism in Japanese workers.[4] The importance of health management measures targeting a decline in productivity that is attributable to presenteeism is becoming increasingly recognized in Japan.

Presenteeism has been associated with a stressful work environment[5] and modulated by individual worker risk factors[6] and the incidence of chronic illnesses.[7] To reduce presenteeism, measures should incorporate both a population approach and a high-risk approach. In the high-risk approach, the employees at high risk of presenteeism should be identified and treated individually. In Japan, employers are obligated to conduct general periodic health examinations for all workers under the Industrial Safety and Health Act,[8] while additional health assessments require cumbersome procedures to protect employees' personal information.[9] The general health examination therefore offers an effective opportunity to identify employees at high risk of presenteeism.

The costs of cardiovascular and cerebrovascular diseases constitute a great burden, and account for half of all causes of death and one-quarter of work disability causes in the working population in Japan.[10] Since employees are now expected to work more years than in the past because of the shrinking workforce, more individuals are projected to develop these diseases prior to retirement.[11] Furthermore, the health effects of long working hours have become a major social issue, and cardiovascular and cerebrovascular diseases are regarded as the main adverse health effect of long working hours and industrial accidents.[12] For these reasons, the Ministry of Health, Labour and Welfare has placed an emphasis on testing for and preventing these diseases.[13]

Studies have reported that medical and absenteeism costs increase with disease-related risks,[14-17] and that the costs of presenteeism are also associated with a number of health risk factors and with the sum of risk factors identified in each employee.[7,18-22] These may also include non-physical factors, such as the refusal to use safety belts or dissatisfaction with life.[22] The costs of presenteeism may therefore not reflect the risk of cardiovascular and cerebrovascular diseases accurately. To the best of our knowledge, there are no published studies that correlate these risks with presenteeism. Such data would be an important resource for managing health and productivity in the workplace.

Risk equations have been developed to estimate the 10-year probability of coronary artery disease and ischemic stroke in Japanese individuals.[23] This probability can be calculated from age, sex, smoking status, systolic blood pressure, antihypertensive medication use, diabetes mellitus, and cholesterol levels; these data can be obtained from standardized laboratory tests and questionnaires during the general periodic health examinations. Coronary artery disease and ischemic stroke are major diseases in Japan. We hypothesized that employees at high risk of cardiovascular and cerebrovascular diseases, as estimated by the risk equations for coronary artery disease and ischemic stroke, would exhibit greater presenteeism than employees deemed at lower risk. We hypothesized as well that employees at high risk would exhibit greater absenteeism and medical/drug costs than employees deemed at lower risk. The purpose of this study was to examine the association between the 10-year probability of developing these diseases and the incidence or costs of presenteeism, as well as the association with medical/drug treatment and absenteeism. By clarifying these associations, it is possible to estimate the effect and economic impact of preventing cardiovascular and cerebrovascular disease, and to clarify the characteristics of the target population for preventing presenteeism.

2 | MATERIALS AND METHODS

We conducted a cross-sectional study of male employees aged 40-65 years in four pharmaceutical companies and their health insurance society. This age group was selected because the minimum age for the applicability of the risk equation method[23] estimating the 10-year probability of coronary artery disease and ischemic stroke is 40 years, and 65 is a retirement age. The predicted probability of incident coronary artery disease within 10 years and the predicted probability of ischemic stroke within 10 years were calculated for each employee by combinations of age, sex, smoking status, systolic blood pressure, cholesterol levels, antihypertensive medication use, and use of medications to control diabetes.[23] These data were obtained from the standardized laboratory tests and health questionnaires administered to employees in 2014 in each participating company.

We divided the subjects into three groups according to the probability of incident coronary artery disease. We defined the workers whose probabilities were less than 0.5% as "low-risk," the workers whose probabilities were 0.5%–2.0% as "moderate-risk," and the workers whose probabilities were more than 2.0% as "high-risk." The cutoff points were set

by reference to low-density lipoprotein cholesterol management target-setting.[24] We also divided the probability of incident ischemic stroke into three categories using the same definition.

This study was approved by the ethics committee of the University of Occupational and Environmental Health, Japan, Kitakyushu, Japan (H26-026 Date: 7/August/2019).

We designed a web-based, self-administered questionnaire about presenteeism and absenteeism in 2014. We asked participants whether they had experienced health issues at work over the preceding month. If the answer was yes, we asked whether the symptoms affected the quality and quantity of their work, in comparison with productivity during periods without symptoms. The quality and quantity were scored on a 0-10 scale.[22,25] When participants had no health issues or indicated that their health issues had not affected the quality and quantity of their work at all, we defined the situation as "no presenteeism." When participants indicated that their health issues did affect their work to any degree, we defined the situation as "presenteeism," and the incidence of presenteeism was defined as existence of "presenteeism." We calculated the presenteeism costs using the following formula[4]:

$$\begin{aligned}\text{Presenteeism costs} = {} & \text{JPY}3,300 \times 8\,(\text{working hours per day}) \\ & \times (1 - \text{quantity}\,(0-10) \times \text{quality}\,(0-10)\,/100) \\ & \times (\text{days with symptoms in a year})\end{aligned}$$

The mean payroll per person per hour was set at 3,300 Japanese Yen (JPY) and based on the average in large manufacturing companies in 2014 in Japan.[26]

We asked participants how many sick-leave days they had taken over the preceding 3 months. All subjects of this study were full-time employees, and they were guaranteed a sufficient sick leave according to their years of service. The salary was guaranteed by the company or health insurance unions depending on the number of days off. If the answer was none, we defined the situation as "no absenteeism." All other answers were scored as "absenteeism," and the incidence of absenteeism was defined as existence of "absenteeism." We calculated the absenteeism costs using the following formula[4]:

$$\begin{aligned}\text{Absenteeism costs} = {} & \text{JPY}3300 \times 8\,(\text{working hours per day}) \\ & \times (\text{sick} - \text{leave days in a year})\end{aligned}$$

We received inpatient medical and pharmaceutical claims, outpatient medical claims, and outpatient pharmaceutical claims data for all participants from the health insurance unions, which covered the period between 1 April 2014 and 31 March 2015. The claims did not include dental treatments or over-the-counter drug expenses. We defined the sum of inpatient medical and pharmaceutical claims, outpatient medical claims, and outpatient pharmaceutical claims as medical/drug costs. We excluded employees who spent more than 10 million JPY in medical expenses during that period to avoid the influence of catastrophic events.

2.1 | Statistical analysis

We first calculated descriptive statistics (percentages, means, and standard deviation) in each risk category. Logistic regression was used to calculate the odds ratio of each incidence of presenteeism and absenteeism comparing each category of coronary artery disease and ischemic stroke risk. We calculated the odds ratio adjusted for occupation (categorical variables) and body mass index (continuous variable), which were not used for estimating the 10-year probability of coronary artery disease and ischemic stroke. Next, we compared absenteeism, presenteeism, and medical/drug costs between the three categories. Statistical analysis was conducted using the Kruskal-Wallis test, and post-hoc multiple comparisons were made using the Mann-Whitney U test with Bonferroni corrections. All tests were two-tailed, with differences reported as significant if $P < .05$. All analyses were performed in SPSS version 25 (IBM SPSS, Armonk, NY, USA) and Stata version 16 (StataCorp, College Station, TX, USA).

3 | RESULTS

We sent an e-mail solicitation for questionnaires to 11 774 male employees aged 40-65 years in four companies, and 6,581 individuals (56%) responded. We excluded 530 employees for missing data and four employees who experienced catastrophic events that required extensive medical treatment (more than 10 million JPY in medical expenses). The number of employees eligible for inclusion in the analysis was 6047. The numbers of employees in each coronary artery disease risk category (low, moderate, and high) were 2374, 1808, and 1865, respectively. The numbers of employees in each ischemic stroke risk category were 2319, 1628, and 2100, respectively. Table 1 lists the characteristics of study participants, stratified by each category.

Regarding coronary artery disease, the incidence of presenteeism (defined as existence of presenteeism for the past a month) was recorded for 19%, 22%, and 27% of participants at low, moderate, and high risk, respectively (Table 2). The incidence of absenteeism (defined as existence of sick-leave for the past three months) was recorded for 17%, 21%, and 30% of participants at low, moderate and high

TABLE 1 Demographic characteristics of the study population

	Total		Coronary artery disease risk						Ischemic stroke risk					
			Low risk N = 1125		Moderate risk N = 4004		High risk N = 918		Low risk N = 2319		Moderate risk N = 3014		High risk N = 714	
	N Mean	% SD	N Mean	% SD	N Mean	% SD	N Mean	% SD	N Mean	% SD	N Mean	% SD	N Mean	% SD
Age[a]														
40-49	3,107	51	1,125	100	1,866	47	116	13	2,319	100	780	26	8	1
50-59	2,679	44	0	0	2,022	50	657	72	0	0	2,183	72	496	69
60-65	261	4	0	0	116	3	145	16	0	0	51	2	210	29
Occupation														
Clerical administrative support	830	14	148	13	559	14	123	13	299	13	436	14	95	13
Sales	2,507	41	403	36	1,643	41	461	50	970	42	1,213	40	324	45
Research and development	1,036	17	218	19	701	18	117	13	460	20	480	16	96	13
Production line	521	9	84	7	361	9	76	8	180	8	263	9	78	11
Other	1,153	19	272	24	740	18	141	15	410	18	622	21	121	17
Smoking[a]														
Yes	1,669	28	0	0	1,202	30	467	51	501	22	822	27	346	48
Treatment for hypertension[a]														
Yes	1,171	19	0	0	483	12	688	75	0	0	659	22	512	72
Treatment for diabetes mellitus[a]														
Yes	266	4	0	0	73	2	193	21	0	0	79	3	187	26
Treatment for hyperlipidemia[a]														
Yes	965	16	83	7	554	14	328	36	172	7	523	17	270	38
Body mass index (kg/m^2)	23.9	3.2	22.9	2.5	23.8	3.1	25.7	3.6	23.2	2.8	24.1	3.2	25.2	3.5
Systolic blood pressure (mmHg)[a]	121	14	115	9	121	14	127	15	115	11	123	14	127	15
Diastolic blood pressure (mmHg)	77	10	73	8	78	10	82	11	74	9	79	10	81	11
Total cholesterol (mg/dL)	202	32	197	28	204	31	204	37	202	31	205	31	194	33
Low-density lipoprotein cholesterol (mg/dL)	123	29	118	25	124	30	123	32	124	29	124	29	114	29
High-density lipoprotein cholesterol (mg/dL)	58	14	60	13	59	15	53	14	58	14	59	15	55	14

(Continues)

TABLE 1 (Continued)

	Total		Coronary artery disease risk						Ischemic stroke risk					
			Low risk N = 1125		Moderate risk N = 4004		High risk N = 918		Low risk N = 2319		Moderate risk N = 3014		High risk N = 714	
	N Mean	% SD	N Mean	% SD	N Mean	% SD	N Mean	% SD	N Mean	% SD	N Mean	% SD	N Mean	% SD
Triglycerides (mg/dL)	127	99	97	50	124	84	175	165	114	74	130	106	155	126
Fasting blood glucose (mg/dL)	97	16	92	8	96	14	108	27	93	10	97	15	109	27
Glycated hemoglobin (HbA1c, %)	5.5	0.6	5.3	0.3	5.4	0.5	5.9	0.9	5.3	0.4	5.5	0.6	5.9	0.9

[a]These variables were used to calculate the risk of coronary artery disease and ischemnic stroke.

risk, respectively. Workers at moderate and high risk also had a significantly higher risk of incidence of presenteeism than workers at low risk (OR: 1.18; CI: 1.00-1.40 for moderate-risk workers and 1.46 [CI: 1.18-1.81] for high-risk workers). Workers at moderate and high risk had a significantly higher risk of incidence of absenteeism than workers at low risk (odds ratio [OR]: 1.29; 95% confidence interval [CI]: 1.08-1.53 for moderate-risk workers and 2.11 [CI: 1.69-2.63] for high-risk workers).

Regarding of ischemic stroke, the incidence of presenteeism was recorded for 20%, 23%, and 25% of participants at low, moderate, and high risk, respectively. The incidence of absenteeism was recorded for 19%, 22%, and 31% of participants at low, moderate and high risk, respectively. Workers at moderate and high risk also had a significantly higher risk of incidence of presenteeism than workers at low risk (OR: 1.17; CI: 1.02-1.33 for moderate-risk workers and 1.24 [CI: 1.01-1.51] for high-risk workers). Workers at moderate and high risk of ischemic stroke had a significantly higher risk of incidence of absenteeism than workers at low risk (OR: 1.23; CI: 1.07-1.41 for moderate-risk workers and 1.94 [CI: 1.59-2.36] for high-risk workers).

The mean presenteeism costs per person per year in groups at low, moderate, and high risk for coronary artery disease were JPY 322 418, JPY 341 768, and JPY 337 277, respectively (Figure 1). Only the high-risk and low-risk groups differed significantly ($P < .01$). The mean absenteeism costs per person per year in groups at low, moderate, and high risk for coronary artery disease were JPY 35 388, JPY 47 697, and JPY 75 059, respectively. All risk groups differed significantly ($P < .001$). Mean medical/drug costs per person per year in the high-risk group were highest (JPY 240 486), followed by costs in the moderate-risk group (JPY 133 820) and in the low-risk group (JPY 97 816). There was a significant cost difference between all risk groups ($P < .001$).

The mean presenteeism costs per person per year in groups at low, moderate, and high risk for ischemic stroke were JPY 330,213, JPY 353 118, and JPY 295 122, respectively (Figure 2). The three risk groups differed significantly in the Kruskal-Wallis test ($P = .031$) but not in the post-hoc multiple comparisons test (Mann-Whitney U-test with Bonferroni correction). The mean absenteeism costs per person per year in groups at low, moderate, and high risk for ischemic stroke were JPY 38 729, JPY 50 733, and JPY 79 792, respectively. All risk groups differed significantly. Mean medical/drug costs per person per year in the low-, moderate-, and high-risk groups were JPY 90 838, JPY 157 818, and JPY 252 531, respectively. The three groups differed significantly ($P < .001$).

4 | DISCUSSION

We sought to associate the probability of developing coronary artery disease and ischemic stroke with the incidence of presenteeism and absenteeism, as well as with the annual mean cost per employee of presenteeism, absenteeism, and medical/drug treatments. Presenteeism and absenteeism were higher in workers at moderate and high risk of coronary artery disease and ischemic stroke. The mean costs of absenteeism and medical/drug treatments were higher in the high-risk groups, and presenteeism costs were higher in the group at high risk for coronary artery disease but not ischemic stroke. Overall, the costs of presenteeism were much higher than those of absenteeism or medical/drug treatments, which is consistent with the findings of our previous study.[4] As far as we know, this is the first study to assess the association between risks of cardiovascular and cerebrovascular diseases calculated with risk equations and presenteeism, absenteeism, and medical/drug treatment simultaneously.

TABLE 2 Adjusted odds ratio of incidence of presenteeism and absenteeism by risk category

	Incidence of presenteeism[a]				Incidence of absenteeism[b]			
	Proportion (%)	Adjusted odds ratio[c]	95% confidence interval	*p* value	Proportion (%)	Adjusted odds ratio[c]	95% confidence interval	*P* value
Coronary artery disease								
Low risk	19	ref			17	ref		
Moderate risk	22	1.18	1.00-1.40	.048	21	1.29	1.08-1.53	.005
High risk	27	1.46	1.18-1.81	<.001	30	2.11	1.69-2.63	<.001
Ischemic stroke								
Low risk	20	ref			19	ref		
Moderate risk	23	1.17	1.02-1.33	.022	22	1.23	1.07-1.41	.003
High risk	25	1.24	1.01-1.51	.039	31	1.94	1.59-2.36	<.001

[a] The incidence of presenteeism was defined as existence of presenteeism for the past a month by a self-administered questionnaire.

[b] The incidence of absenteeism was defined as existence of sick-leave for the past three months by a self-administered questionnaire.

[c] Adjusted for occupation (categorical variables) and body mass index (continuous variable).

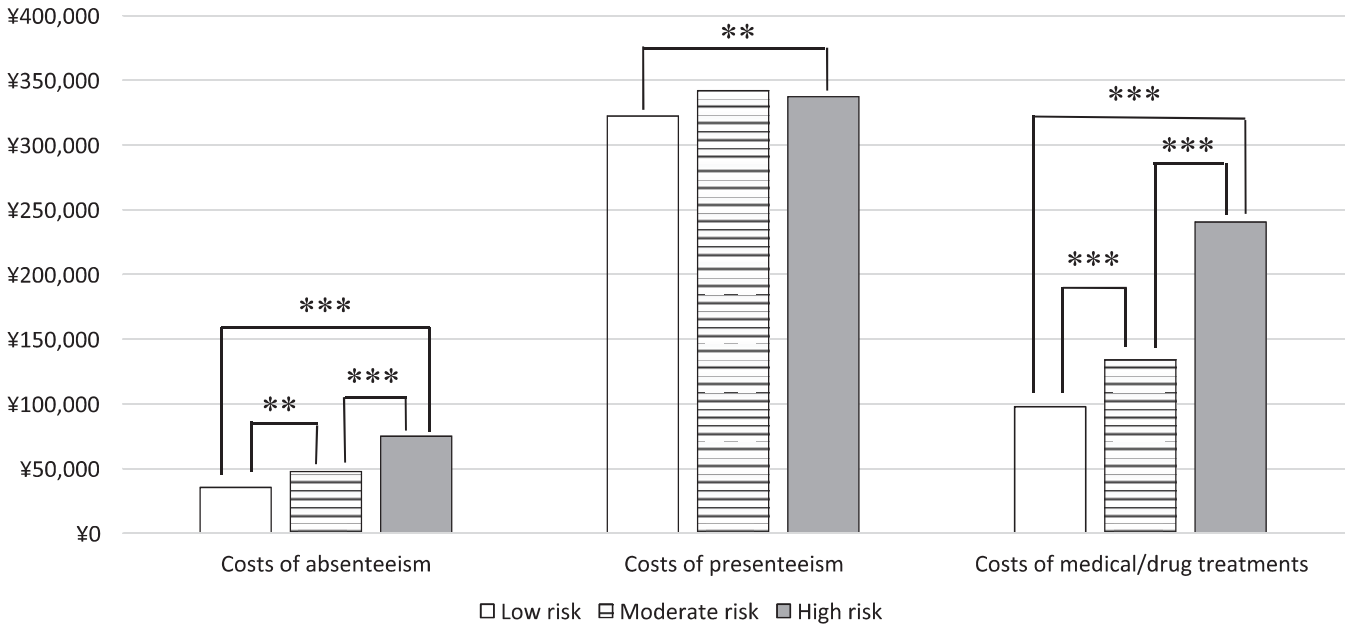

FIGURE 1 Mean costs of absenteeism, presenteeism, and medical/drug treatments per person per year (Japanese Yen in 2014) stratified by risk of coronary artery disease. $^{**}P < .01$; $^{***}P < .001$

Our findings of increased absenteeism and medical/drug treatments in the high-risk group are in accordance with those of studies that reported that absenteeism or medical/drug costs increased as the number of cardiometabolic risk factors increased,[14-17] and suggest that employers would benefit from reducing absenteeism and medical/drug treatments to intervene in high-risk individuals identified from health examinations.

The percentage of employees displaying symptoms that cause presenteeism is reported to be approximately 16%–22%[4,27] among workers in large Japanese companies. Therefore, identifying individuals at high risk and offering them treatment measures would constitute an effective approach. In Japan, employers are required to implement intervention measures in occupational health after general health examination. Since studies have shown that presenteeism increases as the number of risk factors for cardiovascular and cerebrovascular diseases increases,[7,18-22] we examined the feasibility of screening individuals at high risk of presenteeism using the disease risk factors that can be identified by the general health examination. We found that presenteeism was higher in individuals at high risk of coronary artery disease and ischemic stroke, suggesting that this approach is effective. This result contradicts the fact that costs of

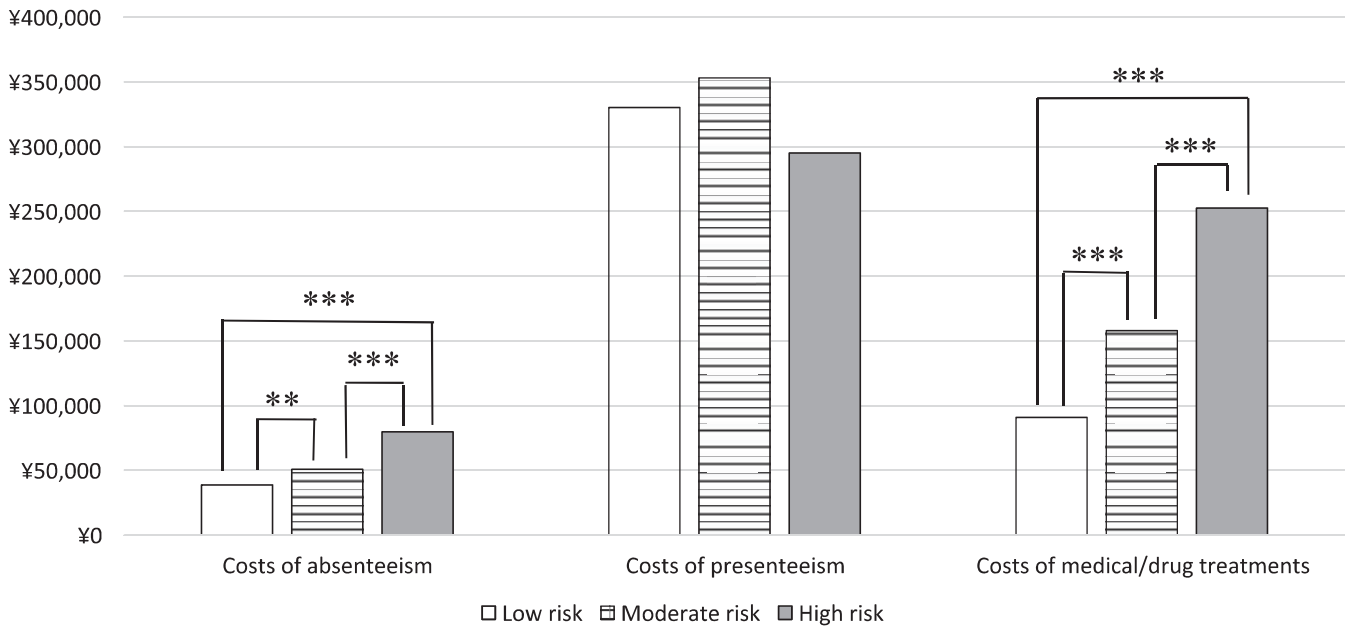

FIGURE 2 Mean costs of absenteeism, presenteeism, and medical/drug treatments per person per year (Japanese Yen in 2014) stratified by risk of ischemic stroke. $^{**}P < .01$; $^{***}P < .001$

presenteeism were not higher according to rising the risk of coronary artery disease and ischemic stroke. Presenteeism costs are calculated not only by the existence of preesnteeism but also by factors that affect the work. A past study revealed that the highest cost burdens of presenteeism from chronic illness were related to mental (behavioral) health conditions.[4] Although the rate of co-morbidity between cardiovascular and cerebrovascular disease and depression is relatively high at around 20%,[28] the risk factors for those diseases are not exactly the same. There might be many people with mental health illness in the low or moderate risk group of cardiovascular and cerebrovascular diseases as those in the high-risk group. In addition to this, the amount of presenteeism costs for people with symptoms of mental illness is higher than for other symptoms.[4] For that reason, costs of presenteeism in workers at low and moderate risk for both coronary artery disease and ischemic stroke may contain costs of presenteeism related to mental health conditions. Costs of presenteeism in workers at low and moderate risk should not be neglected since it involves much higher than costs of absenteeism or medical/drug. These findings also indicate that employers should consider investing in countermeasures against presenteeism, such as interventions to relieve stressful conditions in the workplace.

This study has several limitations. First, we used data from employees of large pharmaceutical companies. The smoking rate was 28% among the subjects of this study (mostly 40-59 year old men). According to the National Health and Nutrition Survey,[29] which is a representative sample of the general population in Japan, smoking rate was 44.2% among men in their 40s and 36.4% in men in their 50s in the 2014 survey. The subjects in this study may be healthier than the general population. However, since this study calculates the absolute risk of cardiovascular and cerebrovascular diseases using data from lifestyle and blood tests, the results of this study can be used in other groups. The future study is needed to confirm reproducibility of this results in small and medium enterprises and other industries. This study was conducted only among men, and it will be necessary to consider it among women in the future. Second, we could not calculate the costs of over-the-counter drugs, but as sales of such drugs in Japan total only JPY 94 billion, compared with JPY 985 billion for prescription drugs,[30] we estimate that the influence of the former is small. Third, dental claims were not included in the medical/drug costs. Again, as dental costs are estimated at only 6.8% of total expenditure for medical care,[31] we surmise that their influence on our findings is negligible. Fourth, this study was cross-sectional, so we were unable to estimate whether programs aimed at preventing cardiovascular and cerebrovascular diseases reduce the economic burdens of presenteeism, absenteeism, and medical/drug treatments. Determining the efficacy of prevention programs would require intervention studies.

Despite the limitations, our study adds to the literature assessing health-related costs in the context of cardiovascular and cerebrovascular diseases. The findings could assist employers in developing effective strategies for the promotion of workplace health and human capital, especially in Japan.

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DISCLOSURE

Approval of the research protocol: This study was approved by the ethics committee of the University of Occupational and Environmental Health, Kitakyushu, Japan, and was conducted in full accordance with the World Medical Association Declaration of Helsinki. *Informed consent*: We explained the study protocol and obtained opt-out consent. *Registry and the registration no. of the study/trial*: N/A. *Animal Studies*: N/A. *Conflict of interest*: None declared.

AUTHOR CONTRIBUTIONS

TN and KM conceived and coordinated the project. KK, TN, and MO completed the data analysis. KK and TN drafted the initial manuscript. MN, S.K, YF, and KM revised the manuscript. All authors commented on drafts of the report.

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Original Article

Combined effect of high stress and job dissatisfaction on long-term sickness absence: a 1-year prospective study of Japanese employees

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Abstract

Objectives: We prospectively examined the combined effect of high stress (i.e., being under great work-related stress), as defined in the Japanese Stress Check Program manual using the Brief Job Stress Questionnaire (BJSQ), and job dissatisfaction on long-term sickness absence lasting 1 month or more. **Methods:** Participants were 7,343 male and 7,344 female financial service company employees who completed the BJSQ. We obtained personnel records covering a 1-year period to identify employees with long-term sickness absence, which was treated as a dichotomous variable. Participants were classified into four groups (high-stress + dissatisfied, high-stress + satisfied, not high-stress + dissatisfied, and not high-stress + satisfied groups) to calculate the hazard ratios (HRs) of long-term sickness absence for these groups using Cox's proportional hazard regression analysis. Furthermore, to examine whether the combined effect of high stress and job dissatisfaction is synergistic or additive, we calculated relative excess risk due to interaction (RERI), attributable proportion due to interaction (AP), synergy index (SI), and their 95% confidence intervals (CIs). **Results:** After adjustment for covariates, the HR of long-term sickness absence was highest among the high-stress + dissatisfied group (HR 6.49; 95% CI, 3.42–12.3) followed by the high-stress + satisfied group (HR 5.01; 95% CI, 1.91–13.1). The combined effect of high stress and job dissatisfaction was additive (95% CIs of RERI and AP included 0 and that of SI included 1). **Conclusions:** Our findings suggest incorporating high stress with job dissatisfaction improves the predictability of long-term sickness absence. However, employees reporting high stress but satisfaction with their jobs may still at increased risk of developing long-term sickness absence.

Keywords: absenteeism, interaction effect, job satisfaction, job stress, longitudinal studies, survival analysis

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Introduction

Sickness absence is a major public health and economic concern in Japan[1,2], as well as in other countries[3–5]. In particular, long-term sickness absence (i.e., sickness absence lasting 4 weeks/1 month or more)[6] results in high costs for various stakeholders, such as employees, employers, insurance agencies, and society at large[7,8]. According to a report from the Organization for Economic Co-operation and Development (OECD), its member countries spend around 1.9% of the gross domestic product (GDP) on sickness absence benefits[9], which are due in large part to long-term sickness absence[4]. Furthermore, long-term sickness absence has adverse effects

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on the probability of returning to work[10,11], as well as on mortality[12–14]; therefore, identifying those who are at high risk of long-term sickness absence at an early stage and preventing it are beneficial for both employees and employers.

In Japan, the Industrial Safety and Health Act was partially amended on June 25th, 2014; all workplaces with 50 or more employees were obligated to implement the Stress Check Program annually for employees starting on December 1st, 2015. This program requires employers to (1) conduct a self-administered questionnaire survey (called a "Stress Check"), which measures job stressors, stress responses, and social support; (2) identify employees under great work-related stress (called "high-stress" employees) based on the results of the Stress Check and arrange a physician interview for them (at their own request); and (3) improve working conditions according to physician's recommendations[15].

A recent study has reported that high stress, as defined in the Stress Check Program implementation manual (hereinafter called "Stress Check Program manual" or simply "program manual")[16] described below, significantly predicted subsequent long-term sickness absence[17]. The Ministry of Health, Labour and Welfare has published the Stress Check Program manual[16], which proposes that high-stress employees are defined using the job stressors, stress responses, and social support scores of the Brief Job Stress Questionnaire (BJSQ)[18] (more detailed proposed criteria are described in the Methods section). Although using the BJSQ is not mandatory to conduct the Stress Check or define high-stress employees in the Stress Check Program, it has been widely used in research and practice in the field of mental health in the Japanese workplace and can measure various aspects of job stressors, stress responses, and social support, as well as job and life satisfaction, with a total of 57 items[18].

In the Stress Check Program, information on job dissatisfaction has been underutilized for defining high-stress employees, although it can be measured using the BJSQ and has been reported to significantly and consistently predict long-term sickness absence by several prospective studies in Japan, as well as in other countries (i.e., Norway and the Netherlands)[19–22]. Given the empirical findings introduced above, those who meet the criteria for high stress and are also dissatisfied with their jobs may be at higher risk of a long-term sickness absence. Tsutsumi et al.[23] have pointed out that screening performance of high stress using the definition of the Stress Check Program manual is limited and that the combination of high stress with other related indicators needs to be examined. Furthermore, Asai et al.[24] have reported that more than 80% of high-stress employees did not request employers to arrange a physician interview. If we can better predict long-term sickness absence by incorporating high stress with job dissatisfaction measures, occupational health staff can identify high-stress employees who are more strongly encouraged to request a physician interview. Even with limited resources, the efficiency of physician interviews may be improved and eventually lead to prevention of long-term sickness absence, thereby saving companies money and resources.

The purpose of the present study was to examine the combined effect of high stress, as defined in the Stress Check Program manual using the BJSQ, and job dissatisfaction on long-term sickness absence. We hypothesized that those who met the criteria for high stress and were also dissatisfied with their jobs would be at higher risk of long-term sickness absence.

Methods

Participants

From July 2015 to July 2016, we conducted a 1-year prospective study of employees from a financial service company of Japan. We gathered information on work-related stress, demographic and occupational characteristics, and long-term sickness absence using the BJSQ and the personnel records of the surveyed company. At baseline (July to August 2015), we invited all employees except board members; employees who were temporarily transferred, overseas, and dispatched; and absentees ($n = 15{,}615$) to participate in this study; a total of 14,711 employees completed the BJSQ (response rate: 94.2%). After excluding 24 employees who had taken long-term sickness absence in the past 3 years, we studied 14,687 employees (7,343 men and 7,344 women) aged 20–66 years for 1 year (until July 31st, 2016) (see Figure 1). We obtained informed consent from participants using the opt-out method for the secondary analysis of existing anonymous data. Kitasato University Medical Ethics Organization reviewed and approved the study procedure (No. B15-113).

Exposure: combination of high stress and job dissatisfaction

High stress was determined and job dissatisfaction was measured using the BJSQ. The BJSQ has high levels of internal consistency reliability and factor-based validity[18] and comprises nine scales of job stressors (i.e., quantitative job overload [3 items], qualitative job overload [3 items], physical demands [1 item], interpersonal conflict [3 items], poor physical environment [1 item], job control [3 items], skill utilization [1 item], suitable jobs [1 item], and meaningfulness of work [1 item]), six scales of stress responses (i.e., vigor [3 items], anger-irritability [3 items], fatigue [3 items], anxiety [3 items], depression [6 items], and physical complaints [11 items]), three scales of social support (supervisor support [3 items], coworker support [3 items], and support from family and friends [3 items]), and two scales of satisfaction (job satisfaction [1 item]

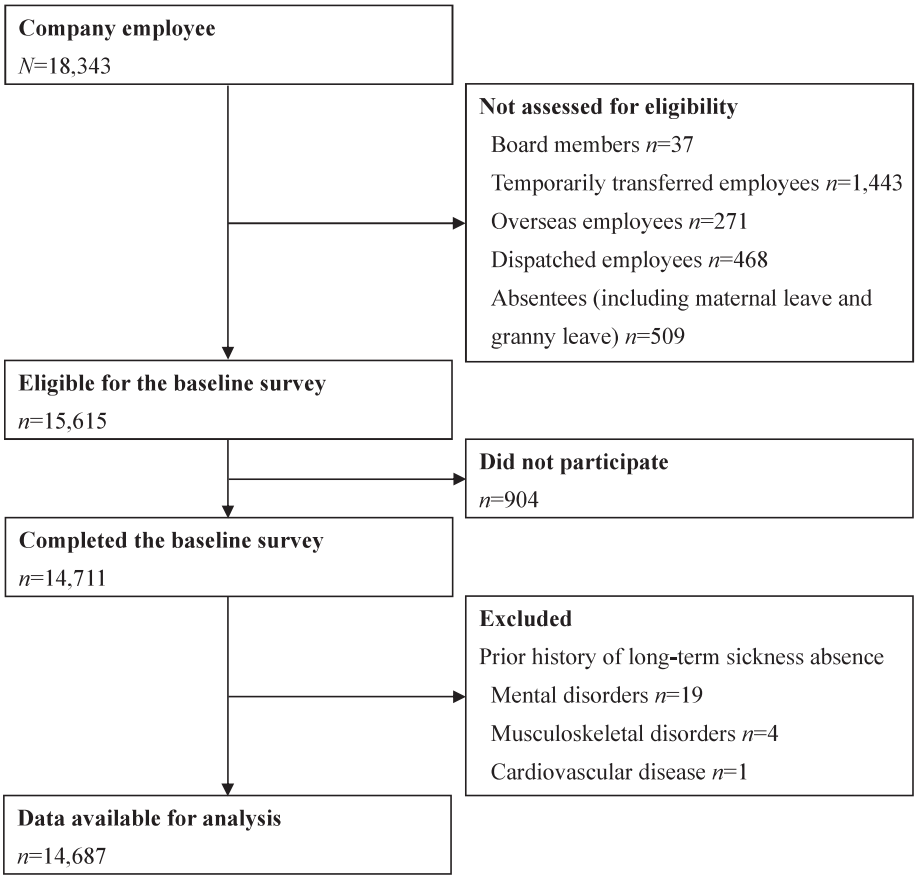

Fig. 1. Recruitment and follow-up flow diagram

and life satisfaction [1 item]). Each item is measured with a four-point response option (1 = *Not at all*, 2 = *Somewhat*, 3 = *Moderately so*, and 4 = *Very much so* for job stressors; 1 = *Almost never*, 2 = *Sometimes*, 3 = *Often*, and 4 = *Almost always* for stress responses; 1 = *Not at all*, 2 = *Somewhat*, 3 = *Very much*, and 4 = *Extremely* for social support; and 1 = *Dissatisfied*, 2 = *Somewhat dissatisfied*, 3 = *Somewhat satisfied*, and 4 = *Satisfied* for satisfaction).

The Stress Check Program manual proposes criteria for defining high-stress employees using the BJSQ[16]: those who have a higher level of stress responses (criterion A) or have above a certain level of stress responses together with remarkably higher level of job stressors and/or lower level of social support (criterion B) are defined as high-stress employees. According to the program manual, a total score of stress responses was calculated by summing up the scale scores of vigor (reversed), anger-irritability, fatigue, anxiety, depression, and physical complaints (score range: 29–116). In a similar way, a total score of job stressors and social support was calculated by summing up the scale scores of quantitative job overload, qualitative job overload, physical demands, interpersonal conflict, poor physical environment, job control (reversed), skill utilization (reversed), suitable jobs (reversed), meaningfulness of work (reversed), supervisor support (reversed), coworker support (reversed), and support from family and friends (reversed) (score range: 26–104). For both scores, a higher score indicates worse (or more stressful) situation. Using the proposed cutoff points by the program manual, those who had 77 or more on the stress responses score (criterion A) or 63–76 on the stress responses score together with 76 or more on the job stressors and social support score (criterion B) were classified as "high-stress (HS)" group; and those who did not meet these criteria were classified as "not high-stress (NH)" group (see Figure 2).

For job dissatisfaction, using the single-item job satisfaction scale of the BJSQ "I am satisfied with my job," those who answered 1 = *Dissatisfied* or 2 = *Somewhat dissatisfied* were classified as the "dissatisfied (D)" group; and those who answered 3 = *Somewhat satisfied* or 4 = *Satisfied* were classified as the "satisfied (S)" group.

On that basis, participants were classified into four groups according to the combination of the classification of high stress and job dissatisfaction (i.e., HS + D, HS + S, NH + D, and NH + S groups).

Outcome: long-term sickness absence

Long-term sickness absence was treated as a dichotomous variable. We obtained information on the dates of

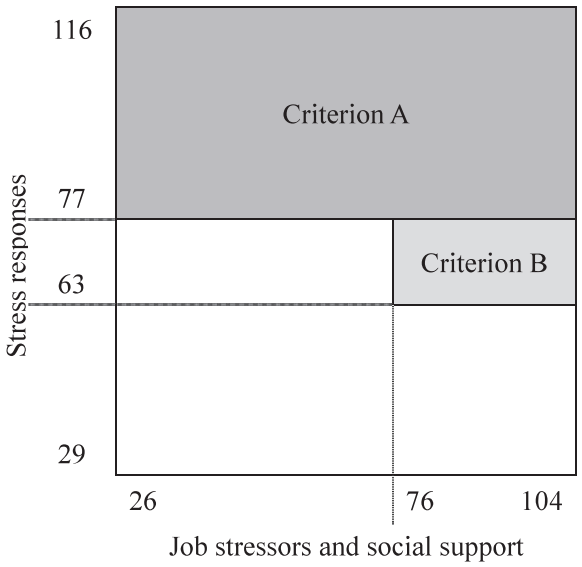

Fig. 2. Criteria for high stress proposed in the Stress Check Program manual[16]

application for invalidity benefit with medical certification for long-term sickness absence lasting 1 month or more from the personnel records of the surveyed company. In the surveyed company, employees were required to submit medical certification from their attending physician to the human resources/labor department when applying for invalidity benefit. Furthermore, because the personnel records included information on the resignation/retirement dates, those who resigned/retired from the surveyed company during the follow-up period were treated as censored cases. The follow-up started when participants answered the BJSQ and ended when they started to take long-term sickness absence (i.e., applied for invalidity benefit), resigned/retired, or when the study concluded on July 31st, 2016, whichever came first.

Covariates: demographic and occupational characteristics

We also obtained information on the demographic and occupational characteristics from the surveyed company. Demographic characteristics included age (years; continuous variable) and gender. Occupational characteristics included length of service (years; continuous variable), job type (four groups: sales, claims service, administrative, and others), and employment position (five groups: manager, staff, senior employee, temporary employee, and others).

Statistical analysis

First, we conducted descriptive analysis to summarize the basic features of each group on the basis of high stress and job dissatisfaction. Then, taking the NH+S group as a reference, we conducted Cox's proportional hazard regression analysis to estimate the hazard ratios (HRs) and their 95% confidence intervals (CIs) of the incidence of long-term sickness absence during the follow-up period among the HS+D, HS+S, and NH+D groups. Furthermore, to examine whether the combined effect of high stress and job dissatisfaction is synergistic or additive, we calculated relative excess risk due to interaction (RERI), attributable proportion due to interaction (AP), and synergy index (SI) as well as their 95% CIs as follows[25]:

$$\mathrm{RERI} = \mathrm{HR}_{\mathrm{HS+D}} - \mathrm{HR}_{\mathrm{HS+S}} - \mathrm{HR}_{\mathrm{NH+D}} + 1$$

$$\mathrm{AP} = \frac{\mathrm{RERI}}{\mathrm{HR}_{\mathrm{HS+D}}}$$

$$\mathrm{SI} = \frac{\mathrm{HR}_{\mathrm{HS+D}} - 1}{\left(\mathrm{HR}_{\mathrm{HS+S}} - 1\right) + \left(\mathrm{HR}_{\mathrm{NH+D}} - 1\right)}$$

If 95% CIs of RERI and AP were greater than 0 and that of SI was greater than 1, the combined effect was determined to be synergistic. Conversely, if 95% CIs of RERI and AP included 0 and that of SI included 1, the combined effect was determined to be additive. In the series of the analyses, we first calculated the crude HRs, RERI, AP, and SI (i.e., without any adjustment) (model 1). Subsequently, we incrementally adjusted for demographic characteristics (i.e., age and gender) (model 2) and occupational characteristics (i.e., length of service, job type, and employment position) (model 3). Furthermore, to be consistent with the main purpose of the Stress Check Program (i.e., primary prevention of mental health problems) and to confirm the robustness of the main results, we conducted a similar analysis taking long-term sickness absence due to mental disorders as an outcome variable. The level of significance was 0.05 (two-tailed). Most statistical analyses were conducted using Stata 14.0 (Stata Corp., College Station, TX, USA), while 95% CIs for RERI, AP, and SI were calculated using the Excel spreadsheet available from the EpiNET (http://epinet.se/res/xls/epinetcalculation.xls)[26].

Results

Table 1 shows the detailed characteristics of each group on the basis of high stress and job dissatisfaction. Compared to the NH+S group, the other three groups were younger, had a shorter length of service, and had a greater proportion of women, claims service personnel, and staff represented, but a lower proportion of administrative, managerial, and senior employees. Among others, the HS+D group had the highest proportion of women and claims service personnel; and the HS+S group had the highest proportion of staff.

Table 2 shows the results of the Cox's proportional hazard regression analysis and the combined effect of high stress and job dissatisfaction. During 5,258,910

Table 1. Demographic and occupational characteristics among employees who participated in the study

	High-stress + dissatisfied (HS + D) group (n = 1,086)		High-stress + satisfied (HS + S) group (n = 431)		Not high-stress + dissatisfied (NH + D) group (n = 2,462)		Not high-stress + satisfied (NH + S) group (n = 10,708)	
	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)
Age, years	40.4 (11.4)		38.9 (11.0)		41.4 (12.5)		41.8 (12.5)	
Gender								
Men		290 (26.7)		121 (28.1)		972 (39.5)		5,960 (55.7)
Women		796 (73.3)		310 (71.9)		1,490 (60.5)		4,748 (44.3)
Length of service, years	12.4 (9.51)		12.0 (8.76)		12.0 (10.0)		12.7 (10.3)	
Job type								
Sales		523 (48.2)		205 (47.6)		1,153 (46.8)		5,155 (48.1)
Claims service		439 (40.4)		160 (37.1)		987 (40.1)		3,669 (34.3)
Administrative		124 (11.4)		66 (15.3)		318 (12.9)		1,875 (17.5)
Others		— (0.0)		— (0.0)		4 (0.2)		9 (0.1)
Employment position								
Manager		54 (5.0)		34 (7.9)		203 (8.2)		2,052 (19.2)
Staff		822 (75.7)		340 (78.9)		1,635 (66.4)		6,250 (58.4)
Senior employee		15 (1.4)		6 (1.4)		77 (3.1)		459 (4.3)
Temporary employee		195 (18.0)		51 (11.8)		543 (22.1)		1,938 (18.1)
Others		— (0.0)		— (0.0)		4 (0.2)		9 (0.1)

SD, standard deviation.

person-days (mean: 358 days, range: 3–373 days), a total of 62 employees (32 men and 30 women) took a long-term sickness absence (mental disorders: 51 cases, musculoskeletal disorders: 6 cases, cerebrovascular disease: 3 cases, and cardiovascular disease: 2 cases). In the crude model (model 1), the HS + D group had the highest HR of long-term sickness absence (HR 5.70; 95% CI, 3.08–10.5) followed by the HS + S group (HR 4.44; 95% CI, 1.72–11.5) and then the NH + D group (HR 2.03; 95% CI, 1.05–3.92). For the combined effect of high stress and job dissatisfaction, RERI and AP were small and SI was close to 1; none of the indicators were statistically significant. These patterns were unchanged after adjustment for demographic and occupational characteristics (models 2 and 3).

When we conducted similar analysis taking long-term sickness absence due to mental disorders as an outcome variable, the combined effect of high stress and job dissatisfaction was similar to the main results, while the estimated risks increased for all three groups (i.e., HS + D, HS + S, and NH + D groups) (Table 3).

Discussion

The present study demonstrated that those who met the criteria for high stress, as identified in the Stress Check Program manual, and were also dissatisfied with their jobs were at highest risk of long-term sickness absence, and that the combined effect of high stress and job dissatisfaction on long-term sickness absence was additive.

Among the groups on the basis of high stress and job dissatisfaction, the HS + D group had the highest HR of long-term sickness absence. This finding is reasonable because, although separately examined, high stress and job dissatisfaction were reported to be associated with increased risk of long-term sickness absence[17,19–22]. Our findings suggest that high-stress employees are at higher risk of subsequent long-term sickness absence compared to their counterparts, and that the risk is further increased when high-stress employees are dissatisfied with their jobs.

The present study found that none of the indicators for an interaction or synergistic effect of high stress and job dissatisfaction were significant, suggesting that the combined effect of high stress and job dissatisfaction on long-term sickness absence is additive. This finding is also reasonable because job (dis)satisfaction does not theoretically have a modifying effect on the association of job stressors, social support, or stress responses with ill-health, as shown by the National Institute for Occupational Safety and Health (NIOSH) model of job stress[27] and the Job Demands-Resources (JD-R) model[28]. There is evidence that job satisfaction buffers the association of adverse psychosocial work environment (such as job demands) with mental health[29]. However, the effect modification by job (dis)satisfaction on the association of psychological or physical distress with future health has not been studied. Our findings suggest that job dissatisfaction does not modify the association of psychological or physical distress with subsequent long-term sickness absence.

On the other hand, the HS + S group also had higher risk of long-term sickness absence, which was more than twice as high as in the NH + D group. Those who are satisfied with their jobs, but suffering from a variety of psychological and physical distress and/or exposure to

Table 2. Combined effect of high-stress and job dissatisfaction on long-term sickness absence among Japanese employees: Cox's proportional hazard regression analysis (7,343 men and 7,344 women)

Combination of high stress and job dissatisfaction	Person-days	Number of events	Incidence rate (/100,000 person-days)	Hazard ratio (95% confidence interval)		
				Model 1 [a]	Model 2 [b]	Model 3 [c]
High-stress + dissatisfied (HS + D) group	383,566	16	4.17	5.70 (3.08 to 10.5)	6.64 (3.51 to 12.5)	6.49 (3.42 to 12.3)
High-stress + satisfied (HS + S) group	154,502	5	3.24	4.44 (1.72 to 11.5)	5.03 (1.92 to 13.2)	5.01 (1.91 to 13.1)
Not high-stress + dissatisfied (NH + D) group	876,560	13	1.48	2.03 (1.05 to 3.92)	2.23 (1.15 to 4.33)	2.16 (1.11 to 4.21)
Not high-stress + satisfied (NH + S) group	3,844,282	28	0.73	1.00	1.00	1.00
Measures of combined effect [d]				Point estimate (95% confidence interval)		
				Model 1 [a]	Model 2 [b]	Model 3 [c]
Relative excess risk due to interaction (RERI)				0.22 (−4.70 to 5.15)	0.38 (−5.24 to 6.00)	0.33 (−5.23 to 5.89)
Attributable proportion (AP)				0.04 (−0.82 to 0.89)	0.06 (−0.77 to 0.89)	0.05 (−0.79 to 0.89)
Synergy index (SI)				1.05 (0.35 to 3.11)	1.07 (0.38 to 3.06)	1.06 (0.37 to 3.06)

[a] Crude (i.e., without any adjustment).
[b] Adjusted for age and gender.
[c] Additionally adjusted for length of service, job type, and employment position.
[d] If 95% confidence intervals (CIs) of RERI and AP are greater than 0 and that of SI is greater than 1, the combined effect is determined to be synergistic. If 95% CIs of RERI and AP include 0 and that of SI includes 1, the combined effect is determined to be additive.

Table 3. Combined effect of high-stress and job dissatisfaction on long-term sickness absence due to mental disorders among Japanese employees: Cox's proportional hazard regression analysis (7,343 men and 7,344 women)

Combination of high stress and job dissatisfaction	Person-days	Number of events	Incidence rate (/100,000 person-days)	Hazard ratio (95% confidence interval)		
				Model 1 [a]	Model 2 [b]	Model 3 [c]
High-stress + dissatisfied (HS + D) group	383,566	15	3.91	7.12 (3.67 to 13.8)	8.16 (4.10 to 16.2)	7.58 (3.79 to 15.1)
High-stress + satisfied (HS + S) group	154,502	5	3.24	5.92 (2.23 to 15.7)	6.42 (2.39 to 17.2)	6.11 (2.27 to 16.5)
Not high-stress + dissatisfied (NH + D) group	876,560	10	1.14	2.08 (0.98 to 4.42)	2.29 (1.07 to 4.91)	2.19 (1.02 to 4.71)
Not high-stress + satisfied (NH + S) group	3,844,282	21	0.55	1.00	1.00	1.00
Measures of combined effect [d]				Point estimate (95% confidence interval)		
				Model 1 [a]	Model 2 [b]	Model 3 [c]
Relative excess risk due to interaction (RERI)				0.11 (−6.35 to 6.58)	0.45 (−6.68 to 7.58)	0.27 (−6.47 to 7.02)
Attributable proportion (AP)				0.02 (−0.89 to 0.92)	0.06 (−0.80 to 0.91)	0.04 (−0.85 to 0.92)
Synergy index (SI)				1.02 (0.35 to 2.97)	1.07 (0.38 to 3.03)	1.04 (0.36 to 3.00)

[a] Crude (i.e., without any adjustment).
[b] Adjusted for age and gender.
[c] Additionally adjusted for length of service, job type, and employment position.
[d] If 95% confidence intervals (CIs) of RERI and AP are greater than 0 and that of SI is greater than 1, the combined effect is determined to be synergistic. If 95% CIs of RERI and AP include 0 and that of SI includes 1, the combined effect is determined to be additive.

adverse work environments, may over-adapt to their jobs, which may lead to increased risk of long-term sickness absence[30]. The present findings suggest that, even if high-stress employees are satisfied with their jobs, their risk of long-term sickness absence is reasonably high; therefore, not only occupational health staff, but also high-stress employees themselves, should not ignore such risk.

Compared to the NH + S group, the other three groups had a greater proportion of women (see Table 1). Considering that such gender imbalance may affect the present findings, we supplementally conducted a gender-stratified analysis and examined an interaction effect between four groups (i.e., the combination of high stress and job dissatisfaction) and gender on long-term sickness absence. As a result, HR for each group was about twice as high for men compared to women (data available upon request), while a significant interaction effect was not observed (p for interaction = 0.397). At least from our dataset, the effect of gender imbalance on the present findings could not be detected. To estimate such effect more precisely, larger-scale research should be conducted in the future.

Possible limitations of the present study should be considered. First, personality traits, which were not measured in the present study, may have affected our findings. Previous studies reported that neuroticism was associated with higher levels of job stressors and stress responses (e.g., depression and anxiety)[31], lower levels of job satisfaction[32], and a higher prevalence of long-term sickness absence[33]; therefore, our findings may have been overestimated. Second, some employees may have transferred to another department in the surveyed company, which may have influenced our findings. However, this impact may be minimal because transfer rates were probably low at 1-year follow-up. Third, although the sample size in the present study was relatively large, we could not conduct cause-specific analyses other than for mental disorders (i.e., musculoskeletal disorders, cerebrovascular disease, or cardiovascular disease) due to the small number of incidence cases. Such analyses may provide additional practical information. Fourth, although we defined long-term sickness absence cases based on the application for invalidity benefit with medical certification, we could not identify whether work-related stress contributed to each case. Perhaps some long-term sickness absence cases were caused by reasons other than work-related stress, which may have led to a less precise association. However, it is plausible that most of the cases were caused by work-related stress since our cause-specific analysis showed strong association of high stress and job dissatisfaction with long-term sickness absence due to mental disorders. Finally, our data was obtained from one particular financial service company in Japan; therefore, we should interpret the present findings with caution, taking limited generalizability into account.

In conclusion, the present study provided evidence that high stress, as defined in the Stress Check Program manual using the BJSQ, and job dissatisfaction additively increase the risk of long-term sickness absence lasting 1 month or more. Although the criteria for high stress proposed by the program manual do not include job dissatisfaction, our findings suggest that incorporating high stress with job dissatisfaction improves the predictability of long-term sickness absence. Occupational health staff can identify high-stress employees who are more strongly encouraged to request physician interview by checking their response to the single-item job satisfaction scale of the BJSQ. On the other hand, high-stress employees who are satisfied with their jobs also had a higher risk of long-term sickness absence; therefore, the encouragement of physician interview for them should not be ignored. It should also be noted that corporate culture and policy play an important role in job stress and health outcomes among employees[34,35]. For example, our surveyed company is listed on the major stock exchange and provides employees with 30 days of paid leave and a standard benefits package, including leave compensation and employment insurance, which may influence long-term sickness absence. Future research on the effect of such factors on the association of high stress with long-term sickness absence is needed.

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Conflict of Interest (COI)

The authors declare that there are no conflicts of interest.

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Workplace social capital and refraining from seeking medical care in Japanese employees: a 1-year prospective cohort study

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ABSTRACT

Objectives We examined the association of workplace social capital (WSC), including structural and cognitive dimensions, with refraining from seeking medical care (RSMC) among Japanese employees.

Design One-year prospective cohort study.

Setting and participants We surveyed 8770 employees (6881 men and 1889 women) aged 18–70 years from 12 firms in Japan using a self-administered questionnaire comprising the WSC scale and the items on potential confounders (ie, age, educational attainment and equivalent annual household income) at baseline (from April 2011 to March 2013).

Outcome measures At a 1-year follow-up, we measured RSMC using a single-item question 'In the past year, have you ever refrained from visiting a hospital, clinic, acupuncturist or dentist despite your sickness (including a slight cold or cavity) or injury?'

Results The results of Cox regression with robust variance showed that, after adjusting for potential confounders, the low WSC group (ie, the lowest tertile group) had a significantly higher relative risk (RR) of RSMC compared with the high WSC group (ie, the highest tertile group) among both men and women (overall WSC: RR 1.09 (95% CI 1.01 to 1.17) and 1.20 (95% CI 1.06 to 1.37); structural dimension: RR 1.13 (95% CI 1.04 to 1.22) and 1.25 (95% CI 1.07 to 1.45); and cognitive dimension: RR 1.11 (95% CI 1.03 to 1.20) and 1.21 (95% CI 1.06 to 1.38), respectively). Trend analysis using a continuous score of the WSC scale also showed a significant association of low WSC with a higher risk of RSMC among both men and women.

Conclusions Our findings suggest that the lack of social capital in the workplace is associated with RSMC among Japanese employees.

Strengths and limitations of this study

- ► This is the first study examining the association of social capital with refraining from seeking medical care in the occupational setting.
- ► We used a large-scale dataset from an occupational cohort survey.
- ► Our sample was recruited from primarily large-scale enterprises in Japan; therefore, the generalisation of our findings should be made with caution.
- ► Refraining from seeking medical care was measured by simply asking the participants to recall their experience over the past year, which may have led to recall bias.

INTRODUCTION

Access to medical care is an essential determinant of health.[1] Delayed access to medical care, often caused by refraining from seeking medical care (RSMC, ie, reluctance to seek or avoidance of medical care),[2] has been reported to have effects on reduced quality of life, more extended hospital stays and mortality in a wide range of age groups.[3–6] Previous studies on RSMC have examined its potential individual determinants, including age,[7] health status,[8] insurance coverage[9] and social class (ie, educational attainment, household income and employment conditions).[10–15]

The interest in the effects of social contextual factors such as social capital on RSMC or access to medical care has been increasing.[1] Although social capital is defined in many ways, all definitions share the notion that social networks, norms of reciprocity and generalised trust are essential aspects of the concept.[16] Particularly in the health research field, social capital is conceptualised primarily as a two-dimensional construct consisting of a structural dimension (ie, what people 'do') and a cognitive dimension (ie, what people 'feel').[17] Based on this construct, the network aspect is categorised as the structural dimension while the reciprocity and trust aspects are categorised as the cognitive dimension.[18] Generally, social capital entails three types: bonding, bridging and linking. Bonding

social capital refers to relations of trust and cooperation among people within relatively homogenous groups; bridging social capital refers to relations of respect and mutuality among people between heterogeneous groups; and linking social capital refers to relations between individuals and groups in different social strata in a hierarchy where different groups have access to power, social status and wealth.[19] As just described, the theoretical framework of social capital encompasses many complex aspects, dimensions and types of social interactions and cognitions that can have potential benefits but also disadvantages for communities and the individuals living within them. Several reviews have highlighted the challenge to empirically verify the associations of social capital with health outcomes.[20–22] Medical care utilisation or RSMC is no exception. It has been theoretically suggested that social capital promotes positive psychological states towards self-care and appropriate medical care utilisation,[23] and empirical evidence to support this suggestion has been accumulated among community residents.[1 20]

The idea of social capital is a natural candidate for expansion to occupational settings. Kawachi[24] pointed out that social capital is likely to be found in settings where people now spend most of their time. The workplace represents an important social unit, mainly since many people spend one-third of their lives at work[25] and the workplace is a significant source of social relations.[26] Several previous studies reported that the lack of workplace social capital (WSC) was associated with various kinds of health outcomes: poor self-rated health,[26–30] hypertension (or high blood pressure),[31 32] poor mental health (eg, depression, depressive symptoms and psychological distress),[27 33–38] unhealthy behaviours (eg, smoking)[39–42] and mortality.[43]

In the theoretical framework of job stress, WSC is considered to be a summary outcome of the favourable psychosocial work environment called job resources (eg, job control, supervisor and coworker support, extrinsic reward, organisational justice, etc) and also to improve mental and physical health among employees.[44] Given the definition of social capital, the workplace with low social capital can be characterised by lack of network, reciprocity and trust. In such a workplace, employees may have difficulty asking coworkers to rearrange their schedules associated with seeking medical care, which may lead to the lack of time to excuse themselves from work and consequently to RSMC and subsequent poor self-rated health.[45] To date, two previous studies in occupational settings have reported that low job control and low organisational justice (ie, procedural justice and interactional justice) were associated with less access to medical care or RSMC.[46 47] However, the association of WSC with RSMC has not been thoroughly examined.

The purpose of the present study was to examine the association of WSC with RSMC among Japanese employees using a 1-year prospective design. It was hypothesised that those who perceived lower levels of WSC at baseline would be more likely to refrain from seeking medical care during the 1-year follow-up. In the present study, we focused mainly on the bonding WSC (ie, social capital within same working teams) because it is of particular importance in Japanese corporate culture, which is group oriented: altruism, teamwork and group cohesiveness are emphasised[48] and it has been reported that bonding social capital is related mainly to better access to medical care.[20] On the other hand, it has also been pointed out that the empirical evidence for the association of bonding social capital with access to medical care is somewhat limited, primarily because of the tendency to mix different dimensions of social capital into overall indices.[20] Therefore, we focused not only on overall bonding WSC but also on its construct dimensions (ie, the structural dimension, including the network aspect and the cognitive dimension, including the reciprocity and trust aspects). Furthermore, in Japanese culture, laughter and smiles are also essential to maintain social harmony,[49] which is one of the elements of cognitive dimension.[17 18] Therefore, we also focused on the laughter/smiles aspect and included it in the cognitive dimension. We analysed the data for men and women separately because a previous study has reported sex differences in medical care utilisation.[50]

METHODS

Study design

We extracted the data from longitudinal datasets collected in an occupational cohort study on social class and health in Japan (Japanese Study of Health, Occupation and Psychosocial Factors Related Equity: J-HOPE). The J-HOPE was conducted in three or four waves at 13 firms located in Japan. The primary industry sectors were information technology, hospital and medical facility, manufacturing, pharmaceutical, service, transportation and real estate. The first wave was conducted from April 2010 to March 2012; the subsequent waves were conducted in 1-year intervals following the first wave. Because the RSMC was assessed only at the third wave in all surveyed firms, except for one hospital, the present study treated the second wave (conducted from April 2011 to March 2013) as a baseline and the third wave (conducted from April 2012 to March 2014) as a 1-year follow-up. The analyses were conducted using the J-HOPE datasets available as of 22 December 2016.

Participants

In the second wave of the J-HOPE (ie, the baseline in the present study), a total of 11 393 employees completed a self-administered questionnaire (response rate 82%). During the 1-year follow-up period, 1497 employees were transferred, took a leave of absence (ie, sick leave, maternity leave or childcare leave), retired or declined to participate. Overall, 9896 employees participated in the third wave (ie, 1-year follow-up in the present study) and completed the follow-up questionnaire (follow-up rate 87%). After excluding 481 hospital employees who were not measured for RSMC in the third wave and 645

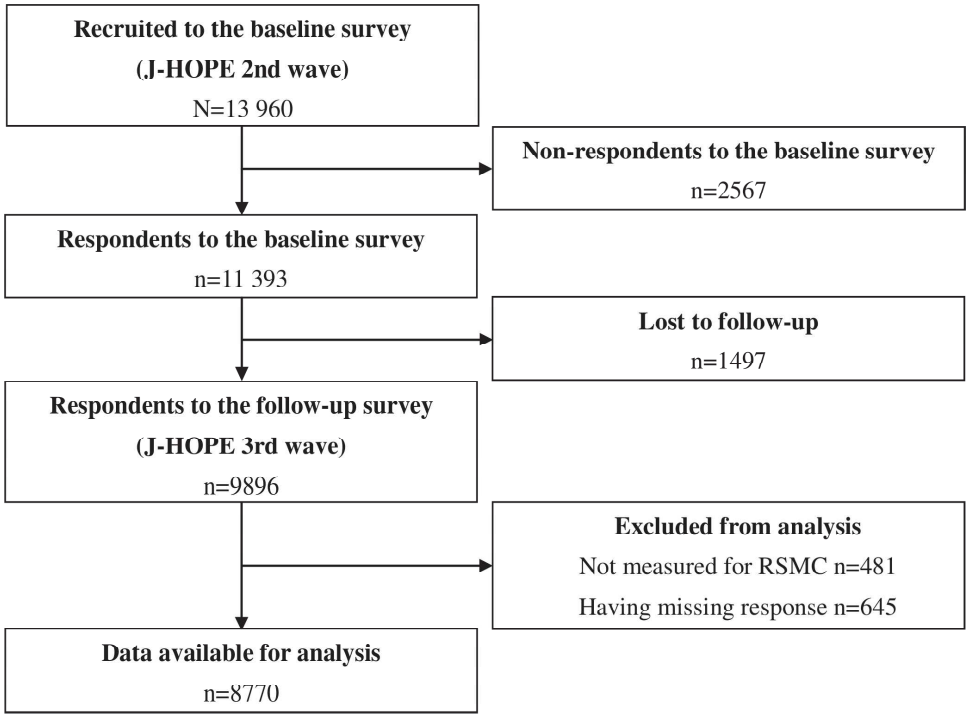

Figure 1 Recruitment and follow-up flow diagram. J-HOPE, Japanese Study of Health, Occupation and Psychosocial Factors Related Equity; RSMC, refraining from seeking medical care.

employees who had at least one missing response for variables relevant to the present study, the data from 8770 employees (6881 men and 1889 women) were analysed (see figure 1). Table 1 shows the type of industry and the number of participants of each firm.

Table 1 Firm code, type of industry and the number of participants in each firm

Firm code (type of industry)	Men (n=6881) N (%)	Women (n=1889) N (%)
1 (Information technology)	588 (8.5)	152 (8.0)
2 (Hospital)*	–	–
3 (Manufacturing)	1937 (28.1)	242 (12.8)
4 (Information)	446 (6.5)	222 (11.8)
5 (Pharmaceutical)	146 (2.1)	149 (7.9)
6 (Service)	13 (0.2)	23 (1.2)
7 (Veterinary)	1 (0.0)	2 (0.1)
8 (Medical)	13 (0.2)	18 (1.0)
9 (Service)	372 (5.4)	182 (9.6)
10 (Manufacturing)	2112 (30.7)	770 (40.8)
11 (Transportation)	1032 (15.0)	44 (2.3)
12 (Real estate)	168 (2.4)	58 (3.1)
13 (Real estate)	53 (0.8)	27 (1.4)

*Excluded from the analyses due to the lack of information on RSMC at follow-up.
RSMC, refraining from seeking medical care.

Measures

Exposure: WSC (baseline)

Bonding WSC was measured using a six-item scale developed by Eguchi *et al*.[48] This scale focuses on the structural and cognitive dimensions of the bonding WSC. The first three items (items #1–#3) that focus on the structural dimension by measuring the network aspect were adapted from the eight-item WSC scale developed by Kouvonen *et al*.[28] The remaining three items (items #4–#6) that focus on the cognitive dimension by measuring the reciprocity, trust and laughter/smiles aspects were based on Japanese studies that used the social cohesion approach to conceptualise social capital.[30 32 42 51–53] These items are shown in the online supplementary appendix. All items were measured on a four-point Likert-type scale (1 *Not at all*, 2 *Not exactly*, 3 *Somewhat so* and 4 *Definitely*). Total scores for overall WSC (items #1–#6), the structural dimension (items #1–#3) and the cognitive dimension (items #4–#6) were calculated by summing their item scores (range 6–24 for overall WSC and 3–12 for structural and cognitive dimensions). In this sample, Cronbach's alpha coefficients were 0.90, 0.83 and 0.82 for overall WSC, the structural dimension and the cognitive dimension, respectively, indicating that the WSC scale had a higher level of internal consistency reliability and a lower risk of measurement error.[54] Participants were classified into tertiles (ie, high, moderate and low) based on the scores for overall WSC and its structural dimensions.

Outcome: RSMC (1-year follow-up)

The follow-up questionnaire included a single-item question measuring RSMC, which had been used in the Japanese General Social Survey conducted in 2008.[13] The participants were asked to respond to the question 'In the past year, have you ever refrained from visiting a hospital, clinic, acupuncturist or dentist despite your sickness (including a slight cold or cavity) or injury?' The response options were '1 *Yes, I have*,' '2 *No, I have not'* and '3 *I did not get sick or injured.*' Participants were dichotomised into those who RSMC (ie, those who answered 1) and those who did not (ie, those who answered 2 or 3).

Potential confounders (baseline)

Among the potential individual determinants of RSMC introduced earlier,[7–15] age, educational attainment and household income were reported to be associated with the level of social capital[55]; therefore, these three factors were treated as potential confounders.

Age was classified into five groups: 29 years or younger, 30–39 years, 40–49 years, 50–59 years and 60 years or older. Educational attainment was classified into four groups: graduate school, college, junior college and high school or junior high school. As an indicator of household income, we calculated equivalent annual household income. The participants were asked to report their annual household income by selecting one of the following six response options: 2.99 million JPY (28 750 EUR) or less, 3–4.99 million JPY (28 850–48 000 EUR), 5–7.99 million JPY (48 100–76 800 EUR), 8–9.99 million JPY (76 900–96 050 EUR), 10–14.99 million JPY (96 150–144 100 EUR) and 15 million JPY (144 200 EUR) or more (EUR was converted from JPY using the average monthly exchange rate from April 2011 to March 2013 (104 JPY per EUR)). Subsequently, equivalent annual household income was computed by dividing the median household income of each response option by the square root of the household size.

Statistical analysis

First, we conducted Student's t-test or Fisher's exact test to compare those who did and did not refrain from seeking medical care in potential confounders as well as in the total score for the WSC scale. Afterwards, using the high overall WSC group (ie, the highest tertile group) as a reference, we estimated the relative risks (RRs) and their 95% confidence intervals (CIs) of RSMC for the moderate and low overall WSC groups (ie, the middle and lowest tertile groups). When the outcome variable is dichotomous, logistic regression is typically used. The odds ratio (OR) calculated by the logistic regression is an approximation of RR when the outcome is relatively rare (ie, <10%). However, it has been pointed out that the OR overestimates RR when the outcome is common.[56] As shown later, the percentage of the RSMC cases was over 40% in the present sample (see tables 2 and 3). Therefore, we did not conduct logistic regression but Cox regression with robust variance, which has been recommended as a suitable method for estimating RR.[57] In the Cox regression, the time variable was treated as a constant since all of the participants analysed in the present study had a 1-year follow-up period and there were no censored cases. In the analysis, we first calculated the crude RR (ie, without any adjustment, model 1). Subsequently, we adjusted for potential confounders (ie, age, educational attainment and equivalent annual household income, model 2). A similar analysis was conducted for the structural and cognitive dimensions of WSC. Furthermore, to examine whether the results of Cox regression using the tertile classification for WSC were robust, trend analysis was conducted using the continuous score of WSC. In the trend analysis, the total score of WSC was reversed (ie, higher score indicated lower WSC) and divided by the number of items (ie, converted so that the scoring range was 1–4), which allowed us to interpret RRs easily and make RRs for overall WSC and its construct dimensions comparable. In addition, we examined the association of every single item of the WSC scale with RSMC. In the analysis, each item score was also reversed for the same reasons mentioned above. The level of significance was 0.05 (two-tailed). The statistical analyses were conducted using Stata/MP V.14.0 for Windows (Stata Corp, College Station, Texas, USA).

Patient and public involvement

Patients or the public were not involved in the design, conduct, reporting or dissemination plans of the present study.

RESULTS

Table 2 details the characteristics of the participants according to those who did and did not refrain from seeking medical care, together with sex. For men, those who refrained from seeking medical care, compared with those who did not, were younger (p<0.001) and highly educated (p=0.012), had lower equivalent annual household income (p<0.001) and perceived lower levels of WSC (overall WSC: p<0.001; structural dimension: p<0.001; and cognitive dimension: p=0.001). For women, those who refrained from seeking medical care, compared with those who did not, were younger (p<0.001) and highly educated (p=0.003) and perceived lower levels of WSC (overall WSC: p=0.001; structural dimension: p<0.001; and cognitive dimension: p=0.006), while there was no significant difference in equivalent annual household income between those who did and did not refrain from seeking medical care (p=0.980).

Table 3 shows the results of the Cox regression with robust variance on overall WSC as well as on its construct dimensions. In the crude model (model 1), the low overall WSC group had a significantly higher RR of RSMC compared with the high overall WSC group for both sexes (RR 1.09, 95% CI 1.01 to 1.17 and RR 1.16, 95% CI 1.02 to 1.33 for men and women, respectively). Conversely, the moderate overall WSC group did not have a significantly

Table 2 Detailed characteristics of employees who participated in the present study

	Men (n=6881)				Women (n=1889)			
	RSMC (n=2924)		Did not refrain from seeking medical care (n=3957)		RSMC (n=870)		Did not refrain from seeking medical care (n=1019)	
	Mean (SD)	N (%)	Mean (SD)	N (%)	Mean (SD)	N (%)	Mean (SD)	N (%)
Age	40.5 (10.3)		42.2 (10.6)		38.1 (9.74)		40.8 (10.3)	
29 years or younger		537 (18.4)		610 (15.4)		222 (25.5)		187 (18.4)
30–39 years		787 (26.9)		938 (23.7)		257 (29.5)		249 (24.4)
40–49 years		996 (34.1)		1294 (32.7)		272 (31.3)		371 (36.4)
50–59 years		537 (18.4)		975 (24.6)		111 (12.8)		188 (18.4)
60 years or older		67 (2.3)		140 (3.5)		8 (0.9)		24 (2.4)
Educational attainment								
Graduate school		359 (12.3)		460 (11.6)		39 (4.5)		31 (3.0)
College		979 (33.5)		1332 (33.7)		234 (26.9)		214 (21.0)
Junior college		377 (12.9)		421 (10.6)		220 (25.3)		266 (26.1)
High school or junior high school		1209 (41.3)		1744 (44.1)		377 (43.3)		508 (49.9)
Equivalent annual household income*	41 153 (18 297)		42 985 (19 161)		35 928 (21 180)		35 904 (21 565)	
WSC								
Overall WSC (items #1–#6) (range 6–24)	17.0 (3.32)		17.4 (3.31)		16.6 (3.55)		17.1 (3.45)	
Structural dimension (items #1–#3) (range 3–12)	8.50 (1.73)		8.68 (1.71)		8.20 (1.84)		8.51 (1.75)	
Cognitive dimension (items #4–#6) (range 3–12)	8.52 (1.77)		8.67 (1.76)		8.36 (1.88)		8.60 (1.86)	

*Currency unit is EUR, which was converted from JPY using the average monthly exchange rate from April 2011 to March 2013 (104 JPY per EUR).
RSMC, refrained from seeking medical care; WSC, workplace social capital.

Table 3 Association of WSC with RSMC during the 1-year follow-up period among Japanese employees: COX regression with robust variance using the time variable as a constant

	Men (n=6881)				Women (n=1889)			
			RR (95% CI)				RR (95% CI)	
	N	Number of cases (%)	Model 1*	Model 2†	N	Number of cases (%)	Model 1*	Model 2†
Overall WSC (items #1–#6)								
High (19–24)	1701	706 (41.5)	1.00	1.00	439	188 (42.8)	1.00	1.00
Moderate (17–18)	2873	1174 (40.9)	0.98 (0.92 to 1.06)	0.99 (0.92 to 1.06)	731	324 (44.3)	1.03 (0.90 to 1.18)	1.07 (0.94 to 1.22)
Low (6–16)	2307	1044 (45.3)	1.09 (1.01 to 1.17)	1.09 (1.01 to 1.17)	719	358 (49.8)	1.16 (1.02 to 1.33)	1.20 (1.06 to 1.37)
Continuous (for one point score)‡			1.11 (1.06 to 1.16)	1.10 (1.05 to 1.16)			1.15 (1.06 to 1.25)	1.17 (1.08 to 1.27)
Structural dimension (items 1#–#3)								
High (10–12)	1368	554 (40.5)	1.00	1.00	305	126 (41.3)	1.00	1.00
Moderate (9)	2891	1168 (40.4)	1.00 (0.92 to 1.08)	1.00 (0.93 to 1.08)	768	331 (43.1)	1.04 (0.89 to 1.22)	1.06 (0.91 to 1.24)
Low (3–8)	2622	1202 (45.8)	1.13 (1.05 to 1.22)	1.13 (1.04 to 1.22)	816	413 (50.6)	1.23 (1.05 to 1.42)	1.25 (1.07 to 1.45)
Continuous (for one point score)‡			1.11 (1.06 to 1.17)	1.10 (1.05 to 1.16)			1.16 (1.08 to 1.26)	1.17 (1.09 to 1.27)
Cognitive dimension (items 4#–#6)								
High (10–12)	1499	614 (41.0)	1.00	1.00	410	177 (43.2)	1.00	1.00
Moderate (9)	2707	1091 (40.3)	0.98 (0.91 to 1.06)	0.99 (0.92 to 1.07)	694	302 (43.5)	1.01 (0.88 to 1.16)	1.05 (0.91 to 1.21)
Low (3–8)	2675	1219 (45.6)	1.11 (1.03 to 1.20)	1.11 (1.03 to 1.20)	785	391 (49.8)	1.15 (1.01 to 1.32)	1.21 (1.06 to 1.38)
Continuous (for one point score)‡			1.08 (1.03 to 1.13)	1.08 (1.03 to 1.13)			1.11 (1.03 to 1.20)	1.14 (1.06 to 1.23)

*Crude (ie, without any adjustment).
†Adjusted for age, educational attainment and equivalent annual household income.
‡To interpret RRs easily and make RRs for overall WSC and its construct dimensions comparable, the total score was reversed (ie, higher score indicated lower WSC) and divided by the number of items (ie, converted so that the scoring range was 1–4).
CI, confidence interval; RR, relative risk; RSMC, refraining from seeking medical care; WSC, workplace social capital.

higher RR of RSMC (RR 0.98, 95% CI 0.92 to 1.06 and RR 1.03, 95% CI 0.90 to 1.18 for men and women, respectively). These patterns remained unchanged after adjusting for potential confounders (model 2). When we separated overall WSC into structural and cognitive dimensions, similar tendencies were observed for both dimensions. Trend analysis using a continuous score of the WSC scale also showed a significant association of low WSC with a higher risk of RSMC, irrespective of sex, statistical model or construct dimensions of WSC.

When we examined the association of every single item of the WSC scale with RSMC, significant RRs for all items were observed, except for the item #6 (laughter/smiles) in the crude model among women (details are available in online supplementary table).

DISCUSSION

We examined the 1-year prospective association of WSC (mainly bonding WSC) with RSMC among Japanese employees. For both sexes, low overall WSC was significantly associated with a higher risk of RSMC, independently of age and socioeconomic characteristics (ie, educational attainment and equivalent annual household income). Similar tendencies were observed when we separated overall WSC into structural and cognitive dimensions.

For both structural and cognitive dimensions, the lack of WSC was significantly associated with a higher risk of RSMC, which supported our hypothesis. Our finding is consistent with the results of a previous systematic review of access to medical care among community residents, which reported that bonding social capital is related to better access to medical care.[20] The present study expanded this evidence into occupational settings. Given the findings from occupational settings suggesting the association of low job control and low organisational justice with RSMC,[46 47] our finding is reasonable because WSC is theoretically considered to be a summary outcome of job resources (ie, favourable psychosocial work environment) including job control and organisational justice.[44] It is common for Japanese employees to take time off (ie, paid holiday) to seek medical care during working days because Japanese law does not necessarily require each company to establish paid sick leave. Although employees have a legitimate right to take time off, and employers should not treat employees who would like to take time off unfairly, Japanese corporate culture recognises working without taking time off as diligent. The social notion that 'working hard is a virtue' is still firmly rooted in the Japanese psyche and taking time off in itself is viewed negatively.[58] Therefore, in the Japanese workplace with low social capital characterised by lack of network, reciprocity and trust, employees who take leave of absence to seek medical care are more likely to be perceived negatively (eg, enjoying benefits or causing trouble for others) by coworkers as well as by supervisors. In other cases, workplaces may have an uncooperative attitude towards rearranging the work schedule of those seeking medical care. Such a situation may prevent employees from seeking necessary medical care. On the other hand, it is unclear whether our findings would emerge in countries other than Japan. For example, in Western countries that are more individualistic compared with Asian countries, including Japan,[59] and have a legally established paid sick leave system, employees may seek medical care when getting sick irrespective of social capital of their workplace; therefore, a clear association of WSC with RSMC may not be observed. Future research is needed to replicate our findings in workplaces cross-culturally.

In the present study, the association of low WSC with RSMC remained unchanged after adjusting for potential confounders, including socioeconomic characteristics (model 2). This finding may be explained by the fact that our study sample comprised a higher proportion of employees at large-scale enterprises who were covered by corporate health insurance and received excellent benefits from their companies. Such homogeneity of our study sample may have decreased the confounding effects of demographic and socioeconomic characteristics on the association of low WSC with RSMC; therefore, our findings should be replicated in more vulnerable employees, such as employees at small-scale and medium-scale enterprises or non-permanent employees, in the future.

Possible limitations of the present study should be considered. First, as discussed above, our study sample comprised Japanese employees from primarily large-scale enterprises, which tend to provide excellent benefits (eg, generous healthcare) to employees; therefore, the present findings should be generalised cautiously. Second, RSMC was measured by simply asking the participants to recall their experience over the past year. Those who evaluated WSC as low may have been more likely to recall their own experience of RSMC during the follow-up period; therefore, our findings may be overestimated due to recall bias. Third, some employees dropped out during the follow-up period due to sick leave. They may have perceived lower levels of WSC at baseline and refrained from seeking medical care until their disease became severe, which may have underestimated the true association. Fourth, the present study did not obtain information on RSMC at baseline or regular hospital visit due to chronic disease, which may have masked the true association. Furthermore, personality traits may also have influenced our findings. Recent studies have reported that neuroticism is associated with an increased number of physician visits[60] as well as with higher levels of work-related stress[61]; therefore, without adjusting for neuroticism, our findings may have inflated the apparent association. Fifth, the influence of psychosocial work environment (ie, job demands or job resources) on the association of WSC with RSMC was not considered in the present study. As introduced earlier, WSC is considered a summary outcome of job resources aimed at improving health outcomes among employees[44]; therefore, various kinds of unobserved job resources may explain the association demonstrated

in the present study. Future work should focus on the mediation effect of WSC on the association of psychosocial work environment with RSMC. Furthermore, some previous studies have examined the moderating effect of WSC on the association of adverse psychosocial work environment with health outcomes (eg, psychological distress and smoking)[36 37 41]; therefore, research on the moderation effect of WSC on the association of psychosocial work environment with RSMC (or interaction effect of WSC and psychosocial work environment on RSMC) is also promising.

CONCLUSIONS

The present study offers evidence that WSC is an essential factor associated with individuals' decision to seek medical care for their perceived health issues independently of age and socioeconomic characteristics among Japanese employees. Our findings suggest that fostering a culture of network, reciprocity and trust in a workplace effectively promotes the medical care-seeking behaviour of Japanese employees. Future workplace intervention studies should investigate the effect of improving WSC on the promotion of employees' medical care seeking.

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Psychosocial Work Environment Explains the Association of Job Dissatisfaction With Long-term Sickness Absence: A One-Year Prospect Study of Japanese Employees

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ABSTRACT

Background: Using a 1-year prospective design, we examined the association of job dissatisfaction with long-term sickness absence lasting 1 month or more, before and after adjusting for psychosocial work environment (ie, quantitative job overload, job control, and workplace social support) in Japanese employees.

Methods: We surveyed 14,687 employees (7,343 men and 7,344 women) aged 20–66 years, who had not taken long-term sickness absence in the past 3 years, from a financial service company in Japan. The Brief Job Stress Questionnaire, including scales on job satisfaction and psychosocial work environment, was administered, and information on demographic and occupational characteristics (ie, age, gender, length of service, job type, and employment position) was obtained from the personnel records of the surveyed company at baseline (July–August 2015). Subsequently, information on the start dates of long-term sickness absences was obtained during the follow-up period (until July 2016) from the personnel records. Cox's proportional hazard regression analysis was conducted.

Results: After adjusting for demographic and occupational characteristics, those who perceived job dissatisfaction had a significantly higher hazard ratio of long-term sickness absence than those who perceived job satisfaction (hazard ratio 2.91; 95% confidence interval, 1.74–4.87). After additionally adjusting for psychosocial work environment, this association was weakened and no longer significant (hazard ratio 1.55; 95% confidence interval, 0.86–2.80).

Conclusions: Our findings suggest that the association of job dissatisfaction with long-term sickness absence is spurious and explained mainly via psychosocial work environment.

Key words: absenteeism; job satisfaction; longitudinal studies; psychosocial job characteristics; survival analysis

INTRODUCTION

Sickness absence is a major public health and economic problem in many countries.[1,2] Among others, long-term sickness absence, often defined as sickness absence lasting 4 weeks/1 month or more,[3] bears high costs for a variety of stakeholders, including employees, employers, insurance agencies, and society at large.[4,5] The Organization for Economic Co-operation and Development (OECD) has reported that OECD member countries spend, on average, approximately 1.9% of the gross domestic product (GDP) on sickness absence benefits,[6] most of which are accounted for by long-term sickness absence.[2] Furthermore, long-term sickness absence has various adverse effects on employees, such as lower probability of returning to work,[7,8] a higher risk of social exclusion,[9] and mortality.[10–12] Therefore, identifying predictors of long-term sickness absence and preventing it are beneficial for both employees and society.

In the occupational health research field, job dissatisfaction (ie, an unpleasant emotion when one's work is frustrating and blocking the affirmation of their values)[13] has been attracting attention as a predictor of sickness absence, as well as of poor mental health (ie, anxiety, burnout, depression, and low self-esteem) and physical health (ie, cardiovascular disease and musculoskeletal disorders).[14] Several prospective studies in European countries have examined the association of job dissatisfaction with sickness absence[15–24]; the results have been inconsistent, and most of these studies focused mainly on short-term sickness absence lasting from a few days to a few weeks. To date, only three studies focused on long-term sickness absence[16,21,22]; two, however, relied on self-reports rather than on personnel records or national register data for measuring sickness absence duration.[21,22] This may have led to a less accurate association with job dissatisfaction.[25] Furthermore, only one study conducted a survival analysis.[23]

In addition to the above, psychosocial work environment may explain the association of job dissatisfaction with sickness

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absence.[26] In fact, major psychosocial work environment, such as described in the job demands-control (JD-C) or demand-control-support (DCS) model,[27,28] has been associated with job dissatisfaction.[29,30] It is also known that poor psychosocial wok environment causes sickness absence.[31] It might be interesting to know how much unique impact job dissatisfaction has on long-term sickness absence independent of psychosocial work environment, because it would be relevant for developing an effective strategy to prevent long-term sickness absence whether targeting on job dissatisfaction *per se* or psychosocial work environment.

Contrary to European countries, the association between psychosocial work environment, job dissatisfaction, and long-term sickness absence has not been fully examined among Japanese employees. In Japan, approximately 60% of employees reported job-related distress due to psychosocial work environment such as job overload and workplace human relations.[32] Furthermore, compared to European countries, Japanese employees have been found to have lower levels of job satisfaction,[33] as well as positive work-related state of mind, such as work engagement.[34] On the other hand, because the social notion that "not taking time off and working hard are virtues" is still strongly rooted in the Japanese psyche,[35] taking long-term sickness absence is a serious event for Japanese employees. Therefore, it is extremely valuable to clarify the association of job dissatisfaction with long-term sickness absence and the role of psychosocial work environment in this association among Japanese employees. To date, two cross-sectional studies have reported the association of job dissatisfaction with sickness absence among Japanese employees,[36,37] while prospective evidence is lacking and the role of psychosocial work environment in the association is still unclear.

The purpose of the present study was twofold. The first purpose was to examine the prospective association of job dissatisfaction with long-term sickness absence obtained from personnel records in a large sample of Japanese employees, conducting survival analysis. The second purpose was to examine whether psychosocial work environment explains the association of job dissatisfaction with long-term sickness absence. In the present study, we focused especially on financial service employees because they experience increased stress and worries due to greater time pressures, problems with ergonomics, conflicting roles, work demands, and difficult relationships with customers.[38]

MATERIAL AND METHODS

Participants

A 1-year prospective study of employees from a financial service company listed on the major stock exchanges was conducted from July 2015 to July 2016. Information was gathered using a self-administered questionnaire and the personnel records of the surveyed company. At baseline (July–August 2015), all employees, except for board members; temporary transferred, overseas, and dispatched employees; and absentees ($N = 15{,}615$) were invited to participate in this study; a total of 14,711 employees completed the baseline questionnaire (response rate: 94.2%). After excluding 24 employees who had histories of long-term sickness absence in the past 3 years, 14,687 employees (7,343 men and 7,344 women) aged 20–66 years were followed for 1 year (until July 31st, 2016) (Figure 1). Informed consent was obtained from participants using the opt-out method for the secondary analysis of existing anonymous data. The study procedure was reviewed and approved by the Kitasato University Medical Ethics Organization (No. B15-113).

Measures

Job dissatisfaction

Job dissatisfaction was measured using the Brief Job Stress Questionnaire (BJSQ). The BJSQ has high levels of internal consistency reliability and factor-based validity[39] and includes a single-item summary measure of job satisfaction ("I am satisfied with my job"). Responses are provided on a four-point Likert scale (1 = *Dissatisfied*, 2 = *Somewhat dissatisfied*, 3 = *Somewhat satisfied*, and 4 = *Satisfied*). Participants were dichotomized into "dissatisfied" (those who answered 1 or 2) and "satisfied" (those who answered 3 or 4) groups.

Long-term sickness absence

Information on dates of application for invalidity benefits with medical certification for long-term sickness absence lasting 1 month or more was obtained from the personnel records of the surveyed company. In the surveyed company, it was mandatory for employees to submit medical certification from his/her attending physician to the human resource department when applying for invalidity benefits. Furthermore, the personnel records included information on resignation/retirement date. Based on this information, those who resigned/retired from the surveyed company during the follow-up period were treated as censored cases. The follow-up began on the date of response to the BJSQ and ended at the start date of long-term sickness absence (ie, the date of application for invalidity benefits), the resignation/retirement date, or July 31st, 2016, whichever came first.

Psychosocial work environment

For psychosocial work environment, we examined quantitative job overload, job control, and workplace social support, based on the JD-C or DCS model.[27,28] These were measured using the BJSQ introduced above. The BJSQ includes three-item quantitative job overload, job control, supervisor support, and coworker support scales. The answers are provided on a four-point Likert scale (1 = *Not at all*, 2 = *Somewhat*, 3 = *Moderately so*, and 4 = *Very much so* for quantitative job overload and job control; 1 = *Not at all*, 2 = *Somewhat*, 3 = *Very much*, and 4 = *Extremely* for supervisor support and coworker support), with the scores of each scale ranging from 3–12. For workplace social support, total scores for supervisor support and coworker support were calculated (score range: 6–24). In this sample, the Cronbach's alpha coefficients were 0.78, 0.70, and 0.88 for quantitative job overload, job control, and workplace social support, respectively.

Covariates

Covariates included demographic and occupational characteristics, all of which were obtained from the personnel records of the surveyed company. Demographic characteristics included age and gender. Age was used as a continuous variable. Occupational characteristics included length of service, job type, and employment position. Length of service was used as a continuous variable. Job type was classified into four groups: sales, claims service, administrative, and others. Employment position was classified into five groups: manager, staff, senior employee, temporary employee, and others.

Statistical analysis

We first conducted a descriptive analysis using Student's *t* test or Fisher's exact test to compare the demographic and occupational

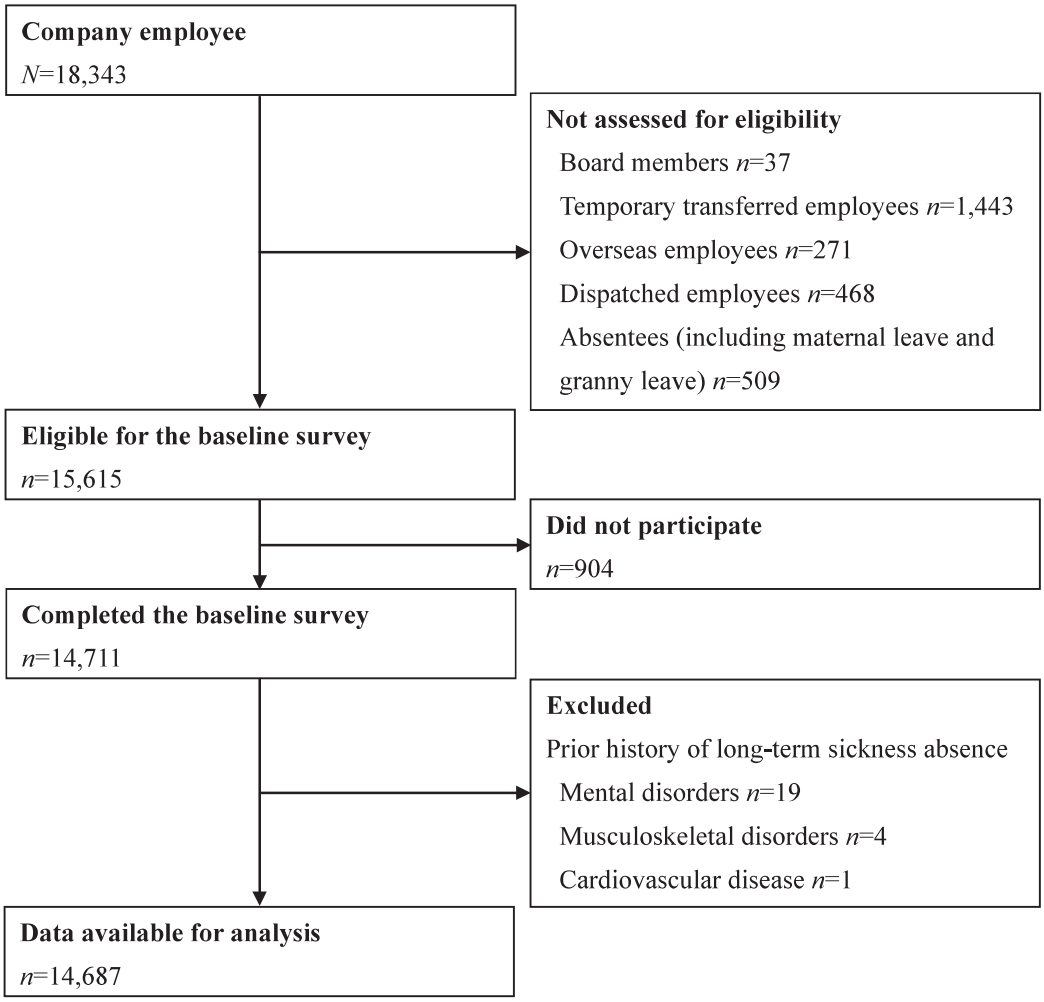

Figure 1. Recruitment and follow-up flow diagram

characteristics and the scale scores between the satisfied and dissatisfied groups. Afterwards, the cumulative hazard of long-term sickness absence was plotted as Kaplan-Meier curves and the log-rank test was conducted to compare the hazard functions between the satisfied and dissatisfied groups. Finally, using the satisfied group as a reference, Cox's proportional hazard regression analysis was conducted to estimate the hazard ratio (HR) and its 95% confidence interval (CI) of the incidence of long-term sickness absence during the follow-up period in the dissatisfied group. In the series of analyses, we first adjusted for demographic characteristics (ie, age and gender) (model 1). Subsequently, we incrementally adjusted for occupational characteristics (ie, length of service, job type, and employment position) (model 2) and psychosocial work environment (ie, quantitative job overload, job control, and workplace social support) (model 3). For model 3, overcontrol bias due to common method variance might occur since the present study measured job dissatisfaction and psychosocial work environment simultaneously with the same self-administered questionnaire (ie, the BJSQ). Therefore, to test the presence of overcontrol bias due to common method variance, Harman's single-factor test[40] was conducted by entering items for job dissatisfaction, quantitative job overload, job control, and workplace social support (ie, a total of 13 items) into the unrotated principal component analysis. Furthermore, as sub-analyses, the log-rank test and the Cox's proportional hazard regression analysis were conducted by gender because men and women are exposed to different work environment in Japan. The level of significance was 0.05 (two-tailed). The statistical analyses were conducted using IBM® SPSS® Statistics Version 23.0 for Windows (IBM Corp., Armonk, NY, USA).

RESULTS

Table 1 shows the detailed characteristics of the participants in the satisfied and dissatisfied groups. Compared to the satisfied group, the dissatisfied group was significantly younger, had a greater proportion of women, claims service, staff, and temporary employees, and perceived significantly higher levels of quantitative job overload and lower levels of job control and workplace social support.

Figure 2 shows the Kaplan-Meier curves for the cumulative hazard of long-term sickness absence among the dissatisfied group compared to the satisfied group. The log-rank test showed that the dissatisfied group had a significantly higher incidence rate of long-term sickness absence compared to the satisfied group ($P < 0.001$).

Table 2 shows the results of the Cox's proportional hazard regression analysis. During 5,258,910 person-days (mean: 358 days, range: 3–373 days), 62 employees (32 men and 30 women) took long-term sickness absence (mental disorders: 51 cases,

Table 1. Demographic and occupational characteristics and scale scores among employees who participated in the study

	Satisfied group (n = 11,139)		Dissatisfied group (n = 3,548)		P value[a]
	Mean (SD)	n (%)	Mean (SD)	n (%)	
Age, years	41.6 (12.4)		41.1 (12.2)		0.027
Gender					<0.001
Men		6,081 (54.6)		1,262 (35.6)	
Women		5,058 (45.4)		2,286 (64.4)	
Length of service, years	12.7 (10.3)		12.1 (9.88)		0.003
Job type					<0.001
Sales		5,360 (48.1)		1,676 (47.2)	
Claims service		3,829 (34.4)		1,426 (40.2)	
Administrative		1,941 (17.4)		442 (12.5)	
Others		9 (0.1)		4 (0.1)	
Employment position					<0.001
Manager		2,086 (18.7)		257 (7.2)	
Staff		6,590 (59.2)		2,457 (69.3)	
Senior employee		465 (4.2)		92 (2.6)	
Temporary employee		1,989 (17.9)		738 (20.8)	
Others		9 (0.1)		4 (0.1)	
Quantitative job overload (3–12)	9.10 (1.86)		10.1 (1.95)		<0.001
Job control (3–12)	8.35 (1.62)		6.79 (1.78)		<0.001
Workplace social support (6–24)	17.6 (3.56)		14.2 (3.46)		<0.001

SD, standard deviation.
[a]Student's t test and Fisher's exact test were used for the continuous and categorical variables, respectively.

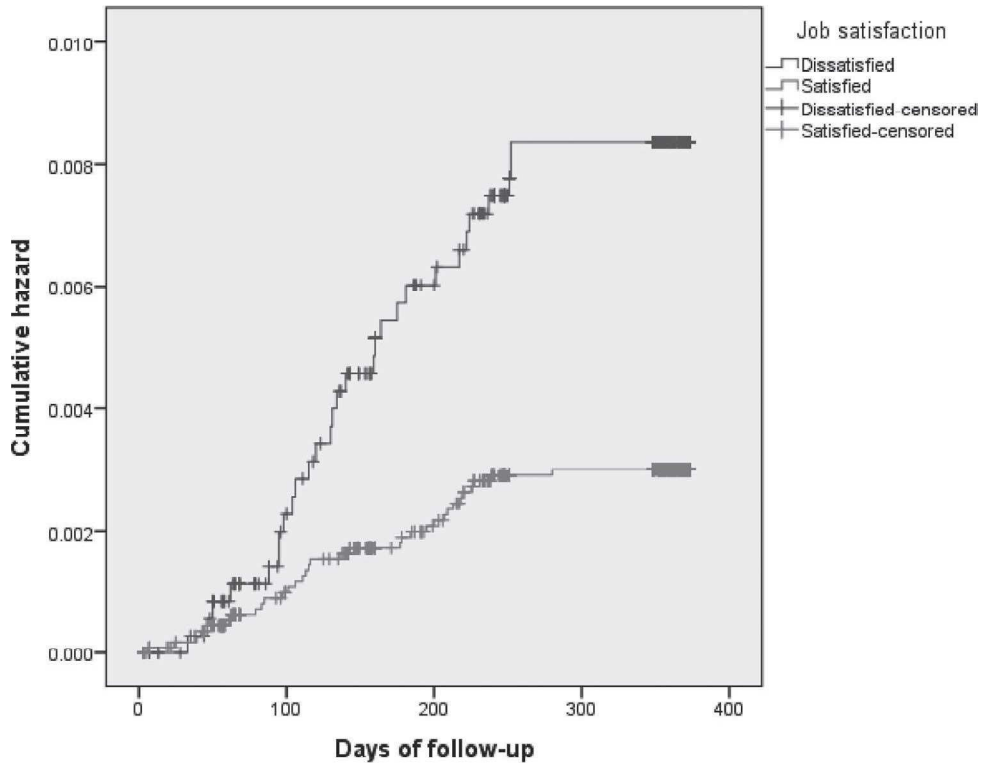

Figure 2. Cumulative hazard of long-term sickness absence among the dissatisfied group compared to the satisfied group

musculoskeletal disorders: 6 cases, cerebrovascular disease: 3 cases, and cardiovascular disease: 2 cases). After adjusting for demographic and occupational characteristics (models 1 and 2), the dissatisfied group had a significantly higher HR of long-term sickness absence than the satisfied group (HR 3.00; 95% CI, 1.80–5.00 and HR 2.91; 95% CI, 1.74–4.87 for models 1 and 2, respectively). However, after additionally adjusting for psychosocial work environment (model 3), this association was weakened and no longer significant (HR 1.55; 95% CI, 0.86–2.80).

For the Harman's single-factor test, three factors with eigenvalues greater than 1.0 were extracted and the first (largest) factor did not account for a majority of the variance (32.7%), indicating that overcontrol bias due to common method variance was not of great concern.

Table 2. Association of job dissatisfaction with long-term sickness absence among Japanese employees: Cox's proportional hazard regression analysis (7,343 men and 7,344 women)

	Person-days	Number of events	Rate/100,000 person-days	Hazard ratio (95% confidence interval)		
				Model 1[a]	Model 2[b]	Model 3[c]
Main analysis						
Satisfied	3,998,784	33	0.83	1.00	1.00	1.00
Dissatisfied	1,260,126	29	2.30	3.00 (1.80–5.00)	2.91 (1.74–4.87)	1.55 (0.86–2.80)
Gender-stratified analysis						
Men						
Satisfied	2,172,019	17	0.78	1.00	1.00	1.00
Dissatisfied	443,864	15	3.38	4.20 (2.08–8.46)	4.13 (2.03–8.42)	2.00 (0.86–4.63)
Women						
Satisfied	1,826,765	16	0.88	1.00	1.00	1.00
Dissatisfied	816,262	14	1.72	2.05 (0.99–4.21)	1.97 (0.95–4.06)	1.14 (0.50–2.63)

[a]Adjusted for age (and gender).
[b]Additionally adjusted for length of service, job type, and employment position.
[c]Additionally adjusted for quantitative job overload, job control, and workplace social support.

When we conducted the gender-stratified analysis, similar tendency to the main analysis was observed among both genders while statistical significance was marginal for the log-rank test ($P = 0.063$) and for models 1 and 2 of the Cox's proportional hazard regression analysis among women (Table 2).

DISCUSSION

The present study demonstrated that after adjusting for demographic and occupational characteristics, those who perceived job dissatisfaction had a significantly higher risk of long-term sickness absence during the 1-year follow-up period than those who perceived job satisfaction. After additionally adjusting for psychosocial work environment based on the JD-C or DCS model, the risk was no longer significant.

Job dissatisfaction was significantly associated with a higher risk of long-term sickness absence after adjusting for demographic and occupational characteristics. This finding is consistent with previous prospective studies in European countries (ie, Norway and the Netherlands) that have reported a significant association of job dissatisfaction with long-term sickness absence in the crude model,[22] as well as after adjusting for demographic and occupational characteristics (eg, age, gender, education, and affiliation).[16,21] Using personnel records to measure long-term sickness absence and conducting a survival analysis, the present study expanded this evidence into other than European countries.

After additionally adjusting for psychosocial work environment based on the JD-C or DCS model, the association of job dissatisfaction with long-term sickness absence was weakened and no longer significant. This is consistent with previous studies in that a significant association of job dissatisfaction with sickness absence (including both short-term and long-term ones) was not observed when psychosocial work environment was included in the model.[16,17,20] Our findings suggest that the association of job dissatisfaction with long-term sickness absence is explained mainly by psychosocial work environment and that improving psychosocial work environment is effective for the prevention of long-term sickness absence. However, although not statistically significant, the fully adjusted HR of job dissatisfaction was still approximately 1.5; therefore, there may be a unique effect of job dissatisfaction on long-term sickness absence independently of psychosocial work environment. Future research should examine more precisely the association between psychosocial work environment, job dissatisfaction, and sickness absence.

Possible limitations of the present study should be considered. First, our sample was recruited from one financial service company in Japan; therefore, our findings should be interpreted with caution in light of limited generalizability. Second, job dissatisfaction was measured using a single-item question, which may limit its measurement validity; however, some researchers have argued that single-item questions are preferred to measure overall job dissatisfaction because differences in individual scores are lost in the total mean scores of multi-item questions.[41,42] Third, some employees may have transferred to another department in the surveyed company, which may have influenced job dissatisfaction and masked the true association; nevertheless, the frequency of transfer may not have been so high at 1-year follow-up. Finally, although some previous studies focused on workplace-level (in addition to individual-level) job dissatisfaction to examine its association with sickness absence,[19] the present study could not take workplace-level job dissatisfaction into account due to a lack of information on the departments to which the individual participants belonged.

In conclusion, the present study provided evidence that the association of job dissatisfaction with long-term sickness absence lasting 1 month or more is spurious and explained mainly via adverse psychosocial work environment. More detailed underlying mechanisms in the association between psychosocial work environment, job dissatisfaction, and sickness absence can be explored using mediation analysis.

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