

Association between working overtime and psychological stress reactions in elementary and junior high school teachers in Japan: a large-scale cross-sectional study

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Abstract: This study aimed to investigate the relationship between working overtime and psychological stress reactions among school teachers. It also evaluated the interaction of overtime work types (on weekdays, on holidays, and bringing work home) and task content (educational, peripheral and both). This cross-sectional study was conducted on Japanese elementary and junior high school teachers. Primary outcome was psychological stress reactions measured with the Brief Job Stress Questionnaire. Participants were asked how long they work overtime on weekdays, holidays, and at home. Participants were also asked whether they engaged in educational tasks and/or peripheral tasks during that overtime work. Multiple linear regression analyses were applied and 6,135 participants were included in the analyses after imputing missing data. Working hours of all three types were significantly correlated with higher psychological stress reactions. Moreover, engaging in both educational and peripheral tasks showed higher psychological stress reactions than in only educational tasks when working overtime on weekdays and holidays. In conclusion, reducing overtime work regardless of work types is crucial for mitigating psychological stress reactions for teachers. It might also be possible to manage the psychological stress reactions by splitting the role of task contents, when working overtime on weekdays and holidays at school.

Key words: Working overtime, Working on holidays, Bringing work home, Peripheral tasks, Psychological stress reactions, School teachers

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Introduction

Teaching represents one of the most stressful occupations around the world, and previous studies have shown that school teachers have poorer mental health than the general working population^{1–4}. For instance, in the United Kingdom, 19–29% of primary school teachers have experienced psychological distress². Another study in South Africa showed that 28.1% of teachers had psychological distress, and 15.5% had depressive symptoms⁵. Improving mental health among teachers is also an important issue in Japan. In a recent government survey, 51.3% of Japanese public elementary and junior high school teachers reported high psychological distress⁶. Moreover, every year, approximately 3,800 teachers take sickness absence due to mental illness, and 600 teachers leave their jobs because of mental disorders^{7, 8}.

Working overtime has been a critical stressor for teachers' mental health and a public concern in Japan in the last few decades. In 2018, The Organization for Economic Co-operation and Development (OECD) Teaching and Learning International Survey (TALIS 2018) reported that the average working hours of junior high school teachers in 48 participating countries were 38.3 hours per week, while they were 56.0 hours per week in Japan, much longer than any other country⁹. Approximately 70% of Japanese teachers work on their holidays (69.2%) and complete unfinished tasks at home (72.5%)^{10, 11}. Therefore, it is common for teachers in Japan to work overtime on weekdays and holidays, and take work home. Besides, peripheral (or administrative) tasks (not directly related to curricular teaching) might lead to long working hours. The aforementioned TALIS 2018 survey revealed that teachers in Japan tend to spend much more time on administrative tasks or extracurricular education (sports and cultural activities) than in other participating countries⁹. Thus, it is necessary to focus on each overtime work type (weekdays, holidays, bringing work home) and content (peripheral task or not) and their associations with mental health.

However, previous findings are unclear as to which of overtime work type—weekdays, working on holidays, or bringing work home—is associated with mental health deterioration among teachers, although long working hours have been associated with the same. A study in Japan has shown that working hours including the time spent working at home was significantly associated with psychological distress¹², while it remains unclear whether working at home is associated with mental health among teachers^{1, 13}. Moreover, it is inconsistent whether performing peripheral

tasks is associated with teachers' mental health. Some studies have shown that peripheral tasks as well as educational tasks were perceived as highly demanding and emotionally exhausting^{14–16}. On the other hand, a study with teachers in Germany reported that individual lesson planning and correction of homework were associated with severe emotional exhaustion, while administrative tasks were associated with less emotional exhaustion¹⁷. In addition, several studies have indicated that role conflict is considered to be one of the stressors among teachers^{11, 18, 19}. Therefore, we hypothesize that performing both educational tasks and peripheral tasks may be associated with teachers' mental health. The complexity of teachers' roles is well-known²⁰ and more research is needed to assess the different components of teachers' responsibilities in order to clarify the associations.

In an attempt to examine specific features of mental distress among Japanese teachers, we conducted a preliminary survey with teachers visiting the Tokai Central Hospital for a health-checkup. The results of the survey were similar to findings reported in another study in Japan²¹. The purpose of the present study was to confirm the relationship between overtime work types (i.e., working overtime on weekdays, working on holidays, or bringing work home), task content (i.e., educational, peripheral, or both) of overtime work, and psychological stress reactions among a large sample of elementary and junior high school teachers in Japan by conducting a large, prefectural base scale survey and investigation.

We proposed the following hypotheses:

H₁ – All types of overtime work are associated with psychological stress reactions.

H₂ – Task contents interact with all types of overtime work on psychological stress reactions.

Although there have been several papers investigating associations between overtime working and psychological reactions, the sample size and target population might not be enough to clearly illustrate the answer to the clinical questions^{12, 13, 19, 21}. In this regard, our data could accomplish the representative investigation, because full support from the Board of Education in the Gifu Prefectural Government was obtained from the start of the investigation, resulting in the submission of questionnaires to over 10,000 teachers in all the target schools. In addition, this is the first study investigating the relationship between the contents of teachers' overtime work tasks and their psychological stress reactions, separately assessed for working on weekdays, holidays, and bringing work home.

Methods

Study design and participants

This study used a cross-sectional survey conducted with public elementary and junior high schools (548 schools) in Gifu Prefecture, Japan. Questionnaires were distributed to 10,824 teachers on May 14, 2018, and a total of 7,861 responses with informed consent were collected by July 4, 2018 (response rate, 72.6%). The following exclusion criteria were used: (i) aged 60 years and over, (ii) not teaching as a full-time job, and (iii) working as school principal, vice-principal, head teacher, nursing teacher, and nutrition teacher. We excluded 1,738 teachers who did not meet the eligibility criteria and the remaining 6,135 participants were included in the analysis. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and following the Helsinki Declaration of 1975, as revised in 2013. Informed consent was obtained from all participants included in the study. This study was approved by the Institutional Ethics Review Board at Tokai Central Hospital (Approval No. 2017101601) and fully supported by the Board of Education, Gifu Prefecture.

Measurements

Participants' sociodemographic information, work-related information, and psychological stress reactions were evaluated. The outcome variable was psychological stress reactions measured by the Brief Job Stress Questionnaire (BJSQ)²². The BJSQ consists of 57 items used to assess job stressors (17 items), psychological stress reactions (18 items), physical symptoms (11 items), and buffering factors such as social support at work (11 items) and job control (3 items). Regarding outcome variables, we used psychological stress reactions (18 items) as converted by the raw score conversion table (main stress score). This questionnaire has been shown to have sufficient reliability and validity^{23, 24}. Overtime work characteristics and other work-related and sociodemographic variables were measured by an original self-reported questionnaire.

Variables

Psychological stress reactions

Psychological stress reactions (lack of vigor, anger-irritability, fatigue, anxiety, and depression) during the past 30 days were measured using corresponding scales of the BJSQ²². All items were rated on a 4-point Likert scale (1=Almost never, 4=Almost always). Total scores were used for analyses and higher scores indicated more severe

stress reactions. Cronbach's alpha was 0.84²³).

Overtime work characteristics

Overtime work, the types and task content were measured by an original self-reported questionnaire. Participants were asked whether they worked longer than 7 hours and 45 minutes per day on weekdays: "Do you work overtime on weekdays?" (Yes=1, No=0); whether they worked on holidays: "Do you work on holidays?" (Yes=1, No=0); and whether they brought work home: "Do you bring your work home?" (Yes=1, No=0). If the participants answered "Yes", they were also asked how long they engaged in that type of overtime work, per week. Overtime working hours were recorded as continuous variables.

In addition, if the participants answered "Yes", participants were asked which tasks they engaged in while that type of overtime work. Based on the framework of the Teaching and Learning International Survey 2018 (TALIS 2018)⁹, the contents of the teachers' tasks were classified into 10 categories: student counseling, planning and preparing for lessons, tasks related to supplementary lessons or homework assignments, preparing tests or evaluating student performance, preparing for school events, administrative tasks related to school management, participating in conferences, parent-teacher association, club activity instruction, and others. A recent national survey conducted by the Ministry of Education, Culture, Sports, Science, and Technology in Japan⁶ regarded the six tasks (student counseling, planning and preparing for lessons, tasks related to supplementary lessons or homework assignments, preparing tests or evaluating student performance, preparing for school events, and club activity instruction) as the tasks related to the teaching students. Therefore, we divided these 10 tasks into two categories, namely "educational tasks" (student counseling, planning and preparing for lessons, tasks related to supplementary lessons or homework assignments, and preparing tests or evaluating student performance, preparing for school events, and club activity instruction) and "peripheral tasks" (administrative tasks related to school management, participating in conferences, parent-teacher association, and others). When participants engaged in only educational tasks on weekdays, a variable "only educational tasks on weekdays" was recorded as "1", otherwise it was recorded as "0". In addition, when participants engaged in only peripheral tasks on weekdays, a variable "only peripheral tasks on weekdays" was recorded as "1", otherwise it was recorded as "0". If participants engaged in both educational and peripheral tasks on weekdays, a variable "both tasks on weekdays" was recorded as

“1”, otherwise it was recorded as “0”. The contents of working on holidays and bringing work home were recorded similarly.

Sociodemographic and work-related variables

The following variables were measured and used as potential confounders in the analyses: age (20–29, 30–39, 40–49, 50–59 years old), gender (male and female), marital status (never married, currently married, and others), children living together (yes and no), type of school of employment (elementary school, junior high school, and integrated elementary and junior high school), number of students (>400, 301–400, 201–300, 101–200, and ≤100), in charge of homeroom class (yes and no), supervisor support (a continuous variable), and coworker support (a continuous variable). Supervisor support, coworker support, and job control were measured with three items of the BJSQ²⁴. All items were rated on a 4-point Likert scale (1=Not at all, 4=Extremely). Total scale scores were used for analyses and higher scores indicated higher perceived support or control. Cronbach’s alphas were 0.79 for supervisor support, 0.76 for coworker support, and 0.65 for job control²³.

Statistical analysis

Descriptive statistics, specifically means and standard deviations, were used for continuous variables and counts and percentages for categorical variables.

First, the relationship between types of overtime work (working overtime on weekdays, working on holidays, and bringing work home: yes and no) and psychological stress reactions was analyzed by multiple linear regression models after adjusting for other variables (age, gender, marital status, children living together, type of school, number of students, in charge of homeroom class, supervisor support, coworker support, and job control). These models estimated the adjusted mean difference, 95% confidence intervals (CIs), and p-values. We also estimated the adjusted unstandardized coefficient (slope) and its 95% CI between number of hours spent in each of the three types of overtime working, instead of the type of overtime working, and psychological stress reactions in the same multiple linear regression model.

Second, we developed models which evaluated whether task content (i.e., only educational tasks, only peripheral tasks, and both tasks: yes and no) interacts with each of the three types of overtime work on psychological stress reactions. Production term of task content (only educational tasks, only peripheral tasks, and both tasks: yes and no) and types of overtime working (working overtime on week-

days, working on holidays, and bringing work home: yes and no) were included in the multiple linear regression model to assess the interaction between task content and types of overtime working with psychological stress reactions. In addition, we changed the types of overtime working to overtime working hours per week during each of the three types of overtime work in the same multiple linear models and evaluated interactions of number of hours spent in overtime work and task content with psychological stress reactions.

In the eligible population, 2,087 participants had at least one missing data for variables used in the regression analysis. We imputed these missing data by using multiple imputation technique with chained equation by MI procedure and MIANALYZE procedure in SAS (SAS Institute Inc., Cary, North Carolina). Variables included in the imputation models were the psychological stress reactions and the same covariates for each regression model. Imputation was performed using fully conditional specification. Twenty imputed datasets were created for each analysis, and each regression parameter was combined by the Rubin’s rule²⁵.

All statistical tests were considered as statistically significant if the p-value was less than 0.05. All analyses were performed using R version 4.0.0, R Studio version 1.2.5042 for Windows and SAS STAT 15.1 (SAS Institute Inc., Cary, North Carolina).

Results

Table 1 shows the characteristics of the participants from elementary schools and junior high schools. The mean score of psychological stress reactions was 38.4 and the mean score of overtime working hours per week on weekdays, on holidays and at home were 16.4, 2.6 and 2.6, respectively. About 50% of the participants were female, currently married, living with children, and 75.0% of the participants were in charge of homeroom class. The mean score of supervisor support, coworker support, and job control were 8.7, 9.1 and 7.8, respectively. As shown in Table 2, almost all teachers (97.7%) worked overtime and 71.9% teachers had worked overtime with both educational and peripheral tasks during weekdays. Moreover, 76.6% of the teachers worked on holidays, and 53.0% of the teachers brought unfinished work home. The mean of overtime work hours per week on weekdays was 15.6 hours among teachers who had only educational tasks, 15.9 hours among teachers who had only peripheral tasks, and 17.2 hours among teachers who had both tasks. Regardless of working type, the mean score of overtime working hours spent per-

Table 1. Characteristics of participants working at public elementary and junior high school in Gifu Prefecture, Japan, from May to July 2018 (N=6,135)

Variables	n (%)	Variables	n (%) Mean (SD) [Min, Max]
Age (years)		In charge of homeroom class	
20–29	1,776 (28.9%)	No	1,475 (24.0%)
30–39	1,319 (21.5%)	Yes	4,600 (75.0%)
40–49	1,401 (22.8%)	missing	60 (1.0%)
50–59	1,627 (26.5%)		
missing	12 (0.2%)		
Gender		Overtime work hours	
Male	2,710 (44.2%)	Working on weekdays	16.4 (12.2) [0, 125]
Female	3,409 (55.6%)		
missing	16 (0.3%)		
Marital status		Working on holidays	2.6 (2.8) [0, 25]
Never married	2,273 (37.0%)		
Currently married	3,716 (60.6%)	Bringing work home	2.6 (4.1) [0, 80]
Others	83 (1.4%)		
missing	63 (1.0%)		
Children living together		Supervisor support	8.7 (2.1) [3, 12]
No	3,499 (57.0%)		
Yes	2,634 (42.9%)		
missing	2 (0.0%)		
Type of school		Coworker support	9.1 (2.0) [3, 12]
Elementary school	3,796 (61.9%)		
Junior high school	2,328 (37.9%)		
Integrated school	11 (0.2%)	Job control	7.8 (1.7) [3, 12]
missing	0 (0.0%)		
Number of students		Psychological stress reactions	38.4 (10.0) [18, 72]
More than 400	2,805 (45.7%)		
301–400	903 (14.7%)		
201–300	808 (13.2%)		
101–200	821 (13.4%)		
100 and less	739 (12.0%)		
missing	59 (1.0%)		

Table 2. Overtime work characteristics among participants working public elementary and junior high school in Gifu Prefecture, Japan (N=6,135)

Variables	n (%)	Overtime work hours per week Mean (SD)
Working overtime on weekdays		
None	144 (2.3%)	–
Only educational tasks	1,243 (20.3%)	15.6 (11.4)
Only peripheral tasks	190 (3.1%)	15.9 (14.6)
Both educational and peripheral tasks	4,409 (71.9%)	17.2 (12.1)
missing	149 (2.4%)	14.1 (8.1)
Working on holidays		
None	1,435 (23.4%)	–
Only educational tasks	1,989 (32.4%)	3.5 (2.7)
Only peripheral tasks	211 (3.4%)	2.3 (2.3)
Both educational and peripheral tasks	2,310 (37.7%)	3.7 (2.7)
missing	190 (3.1%)	3.1 (3.0)
Bringing work home		
None	2,885 (47.0%)	–
Only educational tasks	1,533 (25.0%)	5.1 (4.0)
Only peripheral tasks	192 (3.1%)	5.3 (4.1)
Both educational and peripheral tasks	161 (2.6%)	7.8 (6.6)
missing	1,364 (22.2%)	5.3 (4.5)

Educational tasks comprise student counseling, planning and preparing for lessons, tasks related to supplementary lessons or homework assignments, preparing tests or evaluating student performance, preparing for school events, and club activity instruction.

Peripheral tasks include administrative tasks related to school management, participating in conferences, parent-teacher association, and others.

forming both educational and peripheral tasks were longer than that of performing only educational tasks or peripheral tasks.

Table 3 shows the adjusted unstandardized coefficients (B) of the multiple regression analysis, which investigated the mean difference of the stress reaction score between teachers who had worked overtime and teachers who had not worked overtime according to the three types of overtime work (on weekdays, on holidays, and bringing work home). All types of overtime work were significantly associated with psychological stress reactions. The adjusted unstandardized coefficients (differences in mean of stress reaction score) were as follows: on weekdays, 2.45 (95%

CI=0.96–3.94; $p=0.001$), on holidays, 2.07 (95% CI=1.52–2.62; $p<0.001$), and bringing work home 0.51 (95% CI=0.03–0.99; $p=0.038$). Additionally, Table 4 shows the adjusted unstandardized coefficients of the multiple linear regression analysis of psychological stress reactions on the number of hours spent in overtime work according to the working types. All types of the number of hours spent per week in overtime work were significantly associated with psychological stress reactions. A one-hour increase in the number of hours spent per week in overtime work is associated with 0.06 points (95% CI=0.04–0.09; $p<0.001$), 0.38 points (95% CI=0.29–0.47; $p<0.001$), and 0.07 points (95% CI=0.01–0.13; $p=0.016$) increase in stress reaction score

Table 3. Multiple regression analyses predicting psychological stress reactions from the types of overtime work among public elementary and junior high school teachers in Gifu Prefecture, Japan (N=6,135)

Variables	B	95% CIs		<i>p</i> value
Working overtime on weekdays (reference: No)	2.45	0.96	– 3.94	0.001
Working on holidays (reference: No)	2.07	1.52	– 2.62	<0.001
Bringing work home (reference: No)	0.51	0.03	– 0.99	0.038
Age (reference: 20–29 years)				
30–39	–0.74	–1.43	– –0.04	0.037
40–49	–1.26	–2.01	– –0.50	0.001
50–59	–1.43	–2.18	– –0.68	<0.001
Gender (reference: Male)	0.46	–0.02	– 0.95	0.061
Marital status (reference: Never married)				
Currently married	–0.93	–1.59	– –0.26	0.006
Others	0.15	–1.89	– 2.18	0.888
Children living together (reference: No)	0.23	–0.37	– 0.84	0.452
Type of school (reference: Elementary school)				
Junior high school	0.84	0.03	– 1.05	0.039
Integrated school	0.22	–5.71	– 4.70	0.850
Number of students (reference: More than 400)				
301–400	–0.17	–0.83	– 0.49	0.611
201–300	0.27	–0.43	– 0.97	0.447
101–200	0.19	–0.50	– 0.89	0.583
100 and less	–0.38	–1.11	– 0.34	0.299
In charge of homeroom class (reference: No)	0.71	0.13	– 1.28	0.016
Supervisor support	–0.59	–0.76	– –0.43	<0.001
Coworker support	–0.63	–0.80	– –0.45	<0.001
Job control	–1.87	–2.01	– –1.73	<0.001

B: Unstandardized coefficient, CIs: confidence intervals.

on weekdays, holidays, and bringing work home, respectively.

Table 5 shows the adjusted differences in mean of stress reaction score of the task content of overtime work and interaction between overtime working and its task content according to the working types. On weekdays, engaging in both tasks was significantly associated with psychological stress reactions ($B=2.36$; 95% $CI=0.96-3.77$; $p=0.001$). All kinds of task content on holidays were significantly associated with psychological stress reactions ($B=1.34$; 95%

$CI=0.71-1.97$; $p<0.001$, $B=1.89$; 95% $CI=0.55-3.23$; $p=0.006$ and $B=2.38$; 95% $CI=1.77-3.00$; $p<0.001$, respectively). On the other hand, all kinds of task content at home were not significantly associated with psychological stress reactions. Interactions between only educational tasks and both tasks were statistically significant on weekdays and holidays ($p=0.001$ and $p<0.001$, respectively), and not significant at home. Table 6 shows the adjusted unstandardized coefficients of the multiple linear regression analysis of psychological stress reactions on overtime working

Table 4. Multiple regression analyses predicting psychological stress reactions from the number of hours spent in overtime work among public elementary and junior high school teachers in Gifu Prefecture, Japan (N=6,135)

Variables	B	95% CIs		<i>p</i> value
Working overtime on weekdays (h/week)	0.06	0.04	– 0.09	<0.001
Working on holidays (h/week)	0.38	0.29	– 0.47	<0.001
Bringing work home (h/week)	0.07	0.01	– 0.13	0.016
Age (reference: 20-29 years)				
30–39	–0.74	–1.43	– –0.04	0.038
40–49	–1.25	–2.00	– –0.50	0.001
50–59	–1.21	–1.96	– –0.47	0.001
Gender (reference: Male)				
	0.78	0.30	– 1.27	0.002
Marital status (reference: Never married)				
Currently married	–0.76	–1.42	– –0.10	0.024
Others	0.13	–1.89	– 2.15	0.902
Children living together (reference: No)				
	0.23	–0.38	– 0.83	0.461
Type of school (reference: Elementary school)				
Junior high school	0.11	–0.41	– 0.63	0.680
Integrated school	–1.42	–6.59	– 3.76	0.592
Number of students (reference: More than 400)				
301–400	–0.13	–0.79	– 0.54	0.705
201–300	0.40	–0.28	– 1.09	0.249
101–200	0.38	–0.31	– 1.08	0.280
100 and less	–0.27	–1.00	– 0.46	0.475
In charge of homeroom class (reference: No)				
	0.77	0.20	– 1.34	0.008
Supervisor support				
	–0.59	–0.76	– –0.43	<0.001
Coworker support				
	–0.62	–0.79	– –0.45	<0.001
Job control				
	–1.84	–1.98	– –1.70	<0.001

B: Unstandardized coefficient, CIs: confidence intervals.

hours per week and their interaction between overtime working hours and its task content according to the working types. On weekdays, overtime working hours for both tasks were significantly associated with psychological stress reactions ($B=0.07$; 95% CI=0.05–0.09; $p<0.001$). Overtime working hours on holidays were significantly associated with psychological stress reactions in all three task contents ($B=0.27$; 95% CI=0.15–0.40; $p<0.001$, $B=0.45$;

95% CI=0.05–0.86; $p=0.029$ and $B=0.42$; 95% CI=0.32–0.53; $p<0.001$, respectively). Conversely, overtime working hours for only educational tasks at home was significantly associated with psychological stress reactions ($B=0.09$; 95% CI=0.01–0.17; $p=0.025$). Fig. 1 shows the interaction plot of task content and overtime working hours for psychological stress reactions. The slope of a single showed the adjusted unstandardized coefficients of the re-

Table 5. Multiple regression analyses predicting psychological stress reactions from contents of overtime work among public elementary and junior high school teachers in Gifu Prefecture, Japan (N=6,135)

Variables	B	95% CIs		<i>p</i> value	Interaction <i>p</i>	
Working overtime on weekdays (reference: No)						
Only educational tasks	1.35	-0.11	-	2.82	0.070	Ref.
Only peripheral tasks	1.86	-0.08	-	3.80	0.060	0.498
Both educational and peripheral tasks	2.36	0.96	-	3.77	0.001	0.001
Working on holidays (reference: No)						
Only educational tasks	1.34	0.71	-	1.97	<0.001	Ref.
Only peripheral tasks	1.89	0.55	-	3.23	0.006	0.426
Both educational and peripheral tasks	2.38	1.77	-	3.00	<0.001	<0.001
Bringing work home (reference: No)						
Only educational tasks	0.23	-0.34	-	0.80	0.426	Ref.
Only peripheral tasks	-0.04	-1.35	-	1.28	0.957	0.703
Both educational and peripheral tasks	1.22	-0.12	-	2.57	0.075	0.163

B: Unstandardized coefficient, CIs: confidence intervals.

Educational tasks comprise student counseling, planning and preparing for lessons, tasks related to supplementary lessons or homework assignments, preparing tests or evaluating student performance, preparing for school events, and club activity instruction. Peripheral tasks include administrative tasks related to school management, participating in conferences, parent-teacher association, and others.

sults of the multiple linear regression analysis. The slopes of both tasks were significantly steeper than that for only educational tasks on weekdays and holidays ($p=0.009$ and $p=0.025$, respectively), but this interaction was not significant on holidays and at home.

Discussion

This study showed that teachers who worked overtime on weekdays, worked on holidays, and brought work home had significantly higher psychological stress reactions than teachers who did not work overtime. In addition, a one-hour increase in the number of hours spent per week showed significantly higher stress reaction score on all overtime work types. In contrast, overtime working hours to perform both educational tasks and peripheral tasks showed significantly higher psychological stress reactions

than performing only educational tasks on weekdays and holidays, while the association between overtime working hours and psychological stress reactions did not differ significantly between the task content at home.

Working overtime on weekdays, working on holidays, and bringing work home were all significantly associated with psychological stress reactions, and therefore our hypothesis (H_1) was fully supported. This is the first study to assess the overtime working being free from omissions or duplications by measuring all of three types. The findings were inconsistent with a previous study that reported a non-significant association between working at home and mental health¹⁾. Possible reasons for the discrepancy could be caused by the difference of the sample size. The number of participants in the previous study was around 400, and therefore might not clearly show the associations. Recently, the Japanese government suggested that teachers should

Table 6. Multiple regression analyses predicting psychological stress reactions from number of hours spent in overtime work among public elementary and junior high school teachers in Gifu Prefecture, Japan (N=6,135)

Variables	B	95% CIs		<i>p</i> value	Interaction <i>p</i>	
Working overtime on weekdays						
Only educational tasks	0.03	-0.01	-	0.06	0.106	Ref.
Only peripheral tasks	0.05	-0.03	-	0.13	0.211	0.604
Both educational and peripheral tasks	0.07	0.05	-	0.09	<0.001	0.009
Working on holidays						
Only educational tasks	0.27	0.15	-	0.40	<0.001	Ref.
Only peripheral tasks	0.45	0.05	-	0.86	0.029	0.403
Both educational and peripheral tasks	0.42	0.32	-	0.53	<0.001	0.025
Bringing work home						
Only educational tasks	0.09	0.01	-	0.17	0.025	Ref.
Only peripheral tasks	0.11	-0.10	-	0.31	0.306	0.879
Both educational and peripheral tasks	0.07	-0.08	-	0.23	0.347	0.848

B: Unstandardized coefficient, CIs: confidence intervals.

Educational tasks comprise student counseling, planning and preparing for lessons, tasks related to supplementary lessons or homework assignments, preparing tests or evaluating student performance, preparing for school events, and club activity instruction. Peripheral tasks include administrative tasks related to school management, participating in conferences, parent-teacher association and others.

reduce working hours at school and go back home as soon as possible in order to prevent overwork and deterioration of teachers' health. However, teachers have too many tasks to finish working at school, and need to bring unfinished work home secretly. Our study has shown that not only working overtime at school but also bringing work home might affect teachers' mental health, and it suggests that we need to find some ways to reduce teachers' tasks and prevent overtime working both at school and at home.

On weekdays and holidays, overtime working to engage both educational tasks and peripheral tasks showed significantly higher psychological stress reactions than engaging only educational tasks, and therefore our hypothesis (H_2) were partially supported. This is the first study to show that engaging in both tasks resulted in higher psychological stress reactions than engaging only in educational tasks, even if the number of hours spent per week was the same. Peripheral tasks are not directly related to students' education and might be perceived as less motivating and time-consuming²⁵). When teachers are required to perform peripheral tasks while engaging educational tasks, they might feel that peripheral tasks disturb educational tasks.

This interruption might make teachers feel more stressful. It might be possible to manage psychological stress reactions not only by reducing overtime working hours but also by splitting the role of task contents.

Contrary to our hypothesis, there was no significant interaction between working overtime (overtime working hours) and their task content at home. This result suggests that adding peripheral tasks to educational tasks did not significantly increase teachers' psychological stress reactions when teachers bring work home. However, working hours spent performing only educational tasks at home was significantly correlated with psychological stress reactions. Previous studies examining the association between bringing work home and teachers' mental health have shown mixed results^{12,13}), and therefore the present study considering task content may provide a new finding.

The present study has shown that whether peripheral tasks are associated with psychological stress reactions might differ depending on the type of overtime work. Peripheral tasks on weekdays were associated with psychological stress reactions only when teachers engaged educational tasks and peripheral tasks simultaneously, while

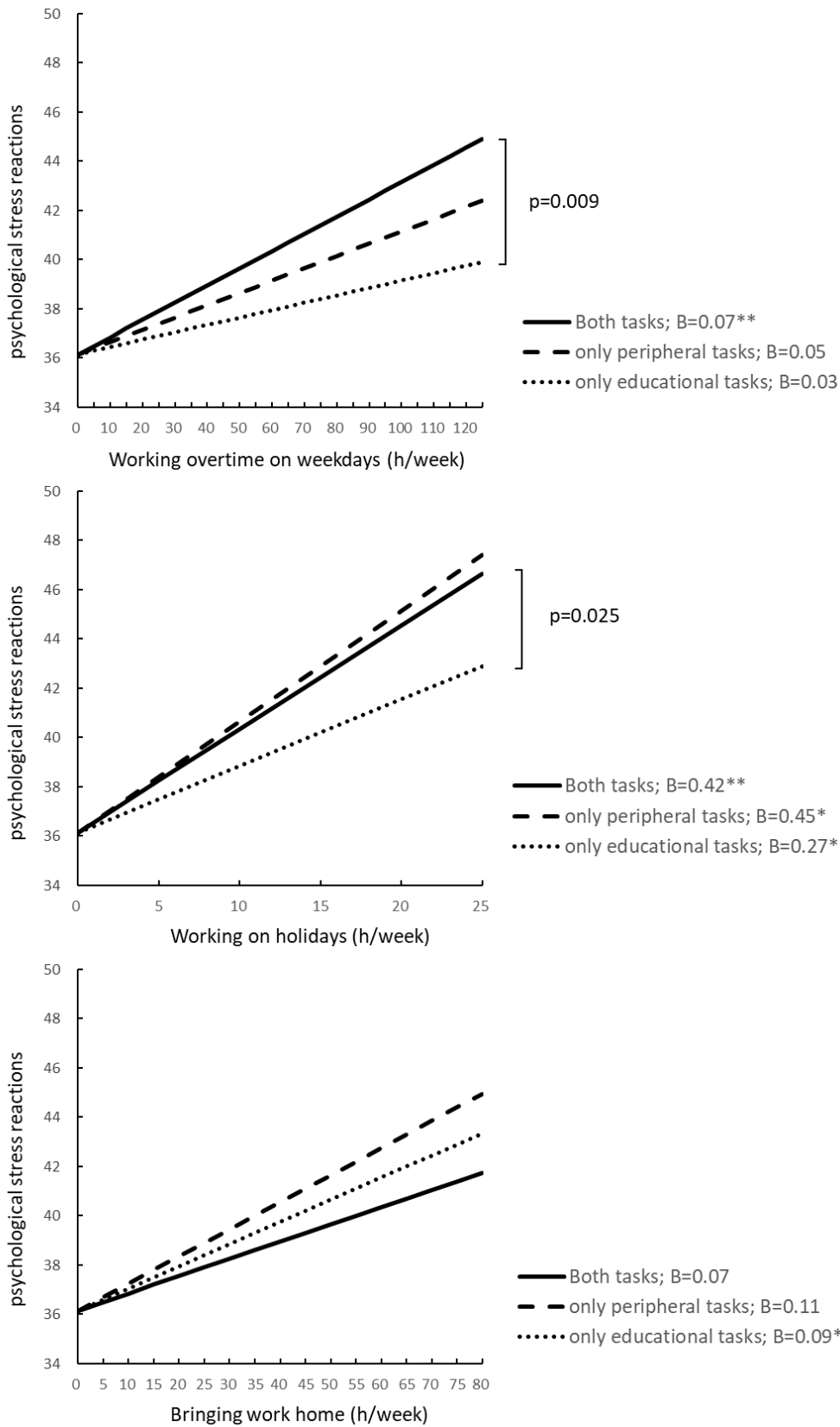


Fig. 1. Interaction effect of task content on the association between number of hours spent in overtime work and psychological stress reactions among public elementary and junior high school teachers in Gifu Prefecture, Japan (N=6,135). B: Unstandardized coefficient. * $p < 0.05$; ** $p < 0.01$

peripheral tasks on holidays were associated with psychological stress reactions by itself. On the other hand, peripheral tasks at home were not significantly associated with psychological stress reactions. These findings are consistent with the previous studies that reported that both educational tasks and peripheral tasks might affect teachers' mental health²⁴⁻²⁶, and provide new evidence for the differences depending on the overtime work types.

This study had several limitations. First, it was a cross-sectional study, and causal relationships could not be determined. Second, the effects of several confounding factors such as individual traits (e.g., teachers' ability or motivation) and medical factors were not evaluated in this study. Third, all variables were assessed using self-reported questionnaires; therefore, information bias and measurement errors may exist. Fourth, there are several classifications of teachers' task and there is no consensus on the definition of peripheral tasks among Japanese teachers. Participating in conferences or engaging administrative work might be indirectly related to students' education, and it is difficult to distinguish between core and non-core tasks. Finally, Japanese teachers have a unique working style (e.g., almost all teachers work overtime on weekdays or spend extensive time on extracurricular activities) compared with other countries. Therefore, the generalizability of our findings to teachers outside Japan is limited.

In conclusion, this study suggests that working overtime on weekdays, working on holidays, and bringing work home is associated with psychological stress reactions among school teachers in Japan. Thus, reducing overtime work regardless of work types is the most important for mitigating psychological stress reactions among teachers. Moreover, overtime working hours spent engaged in both educational tasks and peripheral tasks may be associated with higher psychological stress reactions than those spent engaged only in educational tasks on weekdays and holidays. On weekdays, it might be possible to manage psychological stress reactions by splitting the role of task contents.

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Conflict of Interest

None declared.

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Ethical Considerations & Disclosure

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and following the Helsinki Declaration of 1975, as revised in 2013. Informed consent was obtained from all participants included in the study. This study was approved by the Institutional Ethics Review Board at Tokai Central Hospital (Approval No. 2017101601) and fully supported by the Board of Education, Gifu Prefecture.

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