1. Introduction

There is increasing evidence to suggest that the coronavirus disease (COVID-19) pandemic has significantly impacted child and parent mental health. For example, recent reviews have identified high rates of depression and anxiety among children and adolescents during the pandemic (Nearchou et al., 2020; Miranda et al., 2020). The number of studies that have examined parent mental health is small compared to those that have studied child mental health; still, several studies have indicated that difficulties due to the COVID-19 pandemic have been associated with increased parental anxiety, depression, and stress (Brown et al., 2020; Russell et al., 2020; Spinelli et al., 2020). Moreover, depression and anxiety among the parents of primary, middle, and high school students was shown to be higher than that of the parents of college students (Wu et al., 2020).

In the first wave of the COVID-19 pandemic, international governments launched and implemented disease containment measures, such as lockdown, school closure, social distancing, and home quarantine. Many studies indicated that lockdown and school closure due to the COVID-19 affected children's lives and their mental health all over the world (e.g., Ranjbar et al., 2021; Tang et al., 2021; Waite et al., 2021; Yaesmin et al., 2020). In Japan, the effects of school closure due to the first wave on child mental health, such as suicide or behavioral and emotional problems, (Isumi, et al., 2020; Takahashi & Honda, 2021) and parent stress (Hiraoka & Tomoda, 2020) were also examined. These studies revealed that, although school closure in the first wave affected parent stress (Hiraoka & Tomoda, 2020), a significant change in suicide rates was not found during the period (Isumi, et al., 2020) and the total length of the school closure was not a significant predictor of subsequent emotional/behavioral problems (Takahashi

& Honda, 2021).

The Japanese government requested a nationwide school closure to prevent the spread of COVID-19 on March 2, 2020. According to data from the Ministry of Education, Culture, Sports, Science and Technology in Japan (MEXT, 2020a), 98% of schools in Japan (elementary schools, junior high schools, special needs schools, etc.) were closed on March 16. Then, 86% of schools were closed on May 14. As the number of infected people gradually decreased, the nationwide closure of schools ended in Japan and 98% of schools reopened on June 1. However, if some students, parents, teachers, or school staff were found to be infected with the coronavirus, the school would be suddenly and temporarily closed to prevent its spread. Therefore, Japanese children, adolescents, and parents have been continuously exposed to the risk of sudden and temporary local school closures even after nationwide school closures ended.

There have been two types of local school closures in Japanese educational settings. One was full school closure in which all students were not allowed to physically attend school. The other was partial school closure. Partial school closure was implemented in different ways by each school in Japan. For example, students were divided into several groups and each group attends school for a limited number of hours or days separately. Notably, most schools in Japan were not ready for online learning during the full and partial school closure periods, despite recommendations by the government. According to a report on April 16, 2020, only 5% of schools were available for synchronous interactive online learning before the first national lockdown in Japan (MEXT, 2020b). Therefore, instead of full school closure, partial school closure was implemented in Japanese educational settings to guarantee minimum learning opportunities for students during the pandemic.

Although the widespread impacts of COVID-19 have affected both child and parent mental health worldwide, no studies have investigated child and parent mental health at times of local school closures in Japan. This study aimed to investigate the relationship between local school closures (full or partial) due to COVID-19 and child and parent mental health in Japan. We hypothesized that both child and parent mental health would worsen during full and partial school closures due to the COVID-19 pandemic compared to when schools were fully open. In addition, we hypothesized that full school closure would be associated with worse mental health more than partial closure. This online survey was conducted around November-December 2020 because this period was when the nationwide school closure had ended and local school closures were implemented in Japan.

2. Methods

2.1. Procedure and recruitment

The study was conducted with the approval of the Institutional Review Board of the first author's institution (202017). This study was part of the COVID-19 Online-Survey for Children and Adolescents in Japan (J-COSCA). The J-COSCA is a cross-sectional and longitudinal online survey designed to examine the mental health of children, adolescents, and parents in Japan during the COVID-19 pandemic. The baseline data of the J-COSCA were used for this study. We conducted this national online survey using the panelist pool of Cross Marketing, an online survey company (https://www.cross-m.co.jp/en/). To be eligible, participants had to be parents with children and adolescents aged between 6 and 15 years who lived in Japan. A sample of 2456 participants provided informed consent and completed this survey between November

27 and December 1, 2020. Of these potential participants, only those who completed each scale and provided demographic data were included in this study. During this period, local school closures were implemented intermittently in certain areas where the number of infected people was increasing. Figure 1 shows the changes in the total number of infected people in Japan and the timing of the first nationwide school closures and of this study. The figure was created by the authors based on open data from the Ministry of Health, Labour and Welfare in Japan (MHLW, 2020).

2.2. Participants

A total of 1984 parents of children and adolescents were included in this study. Participants' demographics are presented in Table 1. The demographic data showed that participants were collected from all areas of Japan (Hokkaido, Tohoku, Kanto, Chubu, Kinki, Chugoku, Shikoku, and Kyushu). Japan is a country with low ethnic diversity, and participants of this data was composed of over 99% of Japanese children, adolescents, and parents (compared to 98% from population data: MIC, 2021). The highest frequency of family income (4,000,000 to 7,990,000 yen) of our data was consistent with the average income of families who have children from a Japanese national dataset (7,436,000 yen: MHLW, 2018). Furthermore, the percentage of public schools (92.24%) in this data is also consistent with the percentage from another national dataset (98.42% for elementary school, 91.60% for junior high school: MEXT, 2021b). For these reasons, the data used in this study was considered to be broadly similar to a representative sample of the wider Japanese population.

2.3.Measures

2.3.1. Demographic data

Parents reported on their own age, gender, and ethnicity and for their children or adolescents. In addition, parents were also asked about the regions where their families lived, their employment status, their total household income, and their child's educational settings. We categorized a household income of less than 3,990,000 yen as "low household income". Besides, we also collected variables which could affect mental health problems during the COVID-19 pandemic: (a) whether child or parent have been infected with the COVID-19 (Yes, diagnosed or suspected; No or no answer), (b) whether another family member in household have been infected with the COVID-19 (Yes, diagnosed or suspected; No or no answer), and (c) whether parent has been self-isolated during the pandemic (Yes, self-isolating or social distancing; No or no answer).

2.3.2. Child mental health

The Japanese version of the parent-reported Strengths and Difficulties Questionnaire (SDQ-P) was used (Goodman, 2001; Moriwaki and Kamio, 2014). We used the three sub-scales of the SDQ-P that directly examine mental health symptoms (emotional symptoms, conduct problems, and hyperactivity/ inattention). In addition, child anxiety symptoms, depressive symptoms, oppositional defiant behaviors, and irritability were measured using the following four questionnaires the Japanese version of the parent-reported Spence Children's Anxiety Scale (SCAS-P; Ishikawa et al., 2014; Nauta et al., 2004), the Japanese version of the Depression Parent-Rating Scale for Children (DPRS-C; Birleson, 1981; Denda et al., 2006), Oppositional Defiant Behavior Inventory (ODBI; Harada et al., 2004), and the Japanese version of the Affective Response Index-Parent Form (ARI-P; Stringaris et al., 2012; Takahashi and Kishida, 2020). In the DPRS-C, we used the same items as the Japanese version of the Depression Self-Rating

Scale for Children (Birleson, 1981; Denda et al., 2006). The SDQ-P, ODBI, and ARI-P each measure mental health symptoms in the past 6 months. The DPRS-C measures depression in the last week. The SCAS-P does not set specific timeframes. Cronbach's alpha values in the current study were as follows: .77 for emotional symptoms, .63 for conduct problems, .71 for hyperactivity/ inattention, .95 for the SCAS-P, .86 for the DPRS-C, .89 for the ODBI, and .87 for the ARI-P.

2.3.3. Parent mental health

The Japanese version of the Depression, Anxiety, and Stress Scale-21 Items (DASS-21; Lovibond and Lovibond, 1995; Mitani et al., 2015) and the Japanese version of the State-Trait Anger Expression Scale (STAXI; Spielberger, 1988; Suzuki and Harada, 1994) were used to measure parent mental health problems. The DASS-21 includes three subscales: depression, anxiety, and stress. Trait-anger, which is a subscale of the STAXI, was used for this study, and the other subscales were excluded. The DASS-21 measures symptoms in the last week, while the STAXI does not set a specific timeframe. Cronbach's alpha values in the current study were as follows: .93 for depression, .87 for anxiety, and .89 for stress, and .92 for trait-anger.

2.3.4. School closures in the last week

School closure was measured by asking participants a single question ("Which of the following describes your child's school situation during the past week?"). The participants selected their answers from three options: full school closure due to COVID-19, partial school closure due to COVID-19, and full school open. Data from participants whose children's schools were on regular holidays were excluded from the study because the purpose of this study was to examine the difference between school open and school closures due to COVID-19.

2.4. Statistical analysis

All data were analyzed using SPSS (version 27). First, the relationships between school closure and age and gender were examined. The other demographics were not used because sample sizes for each condition were too small to compare. Second, multivariate analysis of covariance (MANCOVA) was used to compare mental health scores between the three situations (full school closure, partial school closure, and full school open) after controlling for four covariates; low household income (n = 289, 14.6%), child/parent infection (n = 25, 1.3%), family member infection (n = 25, 1.3%), and parent self-isolation (n = 372, 18.8%). Then, univariate analysis of covariance (ANCOVA) after controlling for the four covariates was performed for each variable if the MANCOVA was significant. Bonferroni's method was used for post-hoc analysis to compare the three school situations. The sample size for this study was not predetermined based on a power analysis because percentages of both full and partial school closures were not predictable. Therefore, effect sizes are used to aid interpretation for the results. Effect sizes were estimated using Cohen's *d*, which was calculated by dividing the difference between school closure and school open by their pooled standard deviations. Cohen's *d* was interpreted as 0.2 for small, 0.5 for medium, and 0.8 for large effect sizes.

3. Results

3.1. Demographics and school closures

A total of 1984 parents of children and adolescents were included in this study. Of the parents who responded to the survey, 822 were male/fathers (41.43%) and 1158 were

female/mothers (58.37%). The mean age of parents who responded to the online survey was 44.09 (*SD* = 5.76). Among the children and adolescents, there were 917 girls (46.22%) and 1067 boys (53. 78%). The mean age of children and adolescents was 10.56 (*SD* = 2.64). The proportion of school closures in the last week was 2.02% (*n* = 40) for full school closure due to COVID-19, 5.95% (*n* = 118) for partial school closure due to COVID-19, and 92.04% (*n* = 1826) for full school open.

3.2. Preliminary analysis

There were no significant differences between school situations on the basis of the age of children and adolescents (F (2, 1977) = 1.63, p = .20) or parents (F (2, 1977) = 2.88, p = .06), or of the gender of children and adolescents (χ^2 (2, N = 1984) = 3.26, p = .20) or parents (χ^2 (2, N = 1980) = 3.26, p = .20).

3.3. Relationship between school closure and child mental health

Table 2 shows the means and standard deviations of each variable. The MANCOVA to compare scores for the three subscales of the SDQ-P, SCAS-P, DPRS-C, ODBI, and ARI-P indicated significant differences between school situations (*Wilks' lambda* = .92, F (14, 3936) = 12.83, p < .001). Follow-up univariate ANCOVAs indicated significant school effects on the emotional symptoms and conduct problems of SDQ-P, SCAS-P, DPRS-C, ODBI, and ARI-P (all p < 0.01), except for the hyperactivity/inattention of SDQ (p = .13). Post-hoc tests showed that the children and adolescents under full school closure had significantly higher scores than those under full school open for all scales (all p < .05). In addition, those under partial school closure had significantly higher scores than those under full school open for the SCAS-P, DPRS-C, and ARI-P (all p

< .05), but not for the emotional symptoms, conduct problems and ODBI. Finally, those under full school closure had significantly higher scores than partial school closure for all scales (all $p < .05$).

The effect sizes for child mental health between full school closure, partial school closure, and full school open are shown in Table 2. The results showed that full school closure compared with full school open had large effect sizes for all mental health symptoms (d = 0.84 to 2.13), except hyperactivity/inattention with a small effect size (d = 0.42). Partial school closure compared with full school open had moderate effect sizes for SCAS-P (d = 0.59), and small effect sizes for conduct problems, DPRS-C, and ARI-P (d = 0.20 to 0.39). Finally, full school closure compared with partial school closure had large effect sizes for emotional symptoms, conduct problems, SCAS-P and ARI-P (d = 0.82 to 0.93), moderate for DPRS-C and ODBI (d = 0.61 to 0.67), and small for hyperactivity/inattention (d = 0.45).

3.4. Relationship between school closure and parent mental health

The MANCOVA to compare scores for the three subscales of the DASS-21 and trait-anger of the STAXI indicated significant differences between school situations (*Wilks' lambda* = .94, F (8, 3942) = 16.16, $p < .001$). Univariate ANCOVAs indicated significant school effects on all subscales of the DASS-21 ($p < .001$) and STAXI ($p < .01$). Post-hoc tests showed that the parents under full school closure had significantly higher scores than those under partial school closure and full school open for all scale (all $p < .05$). Those under partial school closure had significantly higher scores than those under full school open for all scales (all $p < .05$), except for trait-anger ($p = .28$). Finally, those under full school closure had significantly higher scores than partial school closure for all scales with medium effect sizes (all $p < .05$), except for trait-anger

(p = .28).

The effect sizes for parent mental health between full school closure, partial school closure, and full school open are also shown in Table 2. The results showed that full school closure compared with full school open had large effect sizes for depression, anxiety, and stress (d = 1.16 to 1.92) and a moderate effect size for trait-anger (d = 0.54). Partial school closure compared with full school open had moderate effect sizes for anxiety (d = 0.68) and small effect sizes for depression and stress (d = 0.33 to 0.42). Finally, full school closure compared with partial school closure had large effect sizes for depression, anxiety, and stress (d = 0.61 to 0.70) and small for trait-anger (d = 0.36).

4. Discussion

In Japan, during the period when this national online survey was conducted, local school closures were implemented in certain areas where the number of infected people was increasing. This study aimed to investigate the relationship between full and partial local school closures due to COVID-19 and child and parent mental health in Japan. The results indicated that, after controlling for other variables regarding the pandemic (i.e., low household income, child/parent infection, family member infection, and parent self-isolation), full school closure was associated with much higher scores in both internalizing problems (e.g., anxiety and depression) and externalizing problems (e.g., conduct problems and oppositional defiant behaviors) in children and adolescents, compared to when schools were fully open. However, school closure might not be associated with higher scores in hyperactivity/inattention in children and adolescents. Then, full school closures were associated with much higher scores in parental depression, anxiety, and stress and with moderately higher scores in parental anger. In

addition, moderately higher scores were found for anxiety symptoms in both children and parents and somewhat higher scores were found for child and parent other mental health problems under partial school closure in comparison with full school open.

This study has three main strengths. The first is a broad assessment of both internalizing and externalizing symptoms in children and adolescents. Most of the studies during the COVID-19 pandemic have utilized anxiety and depression as a benchmark for child mental health (Miranda et al., 2020). Whereas, our study assessed externalizing problems and irritability in addition to anxiety and depression. Our findings revealed that full closure was associated with increases in both internalizing and externalizing problems in children and adolescents, whereas partial closing appeared to have more modest associations with child mental health symptoms, such as anxiety, depression, and irritability. However, our study revealed that school closure might not be associated with higher hyperactivity/inattention in Japanese children and adolescents. Whereas, in the UK, an increase in hyperactivity/inattention in children and adolescents can be seen during the periods of lockdown due to the COVID-19 (Co-SPACE, 2021). This difference may be related to differences in national policies. For example, Japan implemented a 'mild lockdown' with no strict restriction and no punishment (Sugaya et al., 2020; Yamamoto et al., 2020), where activities such as going out or playing in the park were not prohibited. Therefore, children were able to go outside to play and do physical activities even though school closure was implemented, which may have prevented hyperactivity/inattention symptoms from worsening during school closure in Japan.

The second is that parent psychological symptoms were measured in this study. Although there have been several systematic reviews on child mental health during the

COVID-19 pandemic (Miranda et al., 2020; Nearchou et al., 2020), few studies have focused on the mental health problems of parents. In the COVID-19 pandemic, school closures have imposed further burdens on parents, such as house chores, preparing lunch, and homeschooling in addition to remote work for working parents, while children are forced to be housebound with a lot of homework. These circumstances might increase parent-child conflict and parental stress, which could worsen the mental health of parents (Russell et al., 2020; Wu et al., 2020). Our findings suggest that support to mitigate the potential mental health impacts on parents is needed during both full and partial school closures. On the other hand, school closure was shown to have a smaller association with parental trait-anger compared to depression and anxiety. This may be due to the fact that the trait variables were less likely to be changeable. In the future, it may be necessary to use more changeable indicators such as state anger (Spielberger, 1988).

The third and most unique aspect of the study is that it examined both full and partial school closures. After the first nationwide school closure, the Japanese government tried to keep schools open as much as possible as introducing partial closing (MEXT, 2021a), insufficient preparedness for online learning in the society might deprive students of opportunities to learn. Therefore, this strategy which was an attempt to balance containment of the virus and provision of learning opportunities might be specific to Japanese society. Nevertheless, this study suggests that even a partial closing of school might lead to deterioration of mental health, particularly anxiety symptoms, in children, adolescents, and parents. Therefore, consideration of the needs of families is necessary in the context of both full and partial school closures.

This study has several limitations. First, there is a limitation of the small sample size,

especially for full school closure (n = 40). Although preliminary analyses revealed that there were no significance differences in the gender or age of children and parents between the study conditions, this study could not conduct sub-group analyses to explore differences in all the demographic data due to the small number of schools that were full and partially closed. However, we should be mindful of further potential moderators for future study. Also, although each variable might not show normality and equivariance due to small sample sizes, we conducted MANCOVAs and ANCOVAs in order to control the third variables regarding the pandemic. A further study with a large sample size is necessary in the future. Second, considering that school closure could be implemented intermittently depending on each school district, the cross-sectional nature of the study could not detect a causal effect between school closures and mental health. Third, the data of this survey was collected 9 months after the pandemic began in Japan and we were not able to compare our data with pre-pandemic data. Fourth, the time referred to by each measure should be noted. For example, the standard instructions of the SDQ-P, ODBI, and ARI-P stipulate reference should be made to symptoms experienced in the last 6 months. Although the six-month period does not include the impact of the nationwide school closures, the possibility that changes or events affecting mental health during the period cannot be denied. Finally, this study used parent report measures only. Further studies with multiple informants are required.

Despite these limitations, this is the first study to examine the relationships between local school closures (both full and partial school closure) and both child and parent mental health after the first nationwide school closure ended in Japan. Future research to identify how best to prevent deteriorations in both child and parent mental health during school closures in the context of pandemics should be prioritized.

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