

Original

Validity and reproducibility of self-reported working hours among Japanese male employees

Tepei Imai¹, Keisuke Kuwahara², Toshiaki Miyamoto³, Hiroko Okazaki⁴, Akiko Nishihara¹, Isamu Kabe⁵, Tetsuya Mizoue⁶ and Seitaro Dohi⁴
Japan Epidemiology Collaboration on Occupational Health Study Group

¹Azbil Corporation Tokyo, Japan, ²Teikyo University Graduate School of Public Health, Tokyo, Japan, ³Nippon Steel & Sumitomo Metal Corporation Kimitsu Works, Chiba, Japan, ⁴Mitsui Chemicals Inc., Tokyo, Japan, ⁵Furukawa Electric Corporation, Tokyo, Japan and ⁶Department of Epidemiology and Prevention, Center for Clinical Sciences, National Center for Global Health and Medicine, Tokyo, Japan

Abstract: Objective: Working long hours is a potential health hazard. Although self-reporting of working hours in various time frames has been used in epidemiologic studies, its validity is unclear. The objective of this study was to examine the validity and reproducibility of self-reported working hours among Japanese male employees. **Methods:** The participants were 164 male employees of four large-scale companies in Japan. For validity, the Spearman correlation between self-reported working hours in the second survey and the working hours recorded by the company was calculated for the following four time frames: daily working hours, monthly overtime working hours in the last month, average overtime working hours in the last 3 months, and the frequency of long working months (≥ 45 h/month) within the last 12 months. For reproducibility, the intraclass correlation between the first (September 2013) and second surveys (December 2013) was calculated for each of the four time frames. **Results:** The Spearman correlations between self-reported working hours and those based on company records were 0.74, 0.81, 0.85, and 0.89 for daily, monthly, 3-monthly, and yearly time periods, respectively. The intraclass correlations for self-reported working hours between the two questionnaire surveys were 0.63, 0.66, 0.73, and 0.87 for the respective time frames. **Conclusions:** The results of the present study among Japanese male employees suggest that the validity of self-reported working hours is high for all four time frames, whereas

the reproducibility is moderate to high.
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Key words: Self-reported working hours, Validity and reproducibility, Japan

Introduction

Working long hours has been given much attention for its association with coronary heart disease and stroke¹⁾ and their major risk factors, i.e., diabetes²⁾ and hypertension³⁻⁵⁾. The epidemiological evidence to date has been consistent for the relationship between working hours and the risk of coronary heart disease and stroke¹⁾ but inconsistent for the risk of diabetes²⁾ and hypertension³⁻⁵⁾. A major limitation of these studies is that working hours were elicited via self-report. Additionally, researchers measured working hours on a daily^{3,6,7)} or weekly basis⁸⁻¹³⁾ and monthly overtime^{4,5,14)} for various time frames, i.e., the previous week¹²⁾, past month^{5,8,13)}, past 3 months^{5,12)}, and past year¹³⁾, using a single question^{3-11,14)}. All these factors may influence the association between working hours and disease risk. Understanding the validity and reproducibility of self-reporting is important to interpret the results of previous studies and future studies using these measures of working hours. However, to our knowledge, no study has evaluated the validity and reproducibility of such self-reported working hours.

Working hours are defined by the International Labour Organization (ILO) as the hours when workers are available to receive orders from an employer or a person with authority¹⁵⁾. In Japan, for weekly working hours, the labor

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Correspondence to: T. Imai, Azbil Corporation, Tokyo Building, 2-7-3 Marumouchi, Chiyoda-ku, Tokyo 100-6419, Japan (e-mail: t.imai.pz@azbil.com)

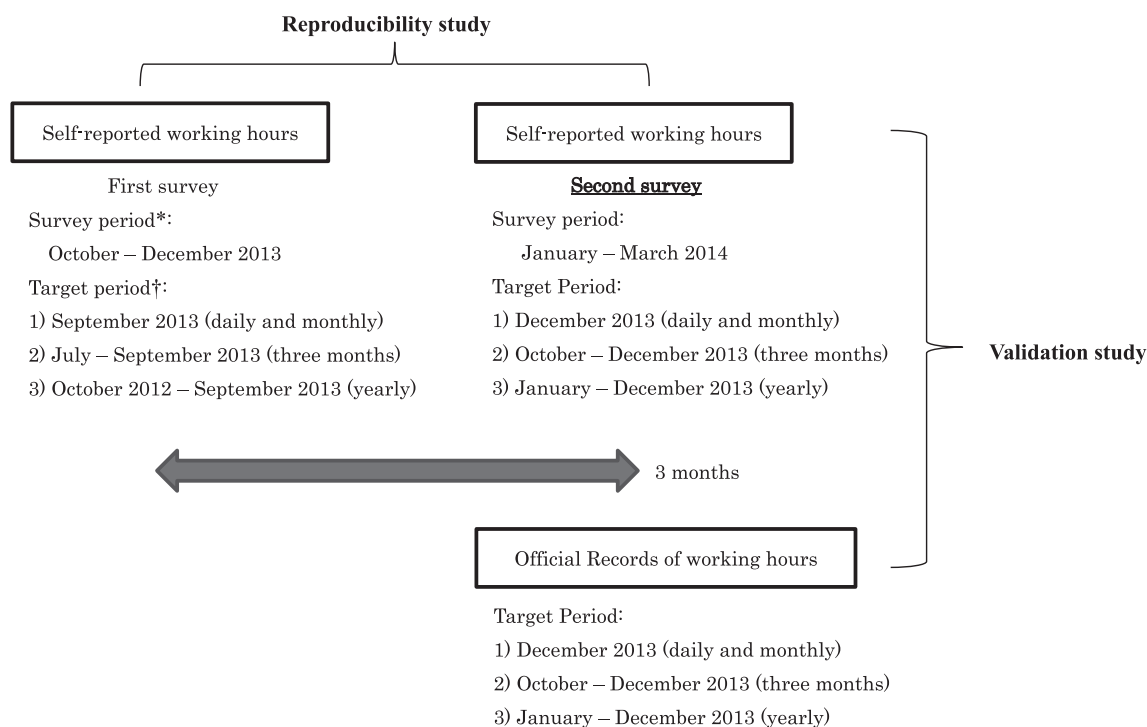


Fig. 1. Study design of the validation and reproducibility study
 *The period in which each survey was conducted.
 †The period of each survey and the targeted time frame for self-reported working hours

standard act sets a limit of 40 h¹⁶⁾, which is allowed to be extended by submitting a labor-management agreement for working hours to the labor standard inspection office. Due to the lack of a standard procedure for measuring working hours¹⁷⁾, the decision of whether to include activities such as preparation, traveling, and waiting time in working hours is left to the individual company. Given such a situation, it is reasonable to use the official records of working hours held by the company as the gold standard in a validity study of self-reported working hours. Here, we examined the validity and reproducibility of self-reported working hours and overtime work hours for various time frames against company records of working hours among Japanese male employees.

Study Population and Methods

Study design and population

This study was conducted as part of the Japan Epidemiology Collaboration on Occupational Health (J-ECOH) Study, an ongoing, large-scale, multi-company study in Japan^{18,19)}. From October to December 2013 (first survey) and from January to March 2014 (second survey), we performed a validation and reproducibility study on working hours among four of 12 companies participating in the J-ECOH Study (Fig. 1). The four participating companies covered the following industries; electrical machinery (two companies), steel, and chemical. The study protocol

was approved by the Ethics Committee of the National Center for Global Health and Medicine, Japan.

We limited the study subjects to full-time male employees because few females worked long hours, e.g., among employees in a sub-group of the J-ECOH Study who worked 80 h/month or more of overtime, only 2% were female⁵⁾. Based on the company records of monthly working hours in September 2013, we recruited 174 male employees who had no work limitations and were not absent for more than 4 days during the 1-month period using mainly convenient sampling methods, e.g., two researchers targeted employees who visited their office, one researcher visited several work places and recruited all the employees, and one researcher selected employees randomly. Equal numbers of subjects were selected from each category of overtime work hours (<10, 10 to <45, 45 to <60, 60 to <80, and ≥80 h/month). Of the 174 employees who participated in the first survey, we excluded 10 participants; these individuals were those who did not participate in the second survey (four subjects), those who had transferred from another office during the past 12 months (two subjects), and those who lacked information on self-reported working hours (four subjects). Therefore, we analyzed data from 164 participants.

Self-reported working hours

The questionnaire included self-reported working hours for the following four time frames: 1) average daily work-

ing hours in the last month (September 2013 and December 2013; <8, 8 to <9, 9 to <10, 10 to <11, 11 to <12, 12 to <13, and ≥ 13 h/day), 2) monthly overtime work hours in the last month (September 2013 and December 2013; <10, 10 to <30, 30 to <45, 45 to <60, 60 to <80, 80 to <100 and ≥ 100 h/month), 3) average monthly overtime work hours in the last 3 months (July to September 2013 and October to December 2013; <10, 10 to <30, 30 to <45, 45 to <60, 60 to <80, 80 to <100, and ≥ 100 h/month), and 4) the frequency of long working months (≥ 45 h/month of overtime work hours) within the last 12 months (times/year) (October 2012 to September 2013 and January 2013 to December 2013). With reference to the Japanese compensation criteria for *Karoshi*²⁰⁾, sudden death from over work²¹⁾, we defined long overtime work hours as 45 h/month or more. As for daily working hours, we calculated the monthly overtime working hours using the following formula: (daily working hours - 8 h) \times 20 days, and we defined long working hours as 10 h/day (about 45 h/month) or more. Regarding the frequency of long working months in a year, we divided the maximum number of overtime work hours in 1 year (360 h/year) that have been legislated in Japan²²⁾ by 45 h/month, and we defined high frequency as 8 months/year or more.

Company records of working hours

We collected participants' records of monthly overtime working hours from four companies over a period of 15 months, from October 2012 to December 2013. We also collected participants' records of absent days over the same period from three companies to control for their effect on monthly working hours; the remaining company disagreed with providing the records of absent days. All four companies required employees to register their working hours through a system on a daily basis. The registered working hours were approved as official company records after being checked monthly by the employees' managers; we used these official records in the present study. Each company uses another system to monitor employees' arrival and departure times, the data for which we did not obtain in the present study. In cases of large discrepancies between registered working hours and those estimated from the arrival and departure times, employees are instructed to register their correct working hours.

Other variables

The questionnaire included information regarding job position, type of department, marital status, and resident status. Job position was categorized as high (department chief, department director, or higher position) or low (others). The type of department was categorized as office (desk work, planning, research, and development, sales, and production technology) or nonoffice work (field-work). Marital status was categorized as married or unmarried (unmarried, divorced, or bereaved). Resident

status was categorized as living alone or living with family.

Statistical analysis

Continuous and categorical variables are presented as the mean (\pm standard deviation) and percentages, respectively. As for the company records, we calculated the median (interquartile range) of the daily overtime working hours, monthly overtime working hours, average monthly overtime working hours in the past 3 months, and average monthly overtime working hours in the past 12 months, respectively. For validity, we calculated Spearman correlations between self-reported working hours and company-recorded working hours for each time frame; we assigned ordinal numbers to increasing levels of self-reported working hours in each time frame, whereas we treated the overtime working hours based on company records as a continuous variable for the analysis of daily working hours and the past month and past 3 months of overtime work. Using company records, we also created a variable indicating the number of months with at least 45 h of overtime during the past 12 months. We were informed that some participants used their company records to report working hours in the first survey, and we requested that participants not use their records for the second survey, which was used for the validation analysis. With regards to reproducibility, the intraclass correlation between the first and second surveys was calculated for the four time frames using two-way random effects model. We assigned median values for each category of working hours for analysis of daily working hours and of overtime hours in the past month and the past 3 months. To control for the effect of absent days working hours, we repeated the above analyses by absent days (<0.5 or ≥ 0.5 days/month, corresponding the median absent days) in three companies. To minimize the effect of a greater sampling weight for participants with longer working hours, we repeated the analyses among employees who worked fewer than 80 h of overtime in September 2013 according to company records. Two-sided *P* values of less than 0.05 were considered to be statistically significant. All analyses were performed using Stata version 13.1 (Stata Corp, College Station, Texas, USA).

Results

Table 1 presents subjects' demographic characteristics. Most subjects tended to work in office-related departments in a low job position and to be married and living with family.

Table 2 shows the proportion of employees with long overtime hours, the median overtime working hours of official records, and the Spearman correlation between self-reported overtime work hours and the record of working hours from each company calculated for the four time

frames in the second survey. The proportions of subjects in each category for the four time frames were shown in Supplement Table 1. As for the self-reported working hours, the proportion of employees who worked long overtime hours in the second survey was 39.0%, 29.3%, 37.2%, and 16.5% for the time frames of daily, monthly, 3-monthly, and yearly basis, respectively. Regarding the records of working hours, the proportion of employees who worked long overtime hours was 34.2%, 31.7%, 39.6%, and 18.3%, respectively. The median overtime working hours in the official records were 1.7 h/day, 32.3 h/month, 38.5 h/month, and 38.2 h/month, respectively. The Spearman correlations between self-reported working hours and records of working hours were 0.74, 0.81, 0.85, and 0.89 for the four time frames (daily, daily, monthly, 3-monthly, and yearly) respectively. In analysis stratified by average monthly absent days (from three companies), the corresponding figures were 0.72, 0.82, 0.84, and 0.87, respectively (daily, monthly, 3-monthly, and yearly) for <0.5 days/month, and were 0.78, 0.93, 0.92, and 0.89, respectively, for ≥0.5 days/month.

Table 2 also presents the intraclass correlations between the first and second surveys for the four time frames. As for the self-reported working hours, the proportions of employees who worked long overtime hours in the first survey were 45.1%, 45.1%, 41.5%, and 17.7% for the time frames consisting of a daily, monthly, 3-

monthly, and yearly basis, respectively, and in the second survey, they were lower than those of the first survey, especially for monthly overtime work hours in the last month. The intraclass correlations between the first and the second surveys were 0.63, 0.66, 0.73, and 0.87 for the four time frames, respectively. In the stratified analysis by average monthly absent days (three companies), the corresponding figures were 0.64, 0.59, 0.62, and 0.84 for < 0.5 days/month for the four time frames respectively, and were 0.67, 0.62, 0.81, and 0.92 for ≥0.5 days/month, respectively. Subgroup analysis of 136 individuals who worked fewer than 80 overtime-work hours per month showed similar results for both validity and reproducibility (Supplement Table 2).

Table 1. Demographic characteristics of the participants*

No. of subjects	164
Age (years)	43.0 (10.2) †
Non-office work department, %	36.6
High job position, %	28.1
Married, %	72.0
Living with family, %	72.6

*Data are based on the second survey.

† Mean (SD).

Table 2. Proportions of subjects with long overtime work hours, Spearman correlations between self-reported working hours and company records of working hours, and intra-class correlations of self-reported working hours between the first and second surveys for the four time frames

	Proportions of subjects with long overtime work hours*, %			Overtime working hours of official records**	Validity†		Reproducibility‡	
	Self-reported working hours		Official records		Spearman correlation	p-value	Intra-class correlation	p-value
	First survey	Second survey						
Daily working hours	45.1	39.0	34.2	1.7 h/day (0.3-2.5)	0.74	<0.01	0.63	<0.01
Monthly overtime work hours in the last month	45.1	29.3	31.7	32.3 h/month (6.3-46.7)	0.81	<0.01	0.66	<0.01
Monthly overtime work hours in the last 3 months	41.5	37.2	39.6	38.5 h/month (17.1-53.6)	0.85	<0.01	0.73	<0.01
Frequency of long working months§ within the last 12 months	17.7	16.5	18.3	38.2 h/month (15.4-54.3)	0.89	<0.01	0.87	<0.01

*Defined as 10 or more working hours per day (daily working hours), 45 or more hours of overtime work in the last month (monthly overtime work hours in the last month), 45 or more hours of overtime work on average in the past 3 months (monthly overtime work hours in the past 3 months) and 8 months/year or more of long working months (frequency of long working months within the last 12 months). The proportions of subjects in each category for the four time frames were shown in Supplement Table 1.

** Data for continuous variables are expressed as median (IQR) for daily overtime working hours (daily working hours), monthly overtime working hours (monthly overtime work hours in the last month), average monthly overtime working hours in the past 3 months (monthly overtime work hours in the past 3 months) and average monthly overtime working hours in the past 12 months (frequency of long working months within the last 12 months).

†Spearman correlation and p-value for correlations between self-reported working hours and company records of working hours.

‡Intra-class correlation and p-value for correlations of self-reported working hours between the first and second surveys.

§Defined as 45 h or more of overtime work in 1 month.

Discussion

In this multi-company study among four manufacturing companies in Japan, we found close correlations between self-reported working hours and company records of working hours over four time frames (daily, monthly, 3 months, and yearly), and we also found moderate to high reproducibility of self-reported working hours over the four time frames. This is the first study to show the validity and reproducibility of self-reported working hours.

In the present study, the official records of working hours were based on the registered working hours of employees from four participating companies, i.e., the registered working hours were approved as official records after being checked by the employees' managers. In Japan, companies are required to monitor the accuracy of their employees' registered working hours using guidelines published by the government²³. Thus, each participating company requires all employees to register their working hours on a daily basis and checks and monitors their registered working hours using their arrival and departure times each month. In these situations, employees may routinely pay attention to the accuracy of their daily working hours. Such a monitoring system for working hours may have contributed to the high validity of the self-reported working hours.

In the present study, the reproducibility of the self-reported working hours was moderate to high and was lower for shorter time frames (daily, monthly, and 3 months) than for long time frame (yearly). This finding is reasonable given that the monthly working hours fluctuate for several reasons, e.g., the number of monthly working days and the change in workload. It would thus be preferable to collect information on long-term working hours in epidemiologic studies that examine the chronic effect of long working hours. With regard to monthly working days, we divided the subjects into two groups based on their average number of absent days per month (<0.5 or ≥0.5 days/month) and repeated the reproducibility analyses in the three participating companies as a sensitivity analysis; however, the results were similar in both groups. Although other factors such as national holidays, e.g., 2 days in September and 1 day in December, traditional holidays, e.g., 2 days in the end of December, and changes in workload may have influenced the reproducibility of self-reported working hours, we did not assess these factors in this study.

The strength of the present study is that the validity and reproducibility of self-reported working hours were assessed for four time frames, ranging from daily to yearly, and compared with company-owned data on working hours. The limitations of the present study warrant mention. First, we recruited equal numbers of participants from each category of overtime-work hours (<10, 10 to

<45, 45 to <60, 60 to <80, and ≥80 h/month), with a greater sampling weight for those with longer working hours. This may influence the estimates of our study. However, subgroup analysis of employees who worked fewer than 80 overtime-work hours per month showed similar results for both validity and reproducibility (Supplement Table 2). Second, the period of the second survey was 3 months, from January to March 2014, and the target period was December 2013 for daily and monthly working hours in the second survey. Subjects who answered the questionnaire in a later period of survey may recall their past working hours less reliably than those who answered in an earlier period. However, most subjects (n=160) completed the questionnaire in January 2014, and an analysis among such subjects only showed similar validity (data not shown). Third, we conducted the study among male employees in large-scale companies in Japan. Thus, it remains unclear whether the present findings can be applied to female employees, employees in small- and medium-sized companies, or employees in other countries.

In conclusion, the present validation study indicates that among male Japanese employees, when assessed against company records on working hours, self-reported working hours for different time frames are highly valid and moderately to highly reproducible. Given various feedback systems that record working hours of employees in different countries and companies, the validity of self-reported working hours should be assessed in each study setting.

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The authors' responsibilities were as follows: TI and KK contributed equally to the work and should be considered co-first authors; SD and T Mizoue conceived and designed the J-ECOH Study; KK, TI, and T Mizoue performed data collection; TI, T Miyamoto, AN, HO, IK, and SD provided databases for the research; KK, TI, T Miyamoto, HO, AN, IK, T Mizoue, and SD drafted the plan for data analysis; KK conducted the data analysis; TI drafted the manuscript; and all authors were involved in the interpretation of the results and revision of the manuscript, and all approved the final version of the manuscript.

References

- 1) Kivimäki M, Jokela M, Nyberg ST, et al. Long working hours and risk of coronary heart disease and stroke: a systematic review and meta-analysis of published and unpublished data for 603838 individuals. *Lancet* 2015; 386: 1739-1746.
- 2) Kivimäki M, Virtanen M, Kawachi I, et al. Long working hours, socioeconomic status, and the risk of incident type 2 diabetes: a meta-analysis of published and unpublished data from 222120 individuals. *Lancet Diabetes Endocrinol* 2015; 3: 27-34.
- 3) Nakanishi N, Yoshida H, Nagano K, Kawashimo H, Nakamura K, Tatara K. Long working hours and risk for hypertension in Japanese male white collar workers. *J Epidemiol Community Health* 2001; 55: 316-322.
- 4) Wada K, Katoh N, Aratake Y, et al. Effects of overtime work on blood pressure and body mass index in Japanese male workers. *Occup Med (Lond)* 2006; 56: 578-580.
- 5) Imai T, Kuwahara K, Nishihara A, et al. Association of overtime work and hypertension in a Japanese working population: A cross-sectional study. *Chronobiol Int* 2014; 31: 1108-1114.
- 6) Virtanen M, Ferrie JE, Singh-Manoux A, et al. Overtime work and incident coronary heart disease: the Whitehall II prospective cohort study. *Eur Heart J* 2010; 31: 1737-1744.
- 7) Nakanishi N, Nishina K, Yoshida H, et al. Hours of work and the risk of developing impaired fasting glucose or type 2 diabetes mellitus in Japanese male office workers. *Occup Environ Med* 2001; 58: 569-574.
- 8) O'Reilly D, Rosato M. Worked to death? A census-based longitudinal study of the relationship between the numbers of hours spent working and mortality risk. *Int J Epidemiol* 2013; 42: 1820-1830.
- 9) Holtermann A, Mortensen OS, Burr H, Søgaard K, Gyntelberg F, Suadicani P. Long work hours and physical fitness: 30-year risk of ischemic heart disease and all-cause mortality among middle-aged Caucasian men. *Heart* 2010; 96: 1638-1644.
- 10) Netterstrøm B, Kristensen TS, Jensen G, Schnor P. Is the demand-control model still a useful tool to assess work-related psychosocial risk for ischemic heart disease? Results from 14 year follow up in the Copenhagen City Heart study. *Int J Occup Med Environ Health* 2010; 23: 217-224.
- 11) Kroenke CH, Spiegelman D, Manson J, Schernhammer ES, Colditz GA, Kawachi I. Work characteristics and incidence of type 2 diabetes in women. *Am J Epidemiol* 2007; 165: 175-183.
- 12) Jeong I, Rhie J, Kim I, et al. Working hours and cardiovascular disease in Korean workers: a case-control study. *J Occup Health* 2013; 55: 385-391.
- 13) Liu Y, Tanaka H; The Fukuoka Heart Study Group. Overtime work, insufficient sleep, and risk of non-fatal acute myocardial infarction in Japanese men. *Occup Environ Med* 2002; 59: 447-451.
- 14) Kawakami N, Araki S, Takatsuka N, Shimizu H, Ishibashi H. Overtime, psychosocial working conditions, and occurrence of non-insulin dependent diabetes mellitus in Japanese men. *J Epidemiol Community Health* 1999; 53: 359-363.
- 15) International Labour Organization. History. [Online]. [cited 2015 Jul. 25]; Available from: URL: <http://www.ilo.org/global/statistics-and-databases/statistics-overview-and-topics/working-time/history/lang--en/index.htm>
- 16) Ministry of Health, Labour and Welfare, Japan. Labor Standard Act. [Online]. [cited 2015 Jul. 25]; Available from: URL: http://www.japaneselawtranslation.go.jp/law/detail_main?vm=&id=5
- 17) International Labour Organization. Working time statistics. [Online]. [cited 2015 Jul. 25]; Available from: URL: <http://www.ilo.org/global/statistics-and-databases/statistics-overview-and-topics/working-time/lang--en/index.htm>
- 18) Kuwahara K, Imai T, Nishihara A, et al. Overtime work and prevalence of diabetes in Japanese employees: Japan epidemiology collaboration on occupational health study. *PLoS One* 2014; 9: e95732.
- 19) Hori A, Nanri A, Sakamoto N, et al. Comparison of body mass index, waist circumference, and waist-to-height ratio for predicting the clustering of cardiometabolic risk factors by age in Japanese workers. *Circ J* 2014; 78: 1160-1168.
- 20) Iwasaki K, Takahashi M, Nakata M. Health problems due to long working hours in Japan: working hours, workers' compensation (karoshi), and preventive measures. *Ind Health* 2006; 44: 537-540.
- 21) Uehata T. Long working hours and occupational stress-related cardiovascular attacks among middle-aged workers in Japan. *J Hum Ergol (Tokyo)* 1991; 20: 147-153.
- 22) Japan External Trade Organization. Laws & regulations on setting up business in Japan. [Online]. [cited 2015 Jul. 25]; Available from: URL: https://www.jetro.go.jp/en/invest/setting_up/laws/section4/page5.html
- 23) Ministry of Health, Labour and Welfare, Japan. Guidelines for employers to monitor the employees' working hours appropriately (in Japanese). [Online]. [cited 2015 Jul. 25]; Available from: URL: <http://www.mhlw.go.jp/houdou/0104/h0406-6.html>

Supplement Table 1. Proportion of subjects in each category of self-reported working hours for the four time frames*

	Categories of self-reported working hours						
	<8	8 to <9	9 to <10	10 to <11	11 to <12	12 to <13	≥13
Daily working hours (h/day)	<8	8 to <9	9 to <10	10 to <11	11 to <12	12 to <13	≥13
Proportions of subjects, %	7.3	20.7	32.9	22.6	9.8	3.7	3.1
Monthly overtime work hours in the last month (h/month)	<10	10 to <30	30 to <45	45 to <60	60 to <80	80 to <100	≥100
Proportions of subjects, %	12.8	32.3	25.6	11.6	11.0	3.7	3.1
Monthly overtime work hours in the last 3 months (h/month)	<10	10 to <30	30 to <45	45 to <60	60 to <80	80 to <100	≥100
Proportions of subjects, %	8.5	25	29.3	18.3	12.2	3.7	3.1
Frequency of long working months† within the last 12 months (times/year)	0	1 to 2	3 to 4	5 to 6	7 to 8	9 to 10	11 to 12
Proportions of subjects, %	29.3	22.6	15.3	12.2	4.3	7.9	8.5

*Data are based on the second survey.

†Defined as 45 h or more of overtime work in 1 month.

Supplement Table 2. Proportions of subjects with long overtime work hours, Spearman correlations between self-reported working hours and company records of working hours, and intra-class correlations of self-reported working hours between the first and second surveys for the four time frames among employees who worked fewer than 80 overtime-work hours per month

	Proportions of subjects with long overtime work hours*, %			Overtime working hours of official records**	Validity†		Reproducibility‡	
	Self-reported working hours		Official records		Spearman correlation	p-value	Intra-class correlation	p-value
	First survey	Second survey						
Daily working hours	36.0	30.9	23.5	1.5 h/day (0.3-2.3)	0.74	<0.01	0.68	<0.01
Monthly overtime work hours in the last month	35.3	21.3	23.5	28.8 h/month (5.5-43.5)	0.80	<0.01	0.69	<0.01
Monthly overtime work hours in the last 3 months	31.6	28.7	31.6	33.2 h/month (13.2-47.9)	0.81	<0.01	0.62	<0.01
Frequency of long working months§ within the last 12 months	10.3	10.3	12.5	34.0 h/month (12.2-46.2)	0.85	<0.01	0.82	<0.01

*Defined as 10 or more working hours per day (daily working hours), 45 or more hours of overtime work in the last month (monthly overtime work hours in the last month), 45 or more hours of overtime work on average in the past 3 months (monthly overtime work hours in the past 3 months) and 8 months/year or more of long working months (frequency of long working months within the last 12 months).

**Data for continuous variables are expressed as median (IQR) for daily overtime working hours (daily working hours), monthly overtime working hours (monthly overtime work hours in the last month), average monthly overtime working hours in the past 3 months (monthly overtime work hours in the past 3 months) and average monthly overtime working hours in the past 12 months (frequency of long working months within the last 12 months).

†Spearman correlation and p-value for correlations between self-reported working hours and company records of working hours.

‡Intra-class correlation and p-value for correlations of self-reported working hours between the first and second surveys.

§ Defined as 45 h or more of overtime work in 1 month.

|| Official records in the second survey were used.