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

PRIMARY SCHOOL TEACHERS’ PANDEMIC STRESS RESPONSE

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Abstract

A school teacher’s job is considered one of the most stressful occupations globally. The coronavirus disease 2019 pandemic has posed further challenges for school teachers. 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 in 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 main stressors matched these trends. Continuous monitoring of teachers’ stress levels is recommended both during and after the pandemic.

Key words: Teachers, Stress Responses, COVID-19 Pandemic, Primary Schools, Stressors, Working Hours
Introduction

A school teacher’s job is considered one of the most stressful occupations worldwide\(^1\),\(^2\). Teachers are exposed to various sources of stress, including high workloads, misbehaving students, and dealing with difficult parents\(^3\)–\(^6\). Occupational stress is linked to decreased job satisfaction and reduced performance, which may negatively affect students’ educational achievements\(^4\). According to the Teaching and Learning International Survey conducted in 2018, the average weekly working hours of school teachers in Japan were the highest, compared to other participating countries\(^7\). In Japan, the percentage of school teachers 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, generating even more challenges for school teachers\(^9\). Studies undertaken during the pandemic reported a growing prevalence of anxiety and depression among teachers\(^9\),\(^10\). Countries implemented social distancing measures to reduce the spread of the contagion\(^11\). The pandemic brought education systems across 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 high levels of 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 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 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 such students 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. Also, 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 might 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 Japan. 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. Stress levels in homeroom teachers, in charge of their class, are reported to be higher than those teachers who are not required to exercise such responsibilities\(^{18,19}\). Considering these heavy daily 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 school teachers’ occupational stress levels accurately and without bias, a large-scale
national-level survey covering a high percentage of the target population would be necessary. However, as far as we know, there have been no studies on this topic using nationwide surveys with a sufficiently high participation rate.

In Japan, the Stress Check Program was introduced by the government in 2015, to help address mental health problems in workers, requiring implementation once a year in workplaces with 50 or more employees\(^{20}\). This program assesses employees’ work-related stresses and stress symptoms. A large proportion of public primary-school teachers in Japan (more than 80% of the total), have participated in this program every year.

This study examined the influence of the COVID-19 pandemic on primary-school homeroom teachers’ stress responses in Japan by analyzing the data obtained from the Stress Check Program conducted for public school employees across the country. By comparing prepandemic 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 these three years.

As noted, the stress level of homeroom teachers in Japan are reported to be higher than that among those not in charge of classes, and their mental health expected to be greatly 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. Fig. 1 shows the flowchart of eligible participants.

[Insert Fig. 1 near here]

**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 levels of stress than male teachers\(^{21, 22}\). Teachers’ years of experience is also reported to be associated with their stress levels\(^{23}\); previous studies have revealed that younger teachers with less teaching experience perceived higher stresses and less job satisfaction\(^{23, 24}\). Therefore, in this study, we also examined the association between gender, years of occupational experience,
and stress response levels among teachers.

**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\(^2\). The BJSQ is widely used in the field of occupational health in Japan, and is an established questionnaire to identify high-stress workers\(^2, 27\). 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 been shown to 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 response 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 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 $\alpha=0.90$). The stress response scores measured by the BJSQ are likely to help in predicting a significant risk of the onset of depression.

**High stress information**

The Stress Check Program manual uses criteria for defining high-stress employees based on the BJSQ. “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), 76 for job stressor and social support scores, and 63 for the stress response score (Criterion B). The criteria were established based on expert consensus, and studies have shown that employees identified as high stress exhibit a significant elevated risk for turnover and long-term sickness absence. 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 teachers**

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 other mental health experts in affiliated hospitals. The percentages of participants who selected “extra-curricular club activities,” “unfamiliar work environment,” “long commuting time,” and “other problems” as 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), and categorical variables 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 test. Epsilon-squared (e²) and
Cramer’s V were used as the effect size measure for the Kruskal-Wallis test and the chi-squared test respectively. A post-hoc test for the chi-squared 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 be significantly different 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 national 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 in terms of the statistical test values as well as descriptive statistics and assessing patterns or trends of variables.

### Results

**Participants Characteristics**

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

[Insert Table 1 near here]

**Relationship between Participants’ Years of Experience and Stress Response Scores**

Table 2 shows participants’ years of experience as full-time teachers and the correlation with stress response 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 ($\chi^2 [2, N=21,3651] = 14.123, p<0.001$). However, the effect size of the difference was negligibly small ($\epsilon^2=0.0000661$).

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.

[Insert Table 2 near here]

**Change 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 males, and the differences were statistically significant ($U=447774206.50, p<0.001$ in 2019, $U=532864518.50, p<0.001$ in 2020, and $U=582817190.00, p<0.001$ in 2021). The Kruskal-Wallis test showed a significant difference in stress response scores between 2019, 2020, and 2021 in both gender groups, ($\chi^2 [2, N=78,060] = 60.948, p<0.001$ in men, and $\chi^2 [2, N=135,591] = 88.401, p<0.001$ in women). The effect size of the difference was marginal.
for both gender ($\chi^2=0.000781$ for male and 0.000652 for female). Also, the changes in stress response scores between years were slight; however, the scores decreased from 2019 to 2020 in a consistent pattern and increased from 2020 to 2021 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 men and women. 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).

[Insert Table 3 near here]

**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 men and 10.0% in women), and lowest in 2020 (10.9% and 8.9%, respectively). A chi-squared test of independence was performed to examine the relationship between the number of high-stress participants and years. The relationship was significant in both gender groups, ($\chi^2[2, N=78,061] = 10.620, p=0.005$ in men, and $\chi^2[2, N=135,591] = 32.722, p<0.001$ in women). The effect size was marginal (Cramer’s $V=0.012$ and 0.016, respectively); however, the pattern of change was similar to that 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.

[Insert Table 4 near here]

**Comparisons of Working Hours between 2019, 2020, and 2021**

Fig. 2 shows percentages of participants in each working-hour category from 2019 to 2021. The percentages of participants in the longer working-hour categories (11–12 h, 12–13 h, and $\geq$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 (≤9 h, 9–10 h, and 10–11 h) was 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 chi-square test of independence was performed to examine the relationship between working hours and years. The results showed that the relation between these variables was significant ($\chi^2[10, N=213,651] = 2102.324, p<0.001$, Cramer’s $V=0.070$).

[Insert Fig. 2 near here]

Fig. 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 ($\chi^2[5, N=65,968] = 1672.686, p<0.001$, $\epsilon^2=0.0254$), in 2020 ($\chi^2[5, N=72,248] = 1906.649, p<0.001$, $\epsilon^2=0.0264$), and in 2021 ($\chi^2[5, N=75,435] = 2127.993, p<0.001$, $\epsilon^2=0.0282$). 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 hours), the stress response scores in 2021 were the highest in each working-hour group among the three years ($\text{Md}_n=53.0$ 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-hour) groups ($\text{Md}_n=52.0$ in <9h, 52.0 in 9–10 h, 54.0 in 10–11 h, and 55.0 in 11–12 h).

[Insert Fig. 3 near here]
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 chi-squared test of independence was performed to examine the association between the frequency of each stressor category and years. The effect size was marginal (Cramer’s V = 0.009 – 0.037), but the association was significant in all stressor categories ($p<0.001$). The percentage of participants who chose “school management duties” as the main stressor was the highest in 2021 (15.2%, AR=10.0), 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 the 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 the 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).

[Insert Table 5 near here]

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 a considerable level of fear toward COVID-19 infection and negative emotional responses, which were associated with their poor mental health during the pandemic\cite{9,34,35}. However, contrary to expectations, teachers’ stress response scores did not increase in the first year of the pandemic (i.e., 2020). Rather, their stress response scores significantly decreased from 2019 to 2020 although the changes were small. The proportion of high-stress
participants also decreased from 2019 to 2020. Survey results of the Ministry of Education, Culture, Sports, Science and Technology also accord with these findings; according to this survey, the percentage of school teachers 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 cannot examine this study any more than this. However, in general, most of the previous studies reported the substantial negative impact of the pandemic on school teachers’ stress-related symptoms such as anxiety and depression.9, 10, 13, 15). Our findings contrast with the findings of these previous studies.

The most probable 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 working hours and psychological distress, and between quantitative workloads and prolonged fatigue among school teachers. In this study, as working hours became shorter, 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 workload on teachers in Japan.18) These activities will contribute greatly to the growth and development of students and are likely to be of great significance in their lives. Teachers generally understand their importance, and fulfilling related duties and tasks is associated with teachers' job satisfaction and motivation. However, as described, working
hours of school teachers in Japan are reported to be the highest among the OECD member countries\textsuperscript{7}, indicating that their workloads could be considered as having been particularly heavy prior to the pandemic. One reason for these long working hours will be the large class size in schools in Japan. The student-teacher ratio is much higher in Japan compared with other OECD member countries\textsuperscript{39}). A recent nationwide survey conducted by Japan’s Ministry of Education, Culture, Sports, Science and Technology found a significant association between working hours of teachers and student-teacher ratios\textsuperscript{40}). Teachers in Japan spend appreciable amount of time on tasks such as marking or correcting student assignments and communication with parents or guardians\textsuperscript{41}). Therefore, tasks related school events and other extracurricular activities, which are important for students’ personal growth and teachers’ sense of job satisfaction, can be presumed to impose an additional, heavy burden on teachers in Japan. According to the Japanese government’s White Paper on Prevention of Death from Overworking, a high percentage of school teachers claim that the reconsideration of annual school events would be necessary to reduce excessive workloads\textsuperscript{42}). In this context, the cancellation of these activities during the COVID-19 pandemic possibly reduced teachers’ working hours and 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 tasks, communicating with parents or guardians, and 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 the main stressor significantly decreased after the pandemic started. Moreover, the percentages of participants who answered “I do not have any particular
stressors” were the highest in 2020, suggesting a decrease in their stress levels in the first year of pandemic.

Previous studies reported teachers’ psychological burdens concerning online classes and related technological problems during the pandemic\(^\text{13,43}\). In Japan, school closure only happened once (April 2020), which continued for a relatively short period (about two months). Among public primary schools, only 8% of the schools provided interactive online classes as of June 2020 (end of the closure), indicating that the implementation was limited\(^\text{44}\). After the government decided to reopen schools, conventional face-to-face classes resumed. 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 (Fig. 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 public schools in Japan. Teachers’ workloads would have likely 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 the 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 still spread throughout Japan. Infection control measures including social distancing had to be implemented to prevent infection in schools while providing face-to-face classes and restarting some of the school activities and events. This difficult situation 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 the main stressor increased since the pandemic started and was the highest in the second year (2021). Studies have shown that more students exhibited symptoms of anxiety or depression during the school closure periods\(^4\),\(^5\),\(^6\). The pandemic caused long-term psychological distress in children, especially those with mental or behavioral problems\(^7\). Taking care of students with behavioral problems has been reported to be a primary stressors 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 teachers, with female teachers exhibiting higher levels of stress than males teachers\(^21\),\(^22\). Female teachers report higher levels of stress and dissatisfaction owing to perceived adverse conditions in the classroom such as disruptive students, and work-family interface\(^48\). 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 teachers’ years of experience had almost no association with their stress levels. The results did not match those in previous studies in which it has been reported that years of experience as a teacher were associated with stress levels\(^23\),\(^24\), and that younger teachers with less teaching experience perceived less job satisfaction\(^24\).

Considering the possible prolonged effects of the COVID-19 pandemic on teachers’ mental health, it is essential to monitor teachers’ 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, which suggests that these duties might have been 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. 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 school teachers is likely to be beneficial in helping protect teachers’ mental health.

This study has some limitations. First, this study comprised three cross-sectional studies involving a year-by-year comparative analysis based on these three studies. 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 essential. However, considering the program’s high participation rate of more than 80%, it was plausible that many of primary school teachers participated in this program in all three years. Therefore, despite these limitations, we still think that it is a valuable dataset to analyze for the study.

Second, the questionnaires 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 response levels in relation to the pandemic.

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

Fourth, this study investigated the stress responses of teachers who worked at public primary schools. The results might differ by school settings, such as high schools or special education schools. Pandemic-related stress responses might have also differed for teachers with administrative positions or among clerical staff. Finally, previous studies reported that job satisfaction, work engagement, and other buffering factors were related to stress responses in 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. Moreover, teachers’ stress levels decreased in the first year of the pandemic (2020), possibly owing to cancellation of school events or activities and a decrease in working hours. However, the stress response scores 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. A higher percentage of teachers felt stressed 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 required both during the pandemic and afterward. Well-designed, prospective studies that consider other potentially influential variables are required.

**Acknowledgements**
This study was fully supported by the Japan Mutual Aid Association of Public-School Teachers. This study could not have been conducted without the assistance and support of the staff at Tokai Central Hospital.

**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.
References


the government and schools take initiative? Reimers FM (Eds.), 125–151, Springer International Publishing, Switzerland.


<table>
<thead>
<tr>
<th></th>
<th>2019 (N=65,968)</th>
<th></th>
<th>2020 (N=72,248)</th>
<th></th>
<th>2021 (N=75,435)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>%</td>
<td></td>
<td>%</td>
<td></td>
<td>%</td>
<td></td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>23,874</td>
<td>36.2%</td>
<td>26,419</td>
<td>36.6%</td>
<td>27,767</td>
<td>36.8%</td>
</tr>
<tr>
<td>Female</td>
<td>42,094</td>
<td>63.8%</td>
<td>45,829</td>
<td>63.4%</td>
<td>47,668</td>
<td>63.2%</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>17,487</td>
<td>26.5%</td>
<td>19,481</td>
<td>27.0%</td>
<td>20,543</td>
<td>27.2%</td>
</tr>
<tr>
<td>30-39</td>
<td>17,415</td>
<td>26.4%</td>
<td>19,326</td>
<td>26.7%</td>
<td>20,703</td>
<td>27.4%</td>
</tr>
<tr>
<td>40-49</td>
<td>14,636</td>
<td>22.2%</td>
<td>15,912</td>
<td>22.2%</td>
<td>16,501</td>
<td>21.9%</td>
</tr>
<tr>
<td>50-59</td>
<td>16,430</td>
<td>24.9%</td>
<td>17,529</td>
<td>24.3%</td>
<td>17,688</td>
<td>23.4%</td>
</tr>
</tbody>
</table>

**Note.** The number of participants with their percentage is shown in each category.
Table 2. Participants’ years of experience as full-time teachers and their correlation with stress response scores

<table>
<thead>
<tr>
<th>Years of experience (Mdn [IQR])a</th>
<th>2019 (N=65,968)</th>
<th>2020 (N=72,248)</th>
<th>2021 (N=75,435)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10.0 (3.0–24.0)</td>
<td>9.0 (3.0–23.0)</td>
<td>9.0 (3.0–21.0)</td>
</tr>
<tr>
<td>Correlation coefficientb</td>
<td>0.033**</td>
<td>0.017**</td>
<td>0.009*</td>
</tr>
</tbody>
</table>

Note. 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 full-time teachers.

*p<0.05; **p<0.01.
Table 3. The changes in stress response scores from 2019 to 2021

<table>
<thead>
<tr>
<th>Gender</th>
<th>Year</th>
<th>N</th>
<th>M (SD)&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mdn (IQR)&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Mean rank</th>
<th>χ²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2019</td>
<td>23,874</td>
<td>55.4 (14.86)</td>
<td>54.0 (44.0–64.0)</td>
<td>39620.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2020</td>
<td>26,419</td>
<td>54.5 (14.93)</td>
<td>53.0 (43.0–63.0)</td>
<td>38164.09</td>
<td>60.948</td>
<td>&lt; 0.001&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>2021</td>
<td>27,767</td>
<td>55.3 (15.18)</td>
<td>54.0 (44.0–64.0)</td>
<td>39347.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>2019</td>
<td>42,094</td>
<td>57.9 (14.35)</td>
<td>56.0 (47.0–67.0)</td>
<td>68233.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2020</td>
<td>45,829</td>
<td>57.3 (14.37)</td>
<td>56.0 (47.0–66.0)</td>
<td>66426.04</td>
<td>88.401</td>
<td>&lt; 0.001&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>2021</td>
<td>47,668</td>
<td>58.1 (14.71)</td>
<td>57.0 (47.0–67.0)</td>
<td>68727.02</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<sup>a</sup> The stress response scores ranged from 29 to 116.

<sup>b</sup> The Kruskal-Wallis test showed a significant difference in stress response scores between 2019, 2020, and 2021 in both gender groups. The effect sizes (ɛ²) were 0.000781 for male and 0.000652 for female. 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 males and females teachers. 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

<table>
<thead>
<tr>
<th>Gender</th>
<th>Year</th>
<th>N (total)</th>
<th>( N )</th>
<th>% (within the year)</th>
<th>( \chi^2 )</th>
<th>( p )</th>
<th>Cramer’s V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>2019</td>
<td>23,874</td>
<td>2,795</td>
<td>11.7 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2020</td>
<td>26,419</td>
<td>2,868</td>
<td>10.9 %</td>
<td>10.620</td>
<td>0.005d</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>2021</td>
<td>27,767</td>
<td>3,210</td>
<td>11.6 %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>2019</td>
<td>42,094</td>
<td>4,018</td>
<td>9.5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2020</td>
<td>45,829</td>
<td>4,083</td>
<td>8.9%</td>
<td>32.722</td>
<td>&lt; 0.001d</td>
<td>0.016</td>
</tr>
<tr>
<td></td>
<td>2021</td>
<td>47,668</td>
<td>4,768</td>
<td>10.0%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) 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 chi-squared test of independence was performed to examine the relationship between the number of high-stress participants and years, and the result showed that the relationship was significant in both gender groups.
Table 5. Comparisons of participants’ perceived main stressors between 2019, 2020, and 2021

<table>
<thead>
<tr>
<th>Main stressor</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>( \chi^2 )</th>
<th>( p )</th>
<th>Cramer’s V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dealing with difficult students</td>
<td>( N = 65,968 )</td>
<td>( N = 72,248 )</td>
<td>( N = 75,435 )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Count</td>
<td>17,085</td>
<td>19,197</td>
<td>20,506</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>% (within the year)</td>
<td>25.9%</td>
<td>26.6%</td>
<td>27.2%</td>
<td>29.770</td>
<td>&lt; 0.001</td>
<td>0.012</td>
</tr>
<tr>
<td>Adjusted residual</td>
<td>-4.8</td>
<td>-0.1</td>
<td>4.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workload of clerical tasks</td>
<td>( N = )</td>
<td>( N = )</td>
<td>( N = )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Count</td>
<td>16,345</td>
<td>15,229</td>
<td>16,596</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% (within the year)</td>
<td>24.8%</td>
<td>21.1%</td>
<td>22.2%</td>
<td>289.976</td>
<td>&lt; 0.001</td>
<td>0.037</td>
</tr>
<tr>
<td>Adjusted residual</td>
<td>16.5</td>
<td>-11.6</td>
<td>-4.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dealing with challenging parents</td>
<td>( N = )</td>
<td>( N = )</td>
<td>( N = )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Count</td>
<td>10,745</td>
<td>10,906</td>
<td>12,099</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% (within the year)</td>
<td>16.3%</td>
<td>15.1%</td>
<td>16.0%</td>
<td>42.037</td>
<td>&lt; 0.001</td>
<td>0.014</td>
</tr>
<tr>
<td>Adjusted residual</td>
<td>4.2</td>
<td>-6.4</td>
<td>2.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School management duties</td>
<td>( N = )</td>
<td>( N = )</td>
<td>( N = )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Count</td>
<td>9,533</td>
<td>9,295</td>
<td>11,463</td>
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<tr>
<td>% (within the year)</td>
<td>14.5%</td>
<td>12.9%</td>
<td>15.2%</td>
<td>170.570</td>
<td>&lt; 0.001</td>
<td>0.028</td>
</tr>
<tr>
<td>Adjusted residual</td>
<td>2.4</td>
<td>-12.4</td>
<td>10.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsibility for students’ learning</td>
<td>( N = )</td>
<td>( N = )</td>
<td>( N = )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Count</td>
<td>7,430</td>
<td>9,182</td>
<td>8,907</td>
<td></td>
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<tr>
<td>% (within the year)</td>
<td>11.3%</td>
<td>12.7%</td>
<td>11.8%</td>
<td>70.622</td>
<td>&lt; 0.001</td>
<td>0.018</td>
</tr>
<tr>
<td>Adjusted residual</td>
<td>-6.5</td>
<td>7.8</td>
<td>-1.4</td>
<td></td>
<td></td>
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<tr>
<td>Personal problems</td>
<td>( N = )</td>
<td>( N = )</td>
<td>( N = )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Count</td>
<td>6,767</td>
<td>7,095</td>
<td>6,843</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>% (within the year)</td>
<td>10.3%</td>
<td>9.8%</td>
<td>9.1%</td>
<td>58.705</td>
<td>&lt; 0.001</td>
<td>0.017</td>
</tr>
<tr>
<td>Adjusted residual</td>
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<td>1.4</td>
<td>-7.2</td>
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<td></td>
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<tr>
<td>Demonstration lessons</td>
<td>6,362</td>
<td>6,780</td>
<td>6,566</td>
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<td></td>
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</tr>
<tr>
<td>% (within the year)</td>
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<td>8.3%</td>
<td>9.7%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted residual</td>
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<td>−10.9</td>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Relationship with colleagues</td>
<td>6,362</td>
<td>6,780</td>
<td>6,566</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% (within the year)</td>
<td>9.6%</td>
<td>9.4%</td>
<td>8.7%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted residual</td>
<td>4.5</td>
<td>1.8</td>
<td>−6.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship with supervisors</td>
<td>3,638</td>
<td>4,336</td>
<td>4,442</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% (within the year)</td>
<td>5.5%</td>
<td>6.0%</td>
<td>5.9%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted residual</td>
<td>−3.2</td>
<td>2.1</td>
<td>1.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nothing particular</td>
<td>11,377</td>
<td>14,539</td>
<td>14,274</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% (within the year)</td>
<td>17.2%</td>
<td>20.1%</td>
<td>18.9%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted residual</td>
<td>−12.4</td>
<td>11.1</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figures

Fig. 1.

A primary school employee who participated in the Stress Check Program

\[ (N = 124,341 \text{ in } 2019, 138,152 \text{ in } 2020, 144,122 \text{ in } 2021) \]

\[ \rightarrow \]

Not a full-time tenure-position teacher \((N = 41,766 \text{ in } 2019, 46,498 \text{ in } 2020, 48,131 \text{ in } 2021)\)

A full-time tenure-position teacher

\[ (N = 82,575 \text{ in } 2019, 91,654 \text{ in } 2020, 95,991 \text{ in } 2021) \]

\[ \rightarrow \]

A teacher not in charge of a class \((N = 13,972 \text{ in } 2019, 16,061 \text{ in } 2020, 16,786 \text{ in } 2021)\)

A homeroom teacher in charge of a class

\[ (N = 68,603 \text{ in } 2019, 75,593 \text{ in } 2020, 79,205 \text{ in } 2021) \]

\[ \rightarrow \]

Aged 60 years and above \((N = 2,635 \text{ in } 2019, 3,345 \text{ in } 2020, 3,770 \text{ in } 2021)\)

Analytic sample

\[ (N = 65,968 \text{ in } 2019, 72,248 \text{ in } 2020, 75,435 \text{ in } 2021) \]
Fig. 2.

(Described in a separate JPG file)
Fig. 3.

(Described in a separate JPG file)
**Figure Legends**

**Fig. 1** Flowchart of eligible participants

**Fig. 2** Percentages of participants in each working-hour group: a comparison between 2019, 2020, and 2021. A chi-square test of independence showed that the relation between working hours and years was significant ($p<0.001$, Cramer’s $V=0.070$).

**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 ($p<0.001$, $\epsilon^2=0.0254$), in 2020 ($p<0.001$, $\epsilon^2=0.0264$), and in 2021 ($p<0.001$, $\epsilon^2=0.0282$).