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Original Article

Comparison of primary school teachers' stress responses between pre-pandemic and pandemic periods: a large-scale nationwide survey in Japan

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Abstract: A schoolteacher's job is considered one of the most stressful occupations globally. The coronavirus disease 2019 pandemic has posed further challenges for schoolteachers. This study aimed to examine the effects of the pandemic on primary school teachers' stress responses in Japan. We analyzed the data from a nationwide survey of public-school teachers conducted between June 2019 and December 2021. The total numbers of participants were 65,968 in 2019, 72,248 in 2020, and 75,435 in 2021. Working hours and perceived main stressors as well as stress response scores were assessed. Contrary to expectations, the results showed that the stress response scores among primary school teachers did not increase in the first year of the pandemic. Rather, the stress response scores and the proportion of high-stress teachers significantly decreased from the pre-pandemic year (2019) to the first year of the pandemic (2020). However, the stress response scores showed a rising trend in the second year of the pandemic (2021). Participants' working hours decreased from 2019 to 2021. The findings in relation to teachers' main stressors matched these trends. Continuous monitoring of teachers' stress levels is required both during and after the pandemic.

Key words: Teachers, Stress responses, Coronavirus disease 2019 (COVID-19) pandemic, Primary schools, Stressors, Working hours

Introduction

A schoolteacher's job is considered one of the most stressful occupations worldwide[1, 2]. Teachers are exposed to various sources of stress, including high quantitative workload, misbehaving students, and dealing with difficult parents[3–6]. Occupational stress is linked to decreased job satisfaction and reduced performance among teachers, which may negatively affect students' educational achievements[4]. According to the Teaching and Learning International Survey conducted by the Organization for Economic Cooperation and Development (OECD) in 2018, the average weekly working hours of school teachers in Japan were the highest among OECD member countries[7]. In Japan, the percentage of schoolteachers taking leave owing to mental illnesses has increased more than fivefold from 0.11% in 1992 to 0.59% in 2019[8].

The emergence of coronavirus disease 2019 (COVID-19) in China at the end of 2019 led to a global pandemic, gen-

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erating even more challenges for schoolteachers[9]. Studies undertaken during the pandemic reported a growing prevalence of anxiety and depression among teachers[9, 10]. Countries implemented social distancing measures to prevent the spread of the contagion[11]. The pandemic brought education systems all over the world to a halt, with school closures affecting millions of children. Online teaching methods were adopted to replace traditional face-to-face classroom lessons[12]. Teachers experienced significant psychological distress owing to the workload involving unfamiliar online education methods during the periods of lockdown[13]. Even after schools reopened, teachers remained under considerable psychological pressure as they had to continue implementing countermeasures against the spread of infection while carrying out regular school duties and educating students. Although the younger generation was less likely to become seriously ill if infected[14], the risk of students' becoming infected was associated with increased levels of anxiety among teachers. Teachers experienced fears related to becoming infected and possible outbreaks in school. A high percentage of teachers experienced anxiety and depression even after the schools reopened[9, 15].

The COVID-19 pandemic is particularly challenging for primary school teachers[16]. As primary school children generally have less emotional self-regulation, given their younger age, it is difficult for primary school teachers to ensure that children abide by infection prevention measures. Online teaching is also challenging in primary schools. Some children may lack sufficient Internet access at home, while for others with Internet access. In addition, it may be difficult for children in their primary school ages to concentrate on learning using video chat[17]. Therefore, the mental health of primary school teachers would be particularly affected by the pandemic.

In Japan, the state of emergency was declared for the first time on April 7, 2020 with regard to the pandemic. Most schools were temporarily closed and reopened on June 1, 2020. However, with many outbreaks among primary and middle school students, COVID-19 cases continued to spread throughout the country. Therefore, appropriate measures had to be taken to prevent infection while conducting face-to-face classes. In the Japanese educational system, homeroom teachers in primary schools generally teach all subjects from math and science to physical education while being expected to engage in a wide variety of duties other than academic teaching in class. These duties include providing guidance concerning students' daily lives, dealing with students who are absent from school, and contacting with parents or guardians when necessary. Accordingly, stress levels among homeroom teachers in charge of a class are higher than those among teachers who are not required to exercise such responsibilities[18, 19]. Considering these massive duties of homeroom teachers in Japan, the pandemic would affect their mental health immensely.

Given this context, the stress levels of primary school teachers in Japan, especially those in charge of classes, could substantially increase during the pandemic. Thus, to maintain primary school teachers' mental health, it is crucial to monitor their stress levels regularly. To assess schoolteachers' occupational stress levels accurately and without bias, a large-scale national-level survey covering a high percentage of the target population is necessary. However, as far as we know, no nationwide surveys having a sufficiently high participation rate exist on this topic.

In Japan, the Stress Check Program was introduced by the government in 2015, to help address mental health problems among workers. The Stress Check Program requires enterprises to implement a "Stress Check" test once a year in workplaces with 50 or more employees[20]. This program assesses employees' work-related stresses and stress symptoms. A significant number of public primary-school teachers in Japan have participated in this program every year.

This study examined the influence of the COVID-19 pandemic on primary-school homeroom teachers' stress responses by analyzing the data obtained from the Stress Check Program conducted for public school employees all across Japan. By comparing pre-pandemic survey data (in 2019) with pandemic-related survey data (in 2020–2021), we aimed to assess the effects of the COVID-19 pandemic on primary school teachers' mental health.

Subjects and Methods

Sample and data collection procedure

We used data from the Stress Check Program conducted for public school employees in all prefectures in Japan by the Mutual Aid Association of Public School Teachers. This survey is performed between the months of June and December each year through a web-based questionnaire. The questionnaire does not include questions specifically related to the effects of the COVID-19 pandemic on teachers' mental health. However, it does include a variety of questions related to teachers' occupational stresses, such as their stress response levels, working hours, demographic variables, and perceived causes of stress. The total

numbers of public primary-school employees participating in this program were 124,342 in 2019, 138,153 in 2020, and 144,123 in 2021, which comprised 80.0%, 81.1%, and 82.9% of all eligible employees, respectively. We could not obtain precise information regarding the proportion of public primary-school teachers who participated in the Stress Check Program in all three years from 2019 to 2021. However, considering the program's high participation rate (80.0%–82.9%), a considerably large proportion of public primary-school teachers may have participated in this program in all three years.

As noted, stress levels among homeroom teachers in Japan are higher than those among teachers not in charge of a class, and their mental health would be significantly affected by the pandemic. Therefore, we used the data concerning homeroom teachers in public primary schools for the analysis. The inclusion criteria for the participants involved being: (1) a full-time tenure-position teacher working at a public primary school, and (2) a homeroom teacher in charge of a class. The exclusion criteria involved being: (1) a part-time or fixed-term teacher, (2) a teacher not in charge of a class, and (3) aged 60 years and above. No participants had missing data. The total numbers of eligible participants were 65,968 in 2019, 72,248 in 2020, and 75,435 in 2021. Figure 1 shows the flowchart of eligible participants.

Measurements

Demographic variables

We obtained participants' demographic information regarding sex, age, and years of experience as a full-time teacher. Regarding sex, previous studies have reported gender differences in stress levels among teachers, with female teachers exhibiting higher stress levels than male teachers[21, 22]. Teachers' years of experience are also reported to be associated with their stress levels[23]; previous studies have revealed that younger teachers with less teaching experience expressed higher stress levels and lower job satisfaction[23, 24]. Therefore, in this study, we also examined the association between gender, years of teaching experience, and stress response levels among schoolteachers.

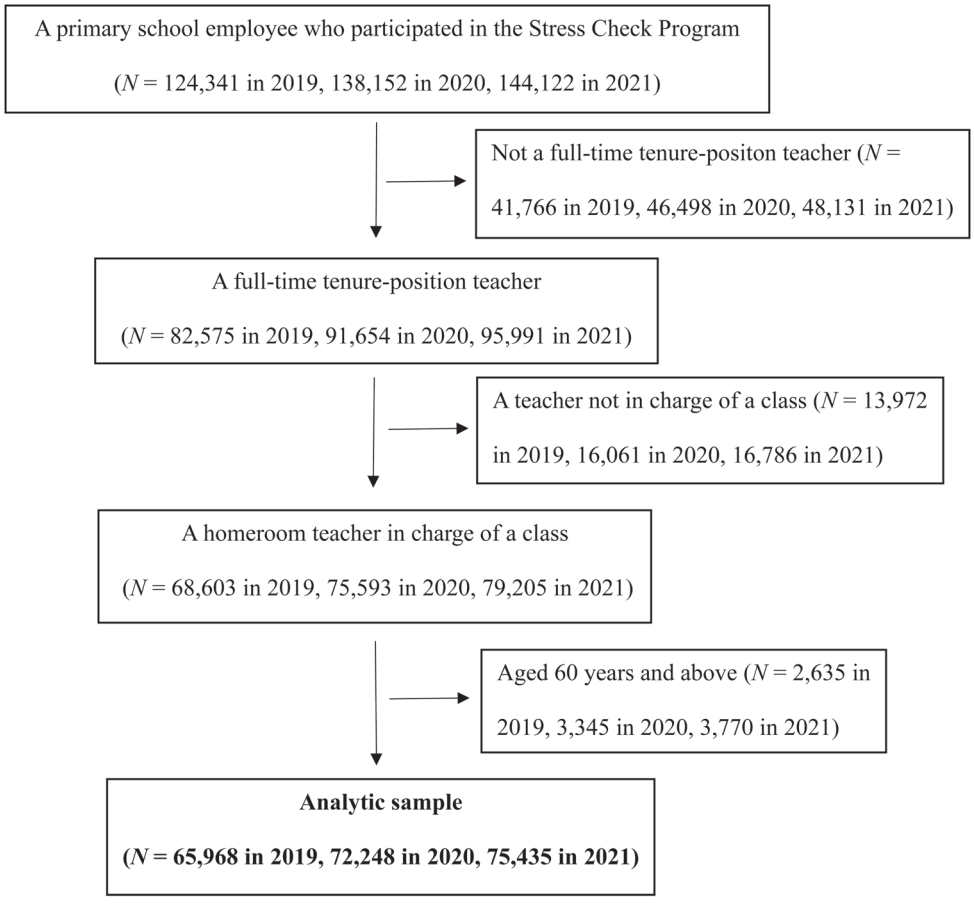

Fig. 1. Flowchart of eligible participants.

Working hours

We collected data on working hours per day, with the seven response options, as follows: (1) less than 8 h (hours), (2) 8 to 9 h, (3) 9 to 10 h, (4) 10 to 11 h, (5) 11 to 12 h, (6) 12 to 13 h, and (7) 13 h or more. The data on working hours in this survey were based on self-reported information, including the time for engaging in various duties other than academic teaching in class. These included preparation of teaching materials, clerical tasks, school management duties, contacting with parents, and extracurricular club activities. Owing to the small number of participants working less than 8 h, participants working less than 8 h and 8 to 9 h were combined to form one group (less than 9 h) for the analysis.

Stress response scores

In the Stress Check Program, the Brief Job Stress Questionnaire (BJSQ) is used to assess teachers' stress levels. Several different language versions of the BJSQ are available for download[25]. The BJSQ is widely used in the field of occupational health in Japan, and is an established questionnaire to identify high-stress workers[26, 27]. It is a 57-item scale, based on the Job Stress Model presented by the National Institute for Occupational Safety and Health[28].

This questionnaire assesses the following three aspects of work-related stress factors: job stressors (17 items), psychological and physical stress responses (29 items), and buffering factors such as social support (11 items). All BJSQ scales have acceptable or high levels of internal consistency reliability and factor-based validity[28]. Each item is rated on a four-point Likert scale (1=almost never, 2=sometimes, 3=often, 4=almost always). The scores for stress responses and the sum of job stressors and social support items range from 29 to 116 and from 26 to 104, respectively, with higher stress response scores indicating higher stress levels and higher social support scores indicating higher levels of social support.

In this study, the total score of the psychological and physical stress responses (29 items) was included in the analysis. Of the 29 items, 18 concern psychological stress responses including the following five dimensions: liveliness (3 items; e.g., "I have been full of energy"), irritability (3 items; e.g., "I have felt angry"), fatigue (3 items; e.g., "I have felt exhausted"), anxiety (3 items; e.g., "I have felt restless"), and depression (6 items; e.g., "I have been depressed"). Physical stress responses are assessed by 11 questions on physical symptoms (e.g., "I have experienced headache"). The total score of psychological and physical stress responses exhibit high internal consistency (Cronbach's α= 0.90)[28]. The stress response scores measured by the BJSQ are likely to help in predicting a significant risk of the onset of depression among workers[26].

High stress information

The Stress Check Program manual uses criteria for defining high-stress employees based on the BJSQ[29]. "High stress" is defined as the highest level of stress response (Criterion A) or having a moderate level of stress response, together with the highest scores of job stressors (or the lowest level of social support in the workplace) (Criterion B). The cutoff scores used in the program manual are 77 for the stress response score (Criterion A) or 76 for job stressor and social support scores combined with 63 for the stress response score (Criterion B)[29].

The criteria were established based on expert consensus, and studies have shown that employees identified as high stress exhibit a significant risk for turnover and long-term sickness absence[30, 31]. We obtained information regarding participants' high stress status based on these criteria, and compared the proportion of high-stress participants between 2019, 2020, and 2021.

Perceived main stressors of schoolteachers

Participants were asked to choose their main stressors out of the following items (up to two items could be selected): (1) responsibility for students' learning, (2) school management duties, (3) giving a demonstration lesson, (4) leading extra-curricular club activities (5) dealing with difficult students, (6) dealing with challenging parents, (7) workload of clerical tasks, (8) relationship with colleagues, (9) relationship with supervisors, (10) unfamiliar work environment due to a transfer, (11) long commuting time, (12) personal problems, (13) other problems, and (14) nothing particular. The survey items on teachers' main stressors were selected by the Mutual Aid Association of Public School Teachers based on the opinions of psychiatrists and psychologists in affiliated hospitals. The percentages of participants who selected "extra-curricular club activities", "unfamiliar work environment", "long commuting time", and "other problems" as their main stressors were relatively minuscule (less than 5%); therefore, these items were excluded from the analysis.

Statistical analysis

Continuous variables were expressed as means (*M*) with standard deviation (*SD*) and medians (*Mdn*) with interquartile range (*IQR*). Categorical variables were expressed as numbers of cases with percentages. The normality of

distribution was assessed using the Kolmogorov–Smirnov test, and all continuous variables were found to deviate significantly from the normal distribution ($p<0.001$). Differences in continuous variables were compared using the Mann–Whitney U test for two variables, and the Kruskal–Wallis test for more than three variables. A post-hoc test using Dunn's test with Bonferroni correction was performed. For the statistical analysis of categorical valuables, cross-tabulated frequencies and percentages were calculated, and all associations were quantified using the chi-squared (χ^2) test. Epsilon-squared (ε^2) and Cramer's V were used as the effect size measure for the Kruskal–Wallis test and the χ^2 test respectively. A post-hoc test for the χ^2 test was performed using the residual analysis. In the residual analysis, when the absolute value of the adjusted residual (AR) is greater than 1.96, the observed frequency is considered to differ significantly from the expected frequency. The correlation between continuous variables was assessed using Spearman's correlation coefficient. All statistical analyses were performed using SPSS, Version 28 software (IBM Corp., Armonk, NY, USA). The level of significance for each test was fixed at 0.05.

This study used data from a large-scale nationwide survey (sample sizes were from 65,968 to 75,435 per year). In general, analysis power is substantially increased in a study that has a extremely large sample size. Consequently, it is possible to reject null hypotheses even though the difference is clinically negligible[32]. Therefore, we evaluated the results comprehensively based on the statistical test values as well as descriptive statistics and observed patterns or trends of variables.

Results

Participants characteristics

Participants' descriptive statistics are shown in Table 1. The percentages of female teachers were higher than those of male teachers in all three years (63.8%, 63.4%, and 63.2%, respectively). A χ^2 test of independence was performed to examine the relationship between gender ratio and survey year, with no significant difference in gender ratio found between 2019, 2020, and 2021 (χ^2 [2, N=21,3651]=5.858, p=0.053). The highest proportion of participants included those aged 20−29 yr (26.5% in 2019, 27.0% in 2020, and 27.2% in 2021) and 30−39 yr (26.4%, 26.7%, and 27.4%, respectively) in all three years. The lowest proportion of participants included those aged 40−49 yr (22.2%, 22.2%, and 21.9%, respectively) in all three years.

Relationship between participants' years of experience and stress response scores

Table 2 shows participants' years of experience as a full-time teacher and their correlation with stress response

Table 1. Participants demographics

		2019 (N=65,968)		2020 (N=72,248)		2021 (N=75,435)	
		N	%	*N*	%	*N*	%
Sex	Male	23,874	36.20%	26,419	36.60%	27,767	36.80%
	Female	42,094	63.80%	45,829	63.40%	47,668	63.20%
Age (years)	20–29	17,487	26.50%	19,481	27.00%	20,543	27.20%
	30–39	17,415	26.40%	19,326	26.70%	20,703	27.40%
	40–49	14,636	22.20%	15,912	22.20%	16,501	21.90%
	50–59	16,430	24.90%	17,529	24.30%	17,688	23.40%

The number of participants with their percentage is shown in each category.

Table 2. Participants' years of experience as a full-time teacher and their correlation with stress response scores

	2019 (N=65,968)	2020 (N=72,248)	2021 (N=75,435)
Years of experience (*Mdn* [*IQR*])[a]	10.0 (3.0–24.0)	9.0 (3.0–23.0)	9.0 (3.0–21.0)
Correlation coefficient[b]	0.033**	0.017**	0.009*

[a]Years of experience as a full-time teacher are shown as median (*Mdn*) with interquartile range (*IQR*).
[b]Spearman's correlation coefficients between participants' stress response scores and years of experience as a full-time teacher.
*p<0.05, **p<0.01.

scores. Participants' years of experience were *Mdn* (*IQR*)= 10.0 (3.0–24.0) in 2019, *Mdn* (*IQR*)=9.0 (3.0–23.0) in 2020, and *Mdn* (*IQR*)=9.0 (3.0–21.0) in 2021. The Kruskal–Wallis test showed a significant difference in participants' years of experience between 2019, 2020, and 2021 (χ^2 [2, *N*=21,3651]=14.123, $p<0.001$). However, the effect size of the difference was negligibly small (ε^2=0.0000661).

Spearman's correlation coefficient was calculated to analyze the correlation between participants' years of experience and their stress response scores. The results revealed a positive correlation between them in all three years, and the correlation was statistically significant (r=0.033, $p<0.001$ in 2019, r=0.017, $p<0.001$ in 2020, and r=0.009, p=0.0017 in 2019). However, the correlation was negligibly small ($r<0.02$) in all three years[33].

Changes in stress response scores from 2019 to 2021

The changes in participants' stress response scores from 2019 to 2021 are shown in Table 3. In all three years, the stress response scores of female teachers were higher than those of male teachers, and the differences were statistically significant (*U*=447,774,206.50, $p<0.001$ in 2019, *U*= 532,864,518.50, $p<0.001$ in 2020, and *U*=582,817,190.00, $p<0.001$ in 2021). The Kruskal–Wallis test showed a significant difference in stress response scores between 2019, 2020, and 2021 in both gender groups, (χ^2 [2, *N*=78,060]=60.948, $p<0.001$ in male teachers, and χ^2 [2, *N*=135,591]=88.401, $p<0.001$ in female teachers). The effect sizes of the difference were marginal for both genders (ε^2=0.000781 for male teachers and 0.000652 for female teachers). In addition, the changes in stress response scores between years were slight; however, the scores decreased from 2019 to 2020 and increased from 2020 to 2021 in a consistent pattern in both gender groups. A post-hoc test using Dunn's test showed significant differences in stress response scores between 2019 and 2020 ($p<0.001$) and between 2020 and 2021 ($p<0.001$) for both male and female teachers. The difference in stress response scores between 2019 and 2021 was not statistically significant in either gender group (p=0.509 in male teachers, and p=0.178 in female teachers).

Percentages of high-stress participants from 2019 to 2021

Table 4 shows the numbers and percentages of high-stress participants from 2019 to 2021. The proportion of participants categorized as "high stress" was the highest in 2021 in both gender groups (11.6% in male teachers and 10.0% in female teachers), and the lowest in 2020 (10.9% and 8.9%, respectively). A χ^2 test of independence was performed to examine the relationship between the number of high-stress participants and survey year. The relationship was significant in both gender groups, (χ^2[2, *N*=78,061]=10.620, p=0.005 in male teachers, and χ^2[2, *N*=135,591]=32.722, $p<0.001$ in female teachers). The effect sizes were marginal (Cramer's V=0.012 and 0.016, respectively), however, the patterns of change were similar to those of participants' stress response scores. The percentages of high-stress participants decreased from 2019 to 2020, and increased from 2020 to 2021 in both gender groups.

Comparisons of working hours between 2019, 2020, and 2021

Figure 2 shows percentages of participants in each working-hour category from 2019 to 2021. The percentages of participants in the longer working-hour categories

Table 3. The changes in stress response scores from 2019 to 2021

Gender	Year	*N*	*M* (*SD*)[a]	*Mdn* (*IQR*)[a]	Mean rank	χ^2	*p*
Male	2019	23,874	55.4 (14.86)	54.0 (44.0–64.0)	39620.58	60.948	<0.001[b]
	2020	26,419	54.5 (14.93)	53.0 (43.0–63.0)	38164.09		
	2021	27,767	55.3 (15.18)	54.0 (44.0–64.0)	39347.50		
Female	2019	42,094	57.9 (14.35)	56.0 (47.0–67.0)	68233.21	88.401	<0.001[b]
	2020	45,829	57.3 (14.37)	56.0 (47.0–66.0)	66426.04		
	2021	47,668	58.1 (14.71)	57.0 (47.0–67.0)	68727.02		

N: Number of cases; *M*: Mean; *SD*: Standard deviation; *Mdn*: Median, *IQR*: Interquartile range.

[a]The stress response scores ranged from 29 to 116.

[b]The Kruskal–Wallis test showed a significant difference in stress response scores between 2019, 2020, and 2021 in both gender groups. The effect sizes (ε^2) were 0.000781 for male teachers and 0.000652 for female teachers. A post-hoc test using Dunn's test showed significant differences in stress response scores between 2019 and 2020 ($p<0.001$) and between 2020 and 2021 ($p<0.001$) for both gender groups. The difference in stress response scores between 2019 and 2021 was not statistically significant in either gender group (p=0.509 in men, and p=0.178 in women).

Table 4. The percentages of high-stress participants from 2019 to 2021

			High-stress participants[a]				
Gender	Year	*N* (total)[b]	*N*	% (within the year)[c]	χ^2	*p*	Cramer's V
Male	2019	23,874	2,795	11.70%	10.620	0.005[d]	0.012
	2020	26,419	2,868	10.90%			
	2021	27,767	3,210	11.60%			
Female	2019	42,094	4,018	9.50%	32.722	<0.001[d]	0.016
	2020	45,829	4,083	8.90%			
	2021	47,668	4,768	10.00%			

[a]High stress is defined as the highest level of stress response or having a moderate level of stress response, together with having the highest scores of job stressors (or the lowest level of social support in the workplace).
[b]Total number of participants in the year.
[c]The percentages of high-stress participants decreased from 2019 to 2020, and increased from 2020 to 2021 in both gender groups.
[d]A χ^2 test of independence was performed to examine the relationship between the number of high-stress participants and survey year, and the result showed that the relationship was significant in both gender groups.

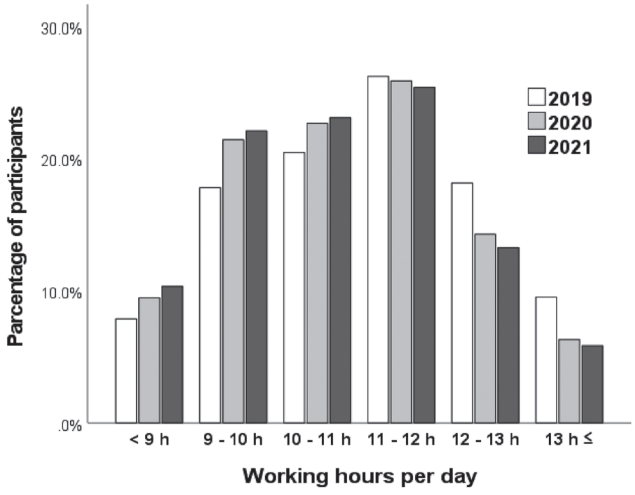

Fig. 2. Percentages of participants in each working-hour group: a comparison between 2019, 2020, and 2021. A χ^2 test of independence showed that the relation between working hours and survey year was statistically significant (p<0.001, Cramer's V=0.070).

(11–12 h, 12–13 h, and ≥13 h) were the highest in 2019 (26.3%, 18.1%, and 9.5%, respectively) and the lowest in 2021 (25.4%, 13.3%, and 5.8%, respectively). Meanwhile, the percentages in the shorter working-hour groups (≤9h, 9–10h, and 10–11h) were the lowest in 2019 (7.9%, 17.8%, and 20.5%, respectively) and the highest in 2021 (10.3%, 22.1%, and 23.1%, respectively). The working hours of participants consistently decreased from 2019 to 2021. A χ^2 test of independence was performed to examine the relationship between working hours and survey year. The results showed that the relation between these variables was statistically significant (χ^2[10, N=213,651]=2102.324, p<0.001, Cramer's V=0.070).

Figure 3 shows the box plots of stress response scores in each working-hour group from 2019 to 2021. The stress response scores increased as the working hours per day became longer in all three years. The Kruskal–Wallis test showed a significant difference in stress response scores between different working-hour groups in 2019 (χ^2[5, N=65,968)]=1,672.686, p<0.001, ε^2=0.0254), in 2020 (χ^2[5, N= 2,248]=1,906.649, p<0.001, ε^2=0.0264), and in 2021 (χ^2[5, N=75,435]=2,127.993, p<0.001, ε^2=0.0282). Moreover, a post-hoc test using Dunn's test showed significant differences in stress response scores between all working-hour group pairs in all three years (p<0.001). Except in the shortest working-hour group (<9 h), the stress response scores in 2021 were the highest in all working-hour groups among the three years (*Mdn*=53.0 in 9–10 h, 55.0 in 10–11 h, 57.0 in 11–12 h, 59.0 in 12–13 h, and 62.0 in >13 h). In contrast, the stress response scores in 2020 were the lowest in the shorter working-hour (<12 h) groups (*Mdn* = 52.0 in <9 h, 52.0 in 9–10 h, 54.0 in 10–11 h, and 55.0 in 11–12 h).

Comparisons of participants' perceived main stressors between 2019, 2020, and 2021

Table 5 shows the comparison of participants' perceived main stressors between 2019, 2020, and 2021. A χ^2 test of independence was performed to examine the association between the frequency of each stressor category and survey year. The effect sizes were marginal (Cramer's V=0.009−0.037), however, the association was significant in all stressor categories (p<0.001). The percentage of participants who chose "school management duties" as their main stressor was the highest in 2021 (15.2%, AR=10.0),

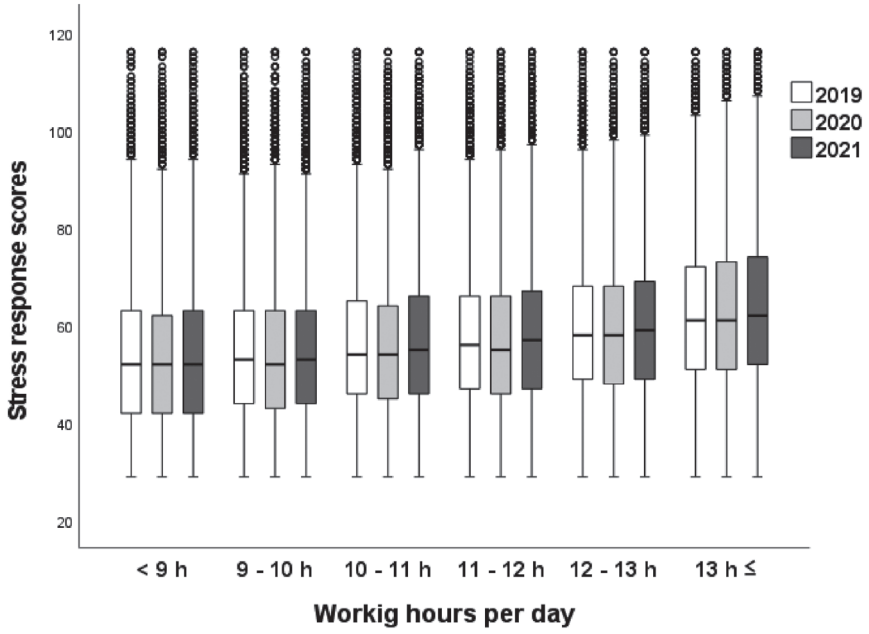

Fig. 3. Stress response scores in each working-hour group: a comparison between 2019, 2020, and 2021. The stress response scores increased as the working hours per day became longer in all three years. The Kruskal–Wallis test showed a significant difference in stress response scores between different working-hour groups in 2019 (p<0.001, ε^2=0.0254), in 2020 (p<0.001, ε^2=0.0264), and in 2021 (p<0.001, ε^2=0.0282).

and the lowest in 2020 (12.9%, AR=−12.4). The percentages of participants who chose "giving demonstration lessons", "dealing with challenging parents", and "workloads of clerical tasks" as their main stressor were the highest in 2019 (9.9%, AR=6.5; 16.3%, AR=4.2; and 24.8%, AR=16.5, respectively) and the lowest in 2020 (8.3%, AR=−10.9; 15.1%, AR=−6.4; and 21.1%, AR=−11.6, respectively). The percentage of participants who selected "dealing with difficult students" as their main stressor was the highest in 2021 (27.2%, AR=4.7) and the lowest in 2019 (25.9%, AR=−4.8). The percentage of participants who chose "nothing particular" was the highest in 2020 (20.1%, AR=11.1) and the lowest in 2019 (17.2%, AR=−12.4).

Discussion

This study investigated the effect of COVID-19 pandemic on the stress responses among primary-school homeroom teachers in Japan. Previous studies reported that teachers exhibited considerable fear toward COVID-19 infection and negative emotional responses, which were associated with their poor mental health during the pandemic[9, 34, 35]. However, contrary to expectations, teachers' stress response scores did not increase in the first year of the pandemic (2020). Rather, their stress response scores significantly decreased from 2019 to 2020 although the changes were minimal. The proportion of high-stress participants also decreased from 2019 to 2020. Survey results of the Ministry of Education, Culture, Sports, Science and Technology (MEXT) accord with these findings; according to this survey, the percentage of schoolteachers taking leave due to mental illness decreased from 0.59% in 2019 to 0.56% in 2020[8].

As far as we know, one previous study exists that revealed a similar result to our findings. Piao *et al.* investigated the differences in occupational stress across industries in Japan and indicated that stress among workers in the educational industry decreased from 2019 to 2020[36]. Detailed demographics of participants were not available in this study, nor did they discuss the reason of this finding; therefore, we could not examine this study any more than this. However, in general, most of the previous studies reported the substantial negative impact of the pandemic on schoolteachers' mental health[9, 10, 13, 15]. Our findings contrasted with those of most existing literature.

The possible reason for this contradicting result is that working hours of teachers in Japan had significantly decreased since the pandemic started (Fig. 2). Previous studies have found a significant association between long

Table 5. Comparisons of participants' perceived main stressors between 2019, 2020, and 2021

Main stressor		2019 (*N*=65,968)	2020 (*N*=72,248)	2021 (*N*=75,435)	χ^2	*p*	Cramer's V
Dealing with difficult students	Count	17,085	19,197	20,506	29.77	<0.001	0.012
	% (within the year)	25.90%	26.60%	27.20%			
	Adjusted residual	−4.8	−0.1	4.7			
Workload of clerical tasks	Count	16,345	15,229	16,596	289.976	<0.001	0.037
	% (within the year)	24.80%	21.10%	22.20%			
	Adjusted residual	16.5	−11.6	−4.5			
Dealing with challenging parents	Count	10,745	10,906	12,099	42.037	<0.001	0.014
	% (within the year)	16.30%	15.10%	16.00%			
	Adjusted residual	4.2	−6.4	2.3			
School management duties	Count	9,533	9,295	11,463	170.57	<0.001	0.028
	% (within the year)	14.50%	12.90%	15.20%			
	Adjusted residual	2.4	−12.4	10			
Responsibility for students' learning	Count	7,430	9,182	8,907	70.622	<0.001	0.018
	% (within the year)	11.30%	12.70%	11.80%			
	Adjusted residual	−6.5	7.8	−1.4			
Personal problems	Count	6,767	7,095	6,843	58.705	<0.001	0.017
	% (within the year)	10.30%	9.80%	9.10%			
	Adjusted residual	5.9	1.4	−7.2			
Demonstration lessons	Count	6,515	6,004	7,280	120.957	<0.001	0.024
	% (within the year)	9.90%	8.30%	9.70%			
	Adjusted residual	6.5	−10.9	4.5			
Relationship with colleagues	Count	6,362	6,780	6,566	40.463	<0.001	0.014
	% (within the year)	9.60%	9.40%	8.70%			
	Adjusted residual	4.5	1.8	−6.1			
Relationship with supervisors	Count	3,638	4,336	4,442	16.195	<0.001	0.009
	% (within the year)	5.50%	6.00%	5.90%			
	Adjusted residual	−3.2	2.1	1.1			
Nothing particular	Count	11,377	14,539	14,274	187.892	<0.001	0.030
	% (within the year)	17.20%	20.10%	18.90%			
	Adjusted residual	−12.4	11.1	1.0			

working hours and psychological distress[37], and between quantitative workload and prolonged fatigue among schoolteachers[38]. Similarly, this study revealed that as teachers' working hours became shorter, their stress response scores decreased accordingly (Fig. 3).

To prevent the spread of infection, many school activities and events remained cancelled in Japan even after schools reopened. These events included school trips, class visitations by parents, sports events, demonstration lessons involving attendance from other schools, and other extracurricular activities. The tasks related to these activities place a considerable burden on teachers in Japan[18]. These activities will contribute to the social and emotional development of students and are of great significance for their lives. Teachers generally understand the importance of these activities. Moreover, fulfilling related duties and tasks is associated with teachers' job satisfaction and motivation. However, as described, working hours of schoolteachers in Japan are the longest among the OECD member countries[7], indicating that their workloads had been considerably high prior to the pandemic. One reason for their extremely long working hours would be due to the large class size in Japanese schools. The student-teacher ratio is much higher in Japan compared with other OECD member countries[39]. A recent nationwide survey conducted by MEXT found a significant association between schoolteachers' working hours and student-teacher ratios[40]. Accordingly, teachers in Japan spend appreciable amount of time on related peripheral tasks such as marking or correcting student assignments and communication with parents or guardians[41]. Therefore, tasks related school events and other extracurricular activities, which

are important for students' personal growth and teachers' perception of job satisfaction, could impose an additional work burden on schoolteachers in Japan. According to the Japanese government's White Paper on Prevention of Death from Overworking, a high percentage of schoolteachers claim that the reconsideration of annual school events is necessary to reduce their excessive workload[42]. In this context, the cancellation of these activities during the COVID-19 pandemic possibly reduced teachers' workload substantially, leading to the significant decrease in their stress levels.

The analysis of teachers' perceived main stressors also supports this interpretation. The cancellation of school events or other activities led to a decrease of related tasks such as clerical works, school management assignments, communicating with parents or guardians, and participating in staff meetings. As shown in Table 5, the percentages of participants who chose "giving demonstration lessons", "dealing with challenging parents", "school management duties", and "workloads of clerical tasks" as their main stressor significantly decreased after the pandemic started. Moreover, the percentage of participants who answered "I do not have any particular stressors" was the highest in 2020, suggesting a decrease in their stress levels in the first year of pandemic.

Previous studies reported teachers' increased work burden concerning online classes and related technological problems during the pandemic[13, 43]. In Japan, school closure was implemented only once (April 2020). In addition, school closure continued for a relatively short period (approximately two months). Among public primary schools, only 8% of the schools provided interactive online classes as of June 2020 (the end of the closure), indicating that the implementation was limited[44]. After the government decided to reopen schools, conventional face-to-face classes resumed immediately. While school closure significantly affected various aspects of teachers' work and students' daily life, teachers' burdens caused by online teaching were unlikely to have notably increased in the first year of the pandemic (2020) in Japan.

Teachers' stress response scores decreased from 2019 to 2020, but increased from 2020 to 2021, although working hours remained shorter (Figs. 2 and 3). A possible reason for this is that certain school events and activities, which had been cancelled in 2020, restarted in 2021 at majority of public schools in Japan. Teachers' workload would have increased accordingly, leading to a rise in their stress levels. Findings concerning teachers' main stressors provided further evidence in support of this understanding. The percentages of teachers who selected "school management works", "giving a demonstration lesson", "dealing with challenging parents", and "workloads of clerical tasks" as their main stressor increased from 2020 to 2021 (Table 5). The implementation of these activities was still partially restricted in 2021, as indicated by the shorter working hours compared with the pre-pandemic year (2019). In 2021, COVID-19 variants repeatedly spread throughout Japan. Infection control measures including social distancing had been implemented to prevent infection in schools while providing face-to-face classes and restarting some of the school activities and events. These difficult conditions might have contributed to the increase in teachers' stress levels in 2021 compared with 2020.

The percentage of teachers who chose "dealing with difficult students" as their main stressor increased since the pandemic started and was the highest in the second year of the pandemic (2021). Studies have shown that a significant proportion of students exhibited symptoms of anxiety or depression during the school closure periods[45, 46]. The pandemic caused long-term psychological distress among children, especially those with mental or behavioral problems[47]. Taking care of students with behavioral problems is a major stressor for teachers[4]. The results suggest that the negative impact of the pandemic on children's behavioral problems might have complicated this situation further.

The results show that in all three years, the stress response scores of female teachers were higher than those of male teachers, and the differences were statistically significant. Previous studies reported gender difference in stress levels among schoolteachers, with female teachers exhibiting higher stress levels than males teachers[21, 22]. In addition, female teachers report higher occupational stress owing to the work-family conflict and their perception of adverse classroom conditions such as disruptive students[48]. This study did not investigate factors associated with the gender difference in teachers' stress responses; however, the results accorded with the findings of previous studies.

The results also revealed that a positive correlation between teachers' years of experience and their stress response scores in all three years. However, the correlation was negligibly small (r=0.009–0.033) in all three years, indicating that years of experience had almost no association with teachers' stress levels. The results did not match those in previous studies suggesting that teachers' years of experience were significantly associated with their stress levels and job satisfaction[23, 24].

Considering the possible prolonged effects of the COVID-19 pandemic on teachers' mental health, it is essential to monitor their stress levels not only during the pandemic, but also after the pandemic is over. This study unexpectedly found that teachers' stress levels decreased in the first year of the pandemic, possibly owing to the cancellation of school events or activities. This finding suggests that the duties related to these activities might place a considerable burden on teachers even though these activities are important for the education of students. Therefore, the implementation of school events or activities needs to be re-evaluated for schoolteachers' mental health. In addition, enhancing support systems for teachers, such as by increasing the number of support staff, should be considered. Moreover, given the high student-teacher ratio in Japan, increasing the number of schoolteachers is crucial for safeguarding teachers' mental health.

This study has some limitations. First, this study comprised three cross-sectional surveys involving a year-by-year comparative analysis based on these three surveys. The dataset is repeated cross-sectional data, which cannot examine the changes at the individual level prior to and following the onset of the pandemic. To more accurately identify the effects of the pandemic on teachers' stress levels, longitudinal studies, which rely on comprehensive panel data collected prior to and during the pandemic, are required. However, considering the program's high participation rate, it was plausible that a significant number of primary school teachers participated in this program in all three years. Therefore, despite these limitations, we believe that our findings offer an important contribution to this field of research.

Second, the questionaries in the Stress Check Program do not include questions directly related to the pandemic's effect on teachers' occupational stress; therefore, it is unclear to what extent the factors discussed in this study accurately reflect teachers' stress responses in relation to the pandemic.

Third, the results revealed a significant difference in stress response scores between 2019, 2020, and 2021. In addition, there was a significant relationship between the number of high-stress participants, the frequency of each stressor category, and survey year. However, the effect sizes of these variables were marginally small as described. Therefore, it is possible that the results might have been generated accidentally; these variables, such as stress response scores among teachers, might have no association with the effects of the pandemic.

Fourth, this study investigated stress responses among teachers who worked at public primary schools. The results might differ in other school settings such as high schools and special education schools. Moreover, pandemic-related stress responses might have differed for teachers with administrative positions and clerical staff. Finally, previous studies reported that job satisfaction, work engagement, and other buffering factors were related to decreased stress levels among teachers[6, 49, 50]. Further well-designed, prospective studies incorporating these factors are required.

Conclusions

This study found that the COVID-19 pandemic did not have a substantial negative effect on teachers' stress levels. Rather, teachers' stress levels decreased in the first year of the pandemic (2020), possibly owing to the cancellation of school events or activities and a decrease in teachers' working hours. However, stress response scores among schoolteachers increased in the second year of the pandemic (2021), which may be related to the restarting of activities or events that had been cancelled in 2020. An increased proportion of teachers experienced significant stress while taking care of difficult students after the pandemic started, which might be related to the negative effects of the pandemic on students' behavioral problems. Continuous monitoring of teachers' stress levels is crucial both during the pandemic and afterward. Well-designed, prospective studies that consider other potentially influential variables are required.

Ethical Considerations and Disclosure

The study was conducted in accordance with the latest version of the Declaration of Helsinki, and was approved by the Institutional Review Board of Tokai Central Hospital (Approved No. 2021111201). This study used existing completely anonymized data from which personal information cannot be extracted. The relevant ethics committee ensured that all procedures were applied appropriately, and waived the need for the informed consent. The authors declare no conflict of interests.

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