

REVIEW ARTICLE

Sociomedical problems of overwork-related deaths and disorders in Japan

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Abstract

Objectives: Cerebrovascular and cardiovascular diseases (CCVDs) and mental disorders, including suicide, are prevalent among overworked individuals in Japan. The 2014 legislation regarding the prevention of overwork-related deaths and disorders has accelerated the research in this field and ultimately the implementation of preventive actions.

Methods: To understand the current problematic situations, the Research Center for Overwork-Related Disorders of the National Institute of Occupational Safety and Health, Japan, conducted analyses of compensated claims for overwork-related CCVDs and mental disorders that were recognized from January 2010 to March 2015.

Results: The majority of CCVD cases were the men in their 50s. Transport and postal activities was the highest risk industry. Cerebrovascular cases were higher than cardiovascular ones. Long working hours was the principal factor for CCVDs. The mental disorder cases comprised approximately 70% men and affected younger age groups (peak in the third decade) with various industries at risk. In men, there was an almost equal number of F3 (Mood [affective] disorders) and F4 (Neurotic, stress-related, and somatoform disorders) diagnoses according to the 10th revision of the International Classification of Diseases and Related Health Problems. A larger number of women were diagnosed to have F4. The mental disorder cases were associated not only with long working hours, but also with injuries and disasters as well as interpersonal conflict at work.

Conclusions: Multiple, simultaneous actions need to be made by employees, employers, researchers, and the authorities to achieve the goal of reducing the number of workers suffering from the overwork-related CCVDs and mental disorders.

KEYWORDS

excessive fatigue, Karoshi, overtime legislation in Japan, primary prevention, psychosocial work environment, work schedules

1 | INTRODUCTION

Why do people die or get sick from diseases due to overwork? We have been struggling with how to address these tragedies for 30 years or more in Japan.¹ Similar circumstances have also been reported in its neighboring countries including

South Korea,² Taiwan,³⁻⁵ and China.⁶ Furthermore, long working hours and other stress factors at work have been targeted as critical hazards to workers' health and well-being in the European countries and the United States.⁷⁻¹⁰

A dramatic change occurred in Japan in November 2014 when the Government enforced the law targeting at preventing

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overwork-related deaths and disorders.¹¹ This progress clearly indicated the vesting of management and prevention of unfavorable events among workers exposed to long working hours and poor psychosocial factors at work as a national responsibility. The legislation required four goals: (i) conducting research to understand the conditions leading to overwork-related deaths and disorders, (ii) increasing awareness to the problems faced, (iii) establishing consultation services, and (iv) supporting nongovernmental organizations for workers and their family who experience the overwork-related problems.

The Research Center for Overwork-Related Disorders (RECORDS), newly developed at the National Institute of Occupational Safety and Health, Japan (JNIOSH), in November 2014, is responsible for the first goal. Specifically, the Center has been carrying out an analysis of workers' compensation claims for overwork-related cerebrovascular and cardiovascular diseases (CCVDs), as well as mental disorders. Here, we present some essential results of our analyses for compensated cases performed during the first phase (fiscal year 2015–2017). Our annual reports for fiscal years 2015–2017 are available on the website of the Ministry of Health, Labour and Welfare.^{12–14}

2 | METHODS

We examined the yearly trends in the number of claimed and compensated cases for overwork-related CCVDs and mental disorders during fiscal years 1998–2017. Next, we assessed the number of compensated cases for overwork-related CCVDs and mental disorders by sex and age from January 2010 to March 2015. Then, we investigated the number of compensated cases and incidence rates (IRs) per industry for overwork-related CCVDs and mental disorders for the same time period.

We also assessed the frequency of occurrence of the types of diagnoses for work-related CCVDs. Mental disorders were evaluated according to the International Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) between men and women and also living and suicide cases. Lastly, work-related events causing a high level of psychological burden were classified and their incidence assessed between men and women.

3 | RESULTS

3.1 | Current status of overwork-related deaths and disorders in Japan: Findings from the claim analyses at RECORDS

3.1.1 | CCVDs

As depicted in Figure 1A, yearly trends in the number of claims filed for overwork-related CCVDs have been

relatively stable (~800 cases per year) since the fiscal year 2002. Approximately 300 out of the filed claims have been compensated, which include a total of 100 deaths. Detailed data have been reported in the previous paper.¹⁵

Of the compensated cases for the overwork-related CCVDs from January 2010 through March 2015 (N = 1561), men were found to account for the majority (96%) of the cases. As depicted in Figure 2A, the age distribution of the overwork-related CCVD cases was characterized by an increase from the third decade of age, peaking in the fifth decade but then reducing in those aged ≥ 60 years. This was true for both CCVD cases.

The claim analyses found that the number of compensated cases for overwork-related CCVDs varied considerably by industry (Figure 3). The largest number of cases was found in transport and postal activities (~30% of all the cases), followed by wholesale and retail trade, manufacturing, and construction. We calculated IRs as the number of compensated cases per 1 million employees in each industry to control for the number of employees working in the given industry. Figure 3 shows that the highest IR was still observed in transport and postal activities (28), except

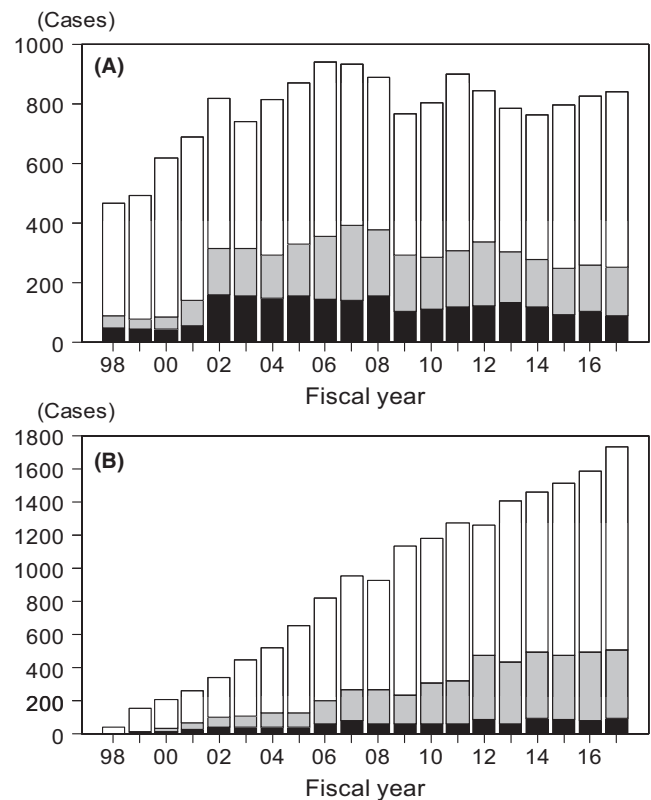


FIGURE 1 (A) Number of claimed (□) and compensated (▒) cases for overwork-related cerebrovascular and cardiovascular diseases during fiscal years 1998 to 2017. Compensated cases include death cases (■). (B) Number of claimed (□) and compensated (▒) cases for overwork-related mental disorders during fiscal years 1998 to 2017. Compensated cases include suicide cases (■)

fisheries having 14 compensated cases. The present observation is very similar to situations in Taiwan.^{3,5}

The recognition criteria for overwork-related CCVDs in Japan classify four types of cerebrovascular diseases and four types of cardiovascular diseases as overwork-related (Table 1).¹⁶ Overall, the number of compensated cases for cerebrovascular diseases was found to be 1.6 times higher than that for the cardiovascular diseases. This tendency is consistent with the dataset of compensated cases for overwork-related CCVDs in South Korean workers.² The observed patterns of diagnosis, for example, intracerebral hemorrhage as the top of the cerebrovascular diseases and myocardial infarction as the most frequently compensated cardiovascular disease, respectively, may inform us of the pathophysiology and management of the CCVDs associated with overwork. Recent findings for prospective studies with large sample sizes support the hypothesis that stroke is more closely related to long working hours.^{7,9,17}

Regarding the occupational risk factors, chronic exposure to long working hours played a principal role. On average, the monthly overtime during the past 6 months before the disease onset was found to increase from 86, 89, 91, 93, 95, and

100 hours in the past 6, 5, 4, 3, 2, and 1 months, respectively. The assessed maximum overtime should be seen as extraordinary, ranging from 292 to 360 hours a month. Among the other factors, a long period of duty was most prevalent (31% of the cases), followed by night and shift work, irregular work schedules, or jobs with high mental demands.

For other relevant conditions, 50% of the cases worked at enterprises with <50 employees, and 10% at those with ≥500 employees. Only 69% received an annual medical-checkup, which was rather below the national average (82%).¹⁸ The Industry Safety and Health Act in Japan requires to provide medical interview by a physician to employees whose monthly overtime exceeds 100 hours in a 40 hours workweek. Only 2% received the medical interview compared with 4% in the national survey.¹⁸ Of the overwork-related CCVD cases, 35% had a past medical history.

3.2 | Mental disorders

In sharp contrast to the CCVDs, the number of claims filed for overwork-related mental disorders has rapidly increased over the last 20 years (Figure 1B). In the fiscal year 2017, 1732 claims were filed. The number of compensated cases also increased, being approximately 500 cases during the past 5 to 6 fiscal years. This figure includes a total of around 100 workers committed suicide. More detailed issues have been reported previously.¹⁵ When compared with South Korea,

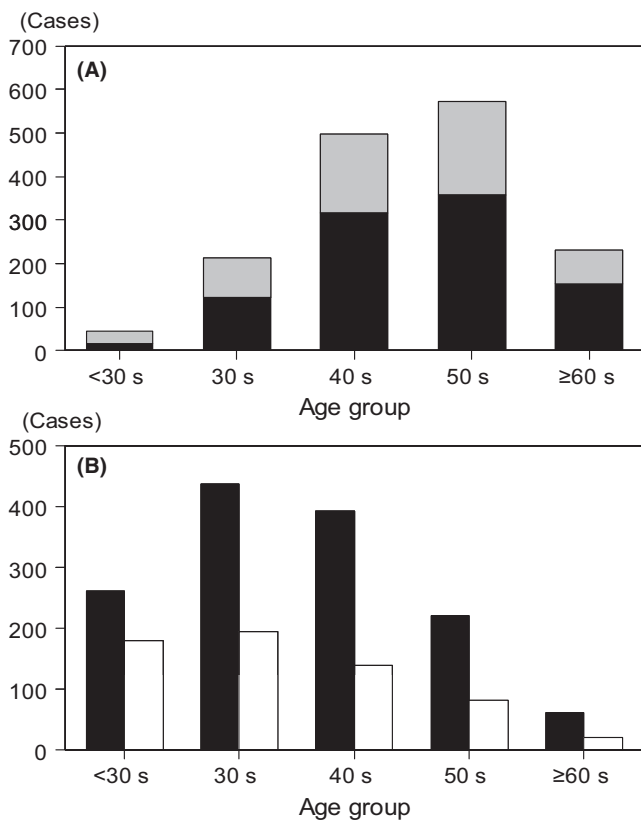


FIGURE 2 (A) Number of compensated cases for overwork-related cerebrovascular (■) and cardiovascular (▒) diseases (A) by age group during January 2010 to March 2015. Note that men accounted for 96% of all the cases. (B) Number of compensated cases for overwork-related mental disorders in men (■) and in women (□) by age group during January 2010 to March 2015

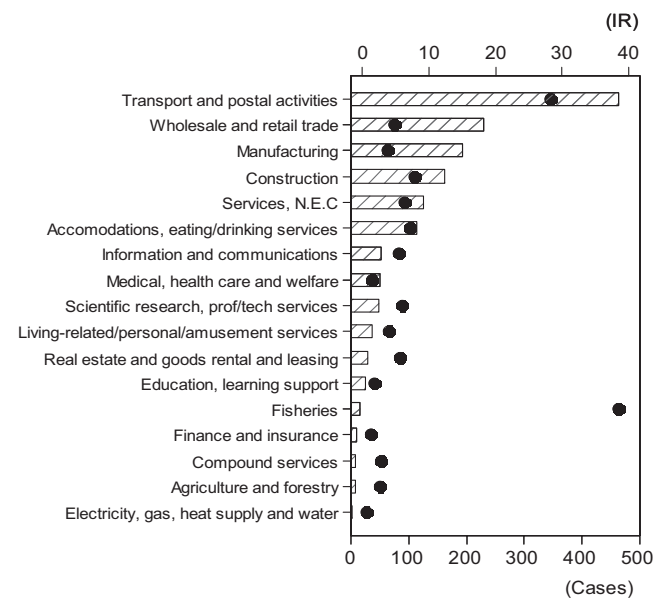


FIGURE 3 Number of compensated cases (▨) and incidence rates (IR, ●) for overwork-related cerebrovascular and cardiovascular diseases during January 2010 to March 2015. Mining and quarrying of stone and gravel excluded because there were no compensated cases. Services, NEC: Services, Not elsewhere classified. Scientific research, prof/tech services: Scientific research, professional and technical services

where the number of claims for the overwork-related mental disorders has increased as well, the approval rate is quite similar (approximately 30%), yet the proportion of suicides among the compensated cases seems lower (19% vs 39% [=74/189] during 2010-2014).¹⁹

RECORDS analyzed the compensated cases for the overwork-related mental disorders that were recognized as overwork-related from January 2010 to March 2015 (N = 2000). Although almost all the CCVD cases were men, the mental disorders cases consisted of men 69% and women 31%. Their age distribution is illustrated in Figure 2B. The number of the cases was found to be largest in the third decade of age and decreased with advancing age in both men and women.

Analyses by industry showed that the mental disorders cases in manufacturing were the most common (Figure 4A). Wholesale and retail trade, medical, health care, and welfare, and transport and postal activities were also found to have a high number of cases. However, when assessing IRs, information and communications (13.5), and transport and postal activities (13.0) had the highest IRs. IRs were high for scientific research, professional, and technical services (11.8), and for real estate and goods rental and leasing (10.6). Data for stratified analyses by gender and age group have been published in a separate paper.²⁰

The suicide cases excluded women (4%) (ie, the men-only cases) were subject to further analyses. As seen in Figure 4B, the overwork-related suicide cases were found to be prevalent in manufacturing, wholesale and retail trade, and construction. However, the highest IR was observed in scientific research, professional, and technical services (4.7). The next highest IR was for information and communications (3.9). The other industries with higher IRs were found for electricity, gas, heat supply, and water (3.5), construction (3.2), and real estate and goods rental and leasing (3.2).

TABLE 1 Diagnosis of overwork-related cerebrovascular and cardiovascular diseases for compensated cases during January 2010 to March 2015

	n	% (N = 1561)
Cerebrovascular diseases	968	
Intracerebral hemorrhage	447	28.6
Subarachnoid hemorrhage	289	18.5
Cerebral infarction	228	14.6
Hypertensive encephalopathy	4	0.3
Cardiovascular diseases	593	
Myocardial infarction	268	17.2
Cardiac arrest ^a	224	14.3
Dissecting aneurysm of the aorta	82	5.3
Angina pectoris	19	1.2

^aIncluding sudden cardiac death.

The recognition criteria for overwork-related mental disorders in Japan addresses diseases with codes F2–F9 according to ICD-10, Chapter V (Mental, Behavioral and Neurodevelopmental disorders).²¹ Among living cases, clear differences in diagnosis were observed between men and women (Table 2). Men suffered equally from F3 (Mood [affective] disorders) and F4 (Neurotic, stress-related and

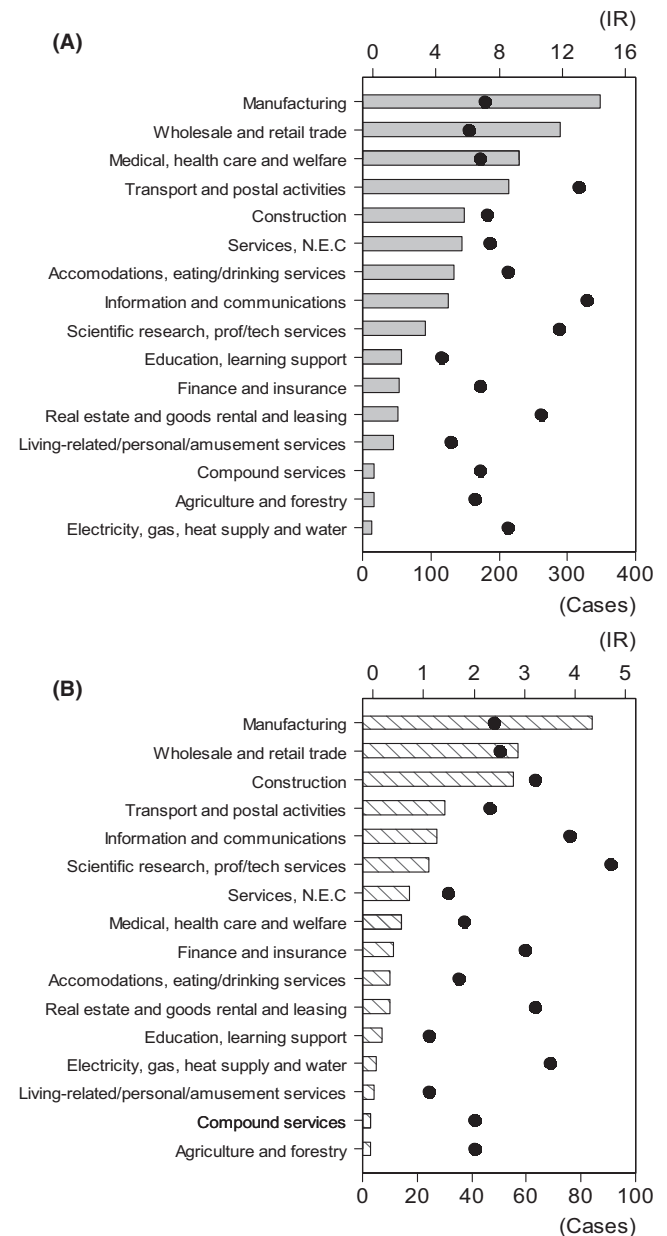


FIGURE 4 (A) Number of compensated cases (□) and IRs (●) for overwork-related mental disorders by industry during January 2010 to March 2015. Industries with >10 cases are selected. (B) Number of compensated cases (□) and IRs (●) for overwork-related suicide in men by industry during January 2010 to March 2015. Mining and quarrying of stone and gravel excluded due to unavailable number of employees. Services, NEC: Services, Not elsewhere classified. Scientific research, prof/tech services: Scientific research, professional and technical services

TABLE 2 Diagnosis of overwork-related mental disorders for compensated cases by condition and gender during January 2010 to March 2015

Living			Suicide		
Men (n = 1010)			Men (n = 363)		
Diagnosis	n	%	Diagnosis	n	%
F30-F39 Mood [affective] disorders	499	49.4%	F30-F39 Mood [affective] disorders	321	88.4%
<i>Top 3:</i>			<i>Top 3:</i>		
F32 Depressive episode	439		F32 Depressive episode	277	
F31 Bipolar affective disorder	20		F3 Subclassification undetermined	27	
F3 Subclassification undetermined	17		F33 Recurrent depressive disorder	11	
F40-F48 Neurotic, stress-related and somatoform disorders	499	49.4%	F40-F48 Neurotic, stress-related and somatoform disorders	41	11.3%
<i>Top 3:</i>			<i>Top 3:</i>		
F43.2 Adjustment disorders	205		F43.2 Adjustment disorders	24	
F43.1 Post-traumatic stress disorder	144		F43 Subclassification undetermined	8	
F43.0 Acute stress reaction	34		F43.0 Acute stress reaction	4	
Other than F3 or F4	12	1.2%	Other than F3 or F4	1	0.3%
Women (n = 610)	n	%	Women (n = 17)	n	%
Diagnosis			Diagnosis		
F30-F39 Mood [affective] disorders	157	25.7%	F30-F39 Mood [affective] disorders	12	70.6%
<i>Top 3:</i>			<i>Top 3:</i>		
F32 Depressive episode	141		F32 Depressive episode	10	
F3 Subclassification undetermined	10		F33 Recurrent depressive disorder	1	
F31 Bipolar affective disorder	4		F3 Subclassification undetermined	1	
F40-F48 Neurotic, stress-related and somatoform disorders	453	74.3%	F40-F48 Neurotic, stress-related and somatoform disorders	5	29.4%
<i>Top 3:</i>			<i>Top 3:</i>		
F43.1 Post-traumatic stress disorder	163		F43.0 Acute stress reaction	2	
F43.2 Adjustment disorders	128		F41 Subclassification undetermined	1	
F43.0 Acute stress reaction	59		F43.2 Adjustment disorders	1	
Other than F3 or F4	0	0.0%	Other than F3 or F4	0	0.0%

Top 3: the top three diagnoses within F3 or F4 are listed.

somatoform disorders), whereas almost 75% of women were diagnosed as F4. However, F32 (Depressive episode) and F43.2 (Adjustment disorders) were predominant in the living men. F43.1 (Post-traumatic stress disorders) was noticeable in the living women. Men accounted for >95% of the suicide cases with the diagnosis of F3, more specifically F32.

The overwork-related mental disorders in Japan can be recognized for compensation if the worker was found to have a high level of psychological burdens at work before the onset of mental disorders.²¹ Those burdens include two extremely stressful events, namely extremely stressful psychological events (eg, life-threatening injuries) and monthly overtime >160 hours, as well as 36 critical events encountered on the job. After categorizing the work-related events into four main domains (long working hours, injuries and

disasters, interpersonal conflict, and others), our recent study indicated that most of the cases in men (56%) was associated with long working hours and 25% and 16% involved injuries and disasters, and interpersonal conflict, respectively.²² In contrast, 41% and 33% of the cases in women were associated with injuries and disasters, and interpersonal conflict, respectively. Furthermore, 25% was exposed to long working hours. Taken together, long working hours accounts for a large proportion of the exposure among the overwork-related mental disorders.^{19,23,24} Careful attention should, however, be given to non-work-hour sources of exposure in the workplace to reduce the number of the mental disorders cases.

For other relevant factors, 45% of the cases worked at enterprises with <50 employees and 15% at those with ≥500 employees. From December 2015, workplaces with

≥50 employees in Japan have to carry out the Stress Check Program to promote the primary prevention toward occupational mental disorders.²⁵ This program measures both psychosocial work stressors and mental/physical responses according to the validated scales. Our studies used the claims until March 2015. In addition, the investigation report for overwork-related problems does not require the evaluation of data from this program at the present stage. Regrettably, it is impossible to make any assessment of results of the impact of the Stress Check Program for the mental disorders cases.

4 | DISCUSSION

4.1 | Overtime legislation in Japan

The Japanese Government is scheduled to regulate overtime by setting a limit following amendment of the Labour Standards Act.²⁶ The maximum overtime is set, in principle, at 45 hours per month and 360 hours per year. Under temporary, exceptional circumstances, 720 hours per year is allowed, provided that overtime including holiday work would be less than 100 hours per single month and 80 hours averaged over 2-6 months. Monthly overtime >45 hours is up to six times a year. A penalty is given to violation. This regulation will be effective in April 2019 for large enterprises, 1 year later for small and medium-sized enterprises, and 5 years later for drivers, construction workers, and medical doctors. The overtime limits proposed are expected to be implemented well and, in turn, receive better compliance. However, given the complicated nature of the overwork problems,²⁷ the other aspects of working conditions need to be simultaneously optimized as discussed below.

4.2 | Potential strategies to reduce the risk of overwork-related deaths and disorders

We should explore potential strategies to mitigate the Karoshi problems identified according to the research outcomes by RECORDS and others. Although long working hours should be avoided to prevent both the CCVDs and mental disorders, another important approach for protecting workers' health and well-being is to facilitate recovery from occupational fatigue after work. Coupled with shortened hours of work, ensuring a daily rest period can be a promising measure. Empirical data to support fatigue recovery with a daily rest period were limited except for shift-working individuals.²⁸⁻³⁰ Recent studies for daytime workers indicate that fatigue is more likely to be recovered as the daily rest period becomes longer in terms of stress responses, sleep duration and quality, and blood pressure.³¹⁻³³ In particular, adequate sleep plays a core role in maintaining the health, productivity, and the quality of life among working populations.^{34,35} In other words, each workplace is recommended to make every effort

to let employees take sufficient sleep through the appropriate design of schedules for work and non-work (daily rest period).³⁶

Our analyses for the compensated cases for overwork-related mental disorders revealed that 16%-33% experienced interpersonal conflict with supervisors and others. Psychosocially healthy work environments are a critical requirement of any workplaces in Japan. We need to recognize each role of employees, supervisors, and employers to ensure a healthy and productive work settings. For the Stress Check Program mentioned above, an important question remains as to how the data obtained should be used to improve the psychosocial work environment.^{37,38} The latest findings for workers in EU countries indicate that occupational stress, measured as job strain, elevates the mortality risk even among individuals with favorable health conditions, such as no lifestyle risk factors, normotensive, and better adherence to pharmacological treatment.⁸ This association highlights the need for managing work stress to avoid any damage in terms of both physical and mental health.

Notably, 25%-41% of the mental disorders cases, including post-traumatic stress disorder and depressive episode, were associated with the injuries and disasters at work. Indeed, occupational injuries and trauma are known to result in psychiatric consequences.^{39,40} These findings emphasize occupational safety as an essential strategy to reduce the likelihood of mental disorders through decreases in on-the-job injuries and unsafe events.

As shown on this paper, the large differences in the CCVDs and mental disorders cases were found among workers' characteristics, industry, and other occupational factors including job type. This call for effective measures to be developed that target these conditions. Our data revealed several industries at high risk, namely transport and postal activities for CCVDs, and information and communications, transport and postal activities, and scientific research, professional and technical services for mental disorders. Each industry (or occupation) has specific risk factors leading to the overwork-related problems. RECORDS undertakes industry-specific analyses of the claims accordingly, and the data will be reported elsewhere. To promote the preventive actions, prioritization is needed for those sectors at risk. Preferably, the relevant professional associations and the authorities may work collaboratively to solve the shared problems. For truck drivers, this sort of action has already been initiated.⁴¹

For the research perspectives, a variety of disciplines and methodologies are welcome. In this respect, epidemiological and experimental research is needed, in addition to claim analysis. The epidemiological research provides evidence for prospective associations between working conditions and subsequent health outcomes via cohort studies and potentially effective measures via intervention studies. Experimental (laboratory) studies are expected to help

determine the mechanisms underlying health disorders associated with long working hours and other stressful sources in a controlled setting. Already employing both approaches, RECORDS has found the longer duration and higher quality of sleep associated with longer periods of daily rest among daytime employees in a cross-sectional survey.³² Our recent data from a simulated long (13 hours) working scenario show increased blood pressure during the work period, with a greater increase in blood pressure among participants with untreated hypertension during the later period.⁴² We also have been trying to develop practical indicators of cardiopulmonary fitness for workers, since the cardiorespiratory fitness is shown to predict health outcomes.^{43,44} As part of this research, the Worker's Living Activity-time Questionnaire was validated.⁴⁵ Moreover, the health benefits of replacing sitting with standing or walking in the workplace were estimated.⁴⁶

Long working hours and other workplace factors should affect the physical and mental health of the workers worldwide. Currently, South Korea, Taiwan, China, and Japan nationally compensate the claims for CCVDs and mental disorders according to the recognition criteria set by each country.⁴⁷ Given the same region and similar backgrounds, mutual communications among the four countries may provide novel insight into how to tackle the urgent issue of overwork-related problems. At the 2018 annual meeting of the Japanese Society of Occupational Health (JSOH), a joint symposium by JSOH and the International Commission of Occupational Health, Japan, was held with speakers from South Korea, Taiwan, and Japan to discuss overwork-related deaths and disorders.⁴⁸ This opportunity is believed to become the first step toward international collaboration.

5 | CONCLUSIONS

Our critical goal is to reduce the number of workers suffering from overwork-related CCVDs and mental disorders. At the same time, we have to prevent excessive fatigue at work and create decent workplaces through participatory actions by employees, employers, researchers, and the authorities. Each task requires significant effort, but it is our missions to realize the workplaces without overwork-related problems as a social responsibility.

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DISCLOSURE

Approval of the research protocol: The Research Ethics Committee of JNIOOSH reviewed and approved the present study. *Informed Consent:* All potential cases and their family members/relatives were informed of the study goals and relevant ethical issues, and also had the opportunity to opt out if they did not want their information to be used for the current research via the websites of both JNIOOSH and the Japanese Ministry of Health, Labour and Welfare. *Registry and the Registration No. of the study/Trial:* N/A *Animal Studies:* N/A.

CONFLICTS OF INTEREST

The author declares that there are no conflicts of interest.

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