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The impact of gender differences, school adjustment, social interactions, and social activities on emotional and behavioral reactions to the COVID-19 pandemic among Japanese school children

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ABSTRACT

The COVID-19 pandemic has had negative psychological effects, such as increased depression, anxiety, and suicide, on children worldwide, including in Japan. To effectively mitigate the negative impact of the pandemic among Japanese children, it is necessary to increase understanding of the culturally specific psychological effects on Japanese children, including age and gender differences, as well as related risk and protective factors. However, no previous research has quantitatively evaluated changes in Japanese children's emotional functioning before and after the pandemic began. The present study examined changes in Japanese children's emotional functioning with pre- and mid-pandemic questionnaires, particularly focusing on age and gender differences. The present study also explored the effects of school adjustment, social interactions, and lifestyle activities on children's emotional and behavioral functioning during the pandemic. Data were analyzed from 293 children from the southwestern region in Japan. The pre-pandemic questionnaire assessed emotional and behavioral functioning and school adjustment, while the mid-pandemic questionnaire assessed emotional and behavioral functioning, social interactions, and lifestyle activities. The results indicated that the COVID-19 pandemic negatively impacted the emotional functioning of Japanese children, especially younger boys. Pre-pandemic school adjustment negatively influenced emotional functioning. Spending time alone, spending little time with one's mother, poor sleep regulation, a lack of exercise, and a high frequency of playing video games were related to poor emotional and behavioral functioning. The findings imply that Japanese children, especially younger boys, may benefit from psychological interventions that promote social interactions, especially with their mothers, regulated sleep patterns, adequate exercise, and that support children in managing video game engagement, to mitigate the pandemic's negative psychological impact.

1. Introduction

The unexpected spread of the novel coronavirus (COVID-19) beginning in late 2019 has resulted in over 165 million infections and 3.4 million deaths globally (COVID Live Update, 2021). Governments worldwide have focused on mitigating the physical risks of COVID-19 by restricting individuals' freedom of movement. This resulted in multifaceted changes in children's lifestyles, such as abrupt withdrawal from school, social life, and outdoor activities; limited connection with classmates; and increased sedentary activities. A recent UNSDG Policy Brief (2020) revealed that over 188 countries had school closures, removing over 1.5 billion children from school at some point during 2020. School closures could particularly impact children's mental health, as schools have long served as an essential mental health support system for many children (Golberstein et al., 2020). The UNSDG labelled children an at-risk group for becoming the biggest victims of COVID-19 pandemic and, for some, the impact will be lifelong (UNSDG Policy Brief, 2020).

From a medical perspective, young people have a low risk of experiencing severe physiological symptoms from COVID-19 infection (Shahid et al., 2020). However, this does not mean they are equally able to

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cope with adverse psychological effects. Research across Asia, Europe, and North America found increased incidents of depression, anxiety, suicide, and self-harm, (O'Sullivan et al., 2021; Ravens-Sieberer et al., 2021), as well as fear of infection and missing school, clinginess, irritability, feelings of helplessness, lethargy, and reduced appetite, as reactions to the COVID-19 pandemic among children (Jiao et al., 2020). Although Japan has had lower infection and death rates compared to the US, India, Brazil, France, and Turkey, Japanese children have still experienced prolonged negative effects from the COVID-19 pandemic (National Center for Child Health and Development, 2021).

1.1. Impact of COVID-19 on children in Japan

A major difference in the social environment during the pandemic between Japan and Western countries, such as the US, France, the UK, Australia, and New Zealand, is that the Japanese government's regulations restricting freedom of movement have been less strict, due to the limited spread of COVID-19 infection compared to other countries (COVID Live Update, 2021). While the Japanese government has declared a national state of emergency several times since early 2020, they have only requested that people reduce how frequently they leave their homes and engage in social activities, without enforcing any penalties. Nevertheless, the Japanese government still enforced school closures for 1–3 months starting on March 2, 2020. School closure duration varied regionally depending on the infection risk. Hence, Japanese children also experienced an abrupt withdrawal from school, social life, and outdoor activities. School closures could particularly exacerbate anxiety for delay in academic learning. Not all children had computer and Internet access at home. Caregivers were required to collect hard copies of educational material from schools, and all children were forced to study without support from teachers. It was not until April 2021 that the Japanese government provided tablets or laptops with Internet access to every school-aged child. Similar to other countries, research indicates that the COVID-19 pandemic has had negative psychological effects on Japanese children, such as increased distress, anxiety, and depression (National Center for Child Health and Development, 2021).

An online survey conducted by National Center for Child Health and Development (2021) from April 30 to May 5, 2020, revealed that 39% of children aged between 7 and 17 years felt uncomfortable when thinking about COVID-19 and 32% were easily irritated. Childline Support Center Japan (2020), a free and anonymous telephone counseling service for children, also reported that over 60% of the children who called regarding issues related to the COVID-19 pandemic from February 28 to April 30, 2020, expressed negative emotions, including anxiety, anger and irritability, and sadness. Furthermore, the suicide rate among children and adolescents increased by 49% during the second wave of COVID-19 infections from June to October 2020 (Tanaka & Okamoto, 2021). Similar to international studies, Japanese research has also highlighted the increased distress among caregivers and how this negatively impacts children's mental health (Horiuchi et al., 2020).

These previous findings suggest that Japanese children also have a strong need for effective psychological support tailored to their unique circumstances to mitigate the negative impact of the COVID-19 pandemic. However, to our knowledge, no previous studies have quantitatively evaluated the changes in Japanese children's mental health before and after the start of the COVID-19 pandemic to accurately understand the extent of its impact. Furthermore, although pre-pandemic studies suggested potential age and gender differences in the presentation of psychological and behavioral reactions to stressors (Moriwaki & Kamio, 2014), no previous studies have investigated the gender differences in the psychological impact of the pandemic on Japanese children. Thus, such information may be useful for developing adequate interventions tailored to unique needs among children of different genders and age groups.

1.2. Impact of age and gender on the emotional and behavioral functioning of Japanese children

Previous studies with Japanese children have consistently reported that younger children tend to present more severe emotional and behavioral problems. For example, Moriwaki and Kamio (2014) reported that, from a national sample of 24,519 caregivers and 7877 school teachers, children aged 7–9 years were found to present significantly more severe total difficulties, emotional symptoms, conduct problems, hyperactivity/inattention, and peer problems compared to those aged 10–12 years old. Differences in emotional and behavioral problems among children in different age groups are potentially attributed to differences in brain development. Previous studies found that amygdala-prefrontal functional connectivity increases with age, which can lead to increased activity in the lateral prefrontal regions, decreased activation in the amygdala, improved down regulation of negative emotions, and increased ability to control various maladaptive behaviors (Martin & Ochsner, 2016; McRae et al., 2012).

Pre-pandemic studies also consistently reported gender differences in reaction to stressors, in that boys tend to experience more externalizing problems, such as aggression, delinquency, and hyperactivity/inattention, while girls tend to experience more internalizing problems, such as depression, withdrawal, anxiety, loneliness, somatic symptoms, and low self-esteem (Chaplin & Aldao, 2013; Maguire et al., 2016). Some studies also reported that, overall, Japanese boys tend to present more emotional and behavioral problems compared with girls. For example, Moriwaki and Kamio (2014) found that boys displayed more total difficulties, conduct problems, hyperactivity/inattention, and peer problems, while girls displayed more emotional symptoms and prosocial behaviors. Gender differences in distress levels may be partly explained by faster brain maturity among girls compared with boys, which contributes to faster development in cognitive and emotional functioning, including the ability to control one's emotions and behaviors (Koolschijn & Crone, 2013; Tao et al., 2014). Neuroscientific studies have consistently revealed that girls' brains mature a few years faster than those of boys, with faster optimization of neural networks in the regions of the prefrontal cortex involved in self-control (Johnson et al., 2009).

As previous studies indicated age and gender differences in reactions to stressors, it would be useful to explore these difference in relation to the COVID-19 pandemic to inform effective interventions suitable for the unique circumstances of boys and girls in different age groups. In addition, pre-pandemic studies also suggested that school adjustment, social interactions, and lifestyle activities may potentially influence children's emotional and behavioral reactions to the COVID-19 pandemic (Chui & Chan, 2017; Veiga et al., 2015).

1.3. Impact of school adjustment, social interactions, and lifestyle activities on children's mental health

School adjustment is the process of adapting to the role of being a student and various aspects of the school environment, such as academic performance, school rules, interpersonal relationships with peers and teachers, a positive attitude toward school, and participation in school activities (Ladd & Burgess, 2001). School adjustment is a key contributor to children's cognitive and emotional development and an important predictor for children's psychological well-being. Previous studies found that better school adjustment is significantly related to reduced risk of depression and anxiety disorders (Chui & Chan, 2017), reduced risk of attention problems (Seo, 2015), and better self-concept and empathy (Veiga et al., 2015). Previous studies across different countries have suggested that, compared with boys, girls tend to display better school adjustment with higher academic achievement and better teacher−-student relationships, owing to better self-regulation skills (Ewing & Taylor, 2009; Weis et al., 2013).

Previous studies also found that some lifestyle activities can promote positive emotional and behavioral functioning among children. Research

has consistently shown that an adequate amount of exercise has positive effects for promoting children's cognitive, emotional, and behavioral functioning (Itagaki et al., 2017; Wegner et al., 2019). Studies also found that regulated sleep patterns have a particularly positive effect on maintaining emotional and cognitive functioning and reducing the risk of depression and anxiety disorders (Matricciani et al., 2019; Sampasa-Kanyinga et al., 2020). In contrast, some previous studies found that sedentary activities, such as playing video games, are strongly linked to increased risk of social isolation, depression, anxiety disorders, and poor academic achievement (Coyne & Stockdale, 2021). Gaming addiction is becoming more prevalent across many countries, including Japan, and boys tend to have a higher risk compared with girls (National Hospital Organization Kurihama Medical and Addiction Center, 2017).

Social interactions are believed to be a basic human need, analogous to other fundamental needs, such as food or sleep (Baumeister & Leary, 1995). A lack of social interactions can make people feel lonely and disconnected, cause profound negative effects on physical and mental health, and even lead to increased mortality (Hawkley & Cacioppo, 2010). Neurobiologically, children who chronically lack social contact are more likely to experience elevated stress and inflammation and decreased cognitive, emotional, behavioral, and physiological functioning (Maydych, 2019). The emotional support provided by social interactions can reduce the damaging effects of stress and generate a positive feedback loop of social, emotional, and physical well-being (Sandstrom & Dunn, 2014).

Among different social relationships, mothers have long been recognized as primary figures for emotional attachment and support. The absence of mother−child interaction has been found to significantly impact cognitive and emotional development and increase the risk of poor emotional regulation (Lincoln et al., 2017; Takeuchi et al., 2015). While a few studies have specifically investigated gender differences among children, previous studies consistently reported that girls tend to have better socioemotional skills and find social interactions to be more rewarding compared with boys, and that boys tend to experience more social isolation than girls across different age groups (Abdi, 2010; Borland et al., 2019).

1.4. Limitations of existing studies and objectives of the present study

Previous studies suggest that the COVID-19 pandemic is likely to negatively impact Japanese children's emotional and behavioral functioning. To effectively mitigate this, the quality and quantity of the pandemic's psychological effects on Japanese children, and the related risk and protective factors for emotional and behavioral functioning, need to be accurately understood. Furthermore, pre-pandemic studies suggested the potential presence of gender differences in the quality and quantity of responses to stressors during the COVID-19 pandemic among Japanese children. However, to our knowledge, no previous study has quantitatively evaluated the changes in children's emotional and behavioral functioning using pre- and mid-pandemic data, investigated age and gender differences in reactions to the COVID-19 pandemic, and explored risk and protective factors that have impacted emotional and behavioral functioning among Japanese children during the pandemic.

Thus, to fill the gap in existing research, the present study aimed to investigate the culturally specific impact of the COVID-19 pandemic on Japanese children's mental health by comparing levels of emotional functioning immediately before and after the start of the pandemic, with particular focus on potential age and gender differences. To identify the risk and protective factors for children's mental health amid the COVID-19 pandemic, the present study also explored the impact of pre-pandemic school adjustment on Japanese children's emotional functioning after the pandemic began. The present study also investigated the relationship between children's social interactions, lifestyle activities, and emotional and behavioral functioning amid the COVID-19 pandemic. The findings of the present study could be useful for the future development of adequate psychological interventions tailored to the unique needs of Japanese boys and girls amid the COVID-19 pandemic.

2. Material and methods

2.1. Overview

The present study employed a quasi-experimental design to analyze questionnaires administered to Japanese children at two time points (immediately before and after the start of the COVID-19 pandemic) to evaluate the pandemic's psychological impact on this population group. Using questionnaires administered both pre- and mid-pandemic, the present study also evaluated the impact of pre-pandemic school adjustment and of social interactions and lifestyle activities on children's behavioral and emotional functioning during the COVID-19 pandemic. All procedures were performed in accordance with the Declaration of Helsinki (The World Medical Association, 2008). Prior to the commencement of study, ethical approval was obtained from the Research Ethics Committee at Tottori University.

2.2. Participants

Participants were 522 children (234 boys, 288 girls) aged 8–12 years from three public primary schools in the southwestern region of Japan. Children were in the third through sixth grades. Children from the first and second grades were excluded from this study as previous research revealed that they have difficulties understanding questions and appropriately responding to self-report measures due to their stage of cognitive development (Nishida et al., 2021).

2.3. Procedure

Participants were recruited using convenience sampling. After obtaining ethical approval, the researchers recruited the participating schools by describing the purpose of the study to school principals in the southwestern region of Japan through telephone calls and emails. For the schools that approved participation, the purpose of the study and confidentiality were described to the parents and children, and the researcher obtained informed consent from parents and children for their study participation. Parents and children were informed that their participation was voluntary and they would not receive any disadvantages if they refused.

Participants completed the first questionnaire in December 2019, before the start of the COVID-19 pandemic in Japan, as part of a regional cohort study conducted by the authors. The primary researcher provided instructions to the homeroom teachers for distributing and collecting questionnaires from students. In their classrooms, students were informed that they may withdraw from the study at any time without penalty and that they could indicate if they did not want their responses to be used in the research. After obtaining consent, the homeroom teachers distributed hard copies of the questionnaires to the students. The students completed their questionnaires during regular classroom hours under the supervision of their homeroom teachers. The homeroom teachers provided instructions for responding to each item, ensured that the children understood the questions, and provided appropriate responses by answering all their queries and clarifying the meaning of any question. The questionnaire took approximately 15–20 min to complete. The primary researcher collected the completed questionnaires from each school.

The children completed the second questionnaire in March 2020, after the COVID-19 pandemic began. During school closures, the questionnaires were provided to either caregivers or children when they came to retrieve educational materials schools or at the children's homes when homeroom teachers delivered educational materials. Children were told that they would be excluded from the research data if they did not want their responses to be used for research purposes and that they would not receive any disadvantages if they refused participation. Children

completed the questionnaires at home at a time convenient for them. Completed questionnaires were either returned to the school via mail or collected by homeroom teachers from the children's homes when they delivered educational materials during school closures. The researcher deidentified and entered the electronic data into a computer with a secure password. The completed questionnaires were stored in a locked cabinet to ensure data security.

2.4. Measures

2.4.1. Pre-pandemic questionnaire

The pre-pandemic questionnaire included the emotional symptoms subscale of the Japanese version of the Strength and Difficulties Questionnaire (SDQ: Goodman, 1997; Noda et al., 2013). The Japanese version of SDQ was developed by Matsuishi and his collegues (2008). The SDQ is a 25-item self-report questionnaire rated on a three-point Likert scale (1 = "not true" to 3 = "certainly true") that screens the emotions and behaviors of children aged 3–16 years. The SDQ consists of five subscales that each contain five items: emotional symptoms, conduct problems, inattention/hyperactivity, peer problems, and prosocial behaviors. This study utilized the SDQ's student self-report version (aged 11–17 years), with which Muris et al. (2004) conducted research with 439 students aged 8–13 years, suggesting the usefulness of the scale for children as young as 8 years old. Japanese research (Noda et al., 2013) revealed that the SDQ had reasonable reliability ($\alpha = 0.86$ for total and $\alpha = 0.67$–84 for subscales) and convergent validity ($r = 0.56$ with Child behavior checklist total score and $r = 0.55$ between emotional symptoms scores of SDQ and Child behavior check list anxiety and depression subscale) with 5072 students (aged 10–15 years). The cut-off score for high needs group is above 16 for total difficulties, above 5 for emotional symptoms, conduct problems and peer-problems subscales, above 7 for hyperattention/inattention subscale and below 4 for prosocial behavior (Noda et al., 2013). This study included the emotional symptoms scale on the pre-pandemic questionnaire to examine the severity of emotional symptoms, such as anxiety, among children.

The pre-pandemic questionnaire also included the 10-item self-report School Adaptation Scale (Furuichi & Tamaki, 1994) to measure children's school adaptation before the pandemic. Each scale item provides a statement that describes enjoyment or motivation for going to school (e.g., "I enjoy going to school") and likeability of school (e.g., "I like this school"). For each item, children were asked to answer on a five-point Likert scale (1 = "does not apply" to 5 = "applies"). The analysis utilized average scores for the 10 items. Previous studies reported this scale's reasonable reliability ($\alpha = 0.88$) and convergent validity for Japanese children ($r = 0.41$ with communication skills, $r = 0.35$ with group work skills) (Fujita & Kagawa, 2014). The pre-pandemic questionnaire also collected data regarding demographic variables, including each child's name, grade, classroom, and gender.

2.4.2. Mid-pandemic questionnaire

The mid-pandemic questionnaire included all the subscales of the SDQ (Goodman, 1997), including emotional symptoms, conduct problems, inattention/hyperactivity, peer problems, and prosocial behaviors subscales for measuring children's comprehensive emotional and behavioral functioning after the pandemic began.

The mid-pandemic questionnaire also included three other measures originally developed for this study. The first original measure was designed to evaluate three types of anxiety children could develop during the COVID-19 pandemic: (1) anxiety related to infection; (2) anxiety related to returning to school after school closures; and (3) anxiety related to academic delay due to school closures. Children were asked to provide responses on a five-point Likert scale (1 = "does not apply" to 5 "applies"). The second original measure was designed to assess the quality of social interactions amid the COVID-19 pandemic. The measure asked children to indicate three people with whom they spent the most time during school closures: alone, mother, father, grandmother, grandfather, sibling(s), other family member(s), friend(s), after-school daycare instructor/extracurricular lesson instructor, and other. Children were asked to rank their responses from the most frequent to the third most frequent person/people with whom they spent time.

The third original measure assessed the frequency of children's engagement in different lifestyle activities amid the pandemic, including (1) extra-curricular lessons (e.g., music and art lessens), (2) playing with friends, (3) spending time outside the house, (4) studying, (5) waking up late in the morning, (6) staying up late at night, (7) eating meals alone, (8) going out with family member(s), (9) playing video games for more than 1 h, (10) watching news media regarding COVID-19, (11) physical exercise, and (12) spending time at daycare. Children were asked to provide the frequency of engagement in each lifestyle activity on a four-point Likert-type scale (1" = "not at all," 2 = "not much, once or twice a week," 3 = "often. three or four times a week," and 4 = "almost daily").

2.5. Data analysis

The data analysis was performed using IBM SPSS 26 and AMOS 26. Time 1 (T1) was immediately before the pandemic, in December 2019. Time 2 (T2) was after the start of pandemic, in March 2020. A MANOVA was performed to explore the effects of age and gender on school adjustment and emotional symptoms at T1 and total difficulties, emotional symptoms, conduct problems, hyperactivity/inattention, peer problems, prosocial behavior, and anxiety related to infection, returning to school, and academic delay at T2. A repeated-measures ANOVA and *t*-test were performed to examine the effects of age and gender on changes in emotional symptoms between T1 and T2. Latent change modeling was performed to examine the impact of school adjustment, gender, and grade level at T1 on the size of the changes in emotional symptoms between T1 and T2.

Pearson correlational analysis was performed to examine the relationship between the frequency of engagement in different lifestyle activities and total difficulties, emotional symptoms, conduct problems, inattention/hyperactivity, peer problems, and prosocial behaviors as measured by the SDQ at T2, and anxiety related to infection, returning to school, and academic delay at T2. A one-tailed independent sample *t*-test was performed to examine the impact of children's social interactions with different individuals at T2 on total difficulties, emotional symptoms, conduct problems, inattention/hyperactivity, peer problems, prosocial behaviors, and anxiety related to infection, returning to school, and academic delay at T2.

3. Results

3.1. Overview

Out of 522 children who completed the pre-pandemic questionnaire at T1, 292 also completed the mid-pandemic questionnaire at T2, for a 43.5% attrition rate between T1 and T2. Only children who completed both the pre-pandemic and mid-pandemic questionnaires ($N = 292$) were included in the data analysis (Table 1). An independent sample *t*-test revealed no differences in emotional symptoms at T1 between children who only responded to the pre-pandemic questionnaire ($M = 2.55$, $SD = 2.55$) and those who completed both the pre-pandemic and mid-pandemic questionnaires ($M = 2.66$, $SD = 2.60$; T1, $t\ (520) = 0.469$, *ns*). Similarly, an independent sample *t*-test revealed no differences in school adjustment at T1 between children who only responded to the pre-

Table 1
Demographic profile of the final sample (n).

	Grade 3	Grade 4	Grade 5	Grade 6	Total
Boys	30	36	39	23	128
Girls	50	54	33	27	164
Total	80	92	73	50	292

pandemic questionnaire ($M = 3.41$, $SD = 0.89$) and those who completed both questionnaires ($M = 3.37$, $SD = 0.49$; T1, t (512) = 0.122, *ns*). Hence, the attrition rate between T1 and T2 was determined to have minimal impact on the analysis results. The proportion of participants who had missing response for each variable measured was less than 5%. The participants who recorded any missing response were excluded form the calculation of each variable.

3.2. School adjustment, behavioral and emotional functioning at T1 and T2

Emotional symptoms and school adjustment measured at T1 and total difficulties, emotional symptoms, conduct problems, hyperactivity/inattention, peer problems, prosocial behavior, and anxiety related to infection, returning to school, and academic delay measured at T2 are summarized in Table 2. The MANOVA results revealed a significant effect of grade level (F (21, 702) = 2.30, $p = .001$: Wilk's $\Lambda = 0.826$). There was significant effect of grade level on school adjustment (F (3, 250) = 2.35, $p < .05$) and emotional symptoms at T1 (F (3, 250) = 2.52, $p < .05$), and on total difficulties (F (3, 250) = 2.60, $p < .05$), emotional symptoms (F (3, 250) = 3.74, $p < .03$), hyperactivity/inattention (F (3, 250) = 3.16, $p < .03$), anxiety related to infection (F (3, 250) = 4.47, $p < .01$), anxiety related returning to school (F (3, 250) = 6.97, $p < .01$), and anxiety related to academic delay (F (3, 250) = 3.03, $p < .03$) at T2.

Post-hoc comparisons using the Tukey HSD test revealed that third graders ($M = 3.66$, $SD = 0.89$) had significantly lower school adjustment at T1 compared to fourth graders ($M = 3.85$, $SD = -0.89$), third graders had significantly more total difficulties at T2 compared to fourth ($M = 10.01$, $SD = 5.26$) and fifth graders ($M = 10.38$, $SD = 5.08$), third graders ($M = 3.44$, $SD = 2.61$) had significantly more emotional symptoms at T2 compared to fourth graders ($M = 2.31$, $SD = 1.97$), fifth graders ($M = 2.32$, $SD = 1.77$) had significantly more conduct problems compared to fourth graders ($M = 1.88$, $SD = 1.17$), third graders ($M = 3.51$, $SD = 1.55$) had significantly stronger anxiety related to infection compared to fifth graders ($M = 2.65$, $SD = 1.50$), third graders ($M = 3.44$, $SD = 1.52$) had significantly stronger anxiety related to returning to school than those in all other grades, and third graders ($M = 3.51$, $SD = 1.49$) had significantly stronger anxiety related to academic delay compared to sixth graders ($M = 3.09$, $SD = 1.54$).

A MANOVA also revealed a significant effect of gender (F (7, 244) = 4.84, $p < .001$; Wilk's $\Lambda = 0.828$). Boys ($M = 3.54$, $SD = 0.95$) had significantly lower school adjustment at T1 compared with girls ($M = 3.73$, $SD = 0.92$; F (1, 250) = 3.46, $p < .05$), while girls ($M = 2.94$, $SD = 2.65$) had significantly more severe emotional symptoms at T1 compared with boys ($M = 2.31$, $SD = 2.49$; F (1, 250) = 3.66, $p < .05$). There were no significant differences in emotional symptoms between boys and girls at T2 (F (1, 250) = 3.46, $p < .05$). At T2, compared with girls, boys had significantly higher total difficulties (boys: $M = 11.68$, $SD = 5.05$; girls: $M = 9.79$, $SD = 5.23$; F (1, 250) = 7.82, $p = .01$), significantly more conduct problems (boys: $M = 2.35$, $SD = 1.68$; girls: $M = 1.82$, $SD = 1.46$; F (1, 250) = 6.48, $p < .001$), significantly more hyperactivity/inattention (boys: $M = 4.16$, $SD = 1.98$; girls: $M = 3.06$, $SD = 2.10$; F (1, 250) = 20.90, $p < .001$), and significantly more peer problems (boys: $M = 2.40$, $SD = 1.66$; girls: $M = 2.04$, $SD = 1.46$; F (1, 250) = 3.31, $p < .05$), and displayed significantly less prosocial behavior (boys: $M = 5.45$, $SD = 1.86$; girls: $M = 6.63$, $SD = 2.02$; F (1, 250) = 23.46, $p < .001$). There was no interaction between age and gender among these variables (F (21, 702) = 0.599, *ns*; Wilk's $\Lambda = 0.927$).

A repeated-measures ANOVA revealed no significant differences in emotional symptoms between T1 and T2 among all children (F (1, 272) = 2.50, $p = .12$; Wilk's $\Lambda = 0.991$). There were no significant interactions between time, gender, and grade level (F (3, 272) = 0.53, $p = .27$; Wilk's $\Lambda = 0.994$); between time and grade level (F (3, 272) = 1.31, $p = .13$; Wilk's $\Lambda = 0.986$); or between time and gender (F (1, 272) = 2.29, $p =$

Table 2
Summary of emotional and behavioral functioning and school adjustment at T1 and T2.

			Grade 3		Grade 4		Grade 5		Grade 6		Total	
	Time	Gender	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
Emotional symptoms	T1	Male	3.11	(2.88)	2.28	(2.65)	2.18	(2.29)	1.61	(1.83)	2.31	(2.49)
		Female	3.42	(2.73)	2.66	(2.63)	2.94	(2.66)	2.63	(2.57)	2.94	(2.65)
		Total	3.30	(2.77)	2.51	(2.63)	2.54	(2.48)	2.16	(2.30)	2.66	(2.60)
School adjustment	T1	Male	3.65	(0.83)	3.72	(0.99)	3.26	(1.10)	3.58	(0.73)	3.54	(0.95)
		Female	3.66	(0.93)	3.94	(0.81)	3.72	(1.14)	3.47	(0.75)	3.73	(0.92)
		Total	3.66	(0.89)	3.85	(0.89)	3.47	(1.13)	3.52	(0.73)	3.64	(0.94)
Total difficulties	T2	Male	13.96	(4.46)	11.06	(5.70)	11.29	(4.82)	10.25	(4.25)	11.68	(5.05)
		Female	10.59	(5.73)	9.32	(4.87)	9.35	(5.25)	9.84	(5.10)	9.79	(5.23)
		Total	11.86	(5.50)	10.01	(5.26)	10.38	(5.08)	10.02	(4.69)	10.60	(5.23)
Emotional symptoms	T2	Male	3.97	(2.69)	2.06	(1.76)	2.66	(2.20)	2.45	(2.04)	2.75	(2.27)
		Female	3.12	(2.54)	2.49	(2.11)	3.19	(2.47)	2.70	(2.64)	2.86	(2.41)
		Total	3.44	(2.61)	2.31	(1.97)	2.90	(2.32)	2.59	(2.37)	2.81	(2.34)
Conduct problems	T2	Male	2.45	(1.70)	2.11	(1.64)	2.74	(1.90)	1.91	(1.15)	2.35	(1.68)
		Female	1.88	(1.39)	1.72	(1.64)	1.85	(1.50)	1.85	(1.20)	1.82	(1.46)
		Total	2.09	(1.53)	1.88	(1.64)	2.32	(1.77)	1.88	(1.17)	2.05	(1.58)
Hyperactivity	T2	Male	4.90	(1.92)	4.22	(2.31)	4.08	(1.87)	3.22	(1.28)	4.16	(1.98)
		Female	3.35	(2.10)	3.09	(1.96)	2.52	(2.20)	3.15	(2.21)	3.06	(2.10)
		Total	3.94	(2.16)	3.54	(2.17)	3.36	(2.16)	3.18	(1.83)	3.54	(2.11)
Peer problems	T2	Male	2.66	(1.61)	2.44	(1.98)	2.08	(1.32)	2.50	(1.71)	2.40	(1.66)
		Female	2.29	(1.68)	1.96	(1.40)	1.68	(1.11)	2.20	(1.44)	2.04	(1.46)
		Total	2.42	(1.66)	2.16	(1.66)	1.90	(1.24)	2.34	(1.56)	2.20	(1.56)
Prosocial behavior	T2	Male	5.50	(1.68)	5.25	(1.95)	5.54	(1.88)	5.57	(2.04)	5.45	(1.86)
		Female	6.47	(1.77)	6.87	(1.97)	6.64	(2.29)	6.41	(2.24)	6.63	(2.02)
		Total	6.10	(1.79)	6.22	(2.11)	6.04	(2.13)	6.02	(2.17)	6.11	(2.03)
Anxiety (infection)	T2	Male	3.80	(1.45)	3.47	(1.42)	2.41	(1.45)	2.96	(1.58)	3.13	(1.55)
		Female	3.34	(1.60)	3.48	(1.44)	2.94	(1.50)	3.33	(1.44)	3.30	(1.50)
		Total	3.51	(1.55)	3.48	(1.42)	2.65	(1.48)	3.16	(1.50)	3.23	(1.52)
Anxiety (returning to school)	T2	Male	3.88	(1.36)	2.67	(1.54)	2.45	(1.57)	2.20	(1.21)	2.84	(1.57)
		Female	3.14	(1.57)	2.95	(1.70)	2.29	(1.46)	2.07	(1.44)	2.77	(1.61)
		Total	3.44	(1.52)	2.85	(1.64)	2.38	(1.51)	2.13	(1.31)	2.80	(1.59)
Anxiety (academic delay)	T2	Male	3.83	(1.36)	2.53	(1.48)	2.49	(1.57)	2.70	(1.29)	2.84	(1.53)
		Female	3.33	(1.55)	3.33	(1.49)	3.15	(1.72)	3.30	(1.38)	3.29	(1.53)
		Total	3.51	(1.49)	3.01	(1.53)	2.79	(1.66)	3.02	(1.36)	3.09	(1.54)

.065; Wilk's $\Lambda = 0.992$). These findings indicated that the deterioration of emotional symptoms between T1 and T2 was not significant, regardless of gender or grade level.

3.3. Effects of school adjustment, grade level, and gender on changes in emotional functioning between T1 and T2

Latent change modeling was employed to investigate changes in emotional symptoms between T1 and T2, without entering gender, grade level, or school adjustment as independent variables. Model fit was interpreted as acceptable if the comparative fit index (CFI) > 0.90, Tucker−Lewis index (TLI) > 0.90, and root mean square error of approximation (RMSEA) < 0.08 (Hancock & Freeman, 2001; Kline, 2015); the model's overall goodness of fit was reasonable: χ^2 (29, N = 292) = 47.67, $p < .05$, CFI = 0.971, TLI = 0.946, RMSEA = 0.47, NFI = 0.933. The results revealed significant individual variability for both the intercept ($\sigma^2 = 0.13$, $t = 4.12$, $p < .001$) and slope ($\sigma^2 = 0.97$, $t = 4.37$, $p < .001$). These results indicated that there were significant individual differences in the level of emotional symptoms at T1 and degree of change in emotional symptoms between T1 and T2. There was a significant association between the intercept and slope after controlling for the impact of gender, grade level, and school adjustment ($b = -0.65$, $t = -3.00$, $p < .01$), indicating that children who already displayed severe emotional symptoms at T1 experienced less deterioration in emotional symptoms between T1 and T2.

Latent change modeling was further used to examine the impact of school adjustment at T1, gender, and grade level on the changes in emotional symptoms between T1 and T2. The overall goodness of fit of the model was reasonable: χ^2 (60, N = 292) = 84.87, $p < .05$, CFI = 0.963, TLI = 0.944, RMSEA = 0.038, NFI = 0.889. The results revealed significant variance in the intercept ($\sigma^2 = 0.12$, $t = 4.56$, $p < .001$) and slope ($\sigma^2 = 0.10$, $t = 4.46$, $p < .001$). These results indicated significant individual differences in the level of emotional symptoms at T1 and the degree of change in emotional symptoms between T1 and T2, regardless of gender, grade level, or school adjustment. There was a significant association between the intercept and slope after controlling for the impact of gender, grade level, and school adjustment ($\beta = -0.61$, $t = -4.04$, $p < .01$), indicating that children who already displayed severe emotional symptoms at T1 experienced less deterioration in emotional symptoms between T1 and T2, regardless of gender, grade level, or school adjustment.

School adjustment at T1 had a significant negative path to initial values of emotional symptoms at T1 ($\beta = -0.22$, $t = -3.23$, $p < .01$), indicating that children with better pre-pandemic school adjustment had lower levels of emotional symptoms pre-pandemic. However, there was no impact of school adjustment at T1 on the slope ($\beta = 0.03$, $t = 0.39$, *ns*), indicating that school adjustment at T1 did not impact the degree of change in emotional symptoms between T1 and T2. Gender also had a significant negative relationship with the intercept ($\beta = -0.13$, $t = -2.02$, $p < .05$), indicating that boys had significantly lower emotional symptoms at T1 compared with girls. However, gender did not predict the slope ($\beta = 0.11$, $t = 1.49$, *ns*), indicating that gender did not impact the degree of change in emotional symptoms between T1 and T2. Grade level also had a significant negative path to the intercept ($\beta = -0.16$, $t = -2.02$, $p < .05$), indicating that children in lower grade levels had significantly higher emotional symptoms at T1. Grade level did not predict the slope ($\beta = 0.08$, $t = 1.06$, *ns*), indicating that grade level did not impact the degree of change in emotional symptoms between T1 and T2.

To further analyze the impact of school adjustment at T1 on the change in emotional symptoms between T1 and T2, children were categorized into three groups with different school adjustment levels at T1 (Table 3). Children were categorized into the high school adjustment group if school adjustment at T1 was less than 4.11 ($>M + 0.5SD$ school adjustment), the medium school adjustment group if school adjustment at T1 was between 3.17 and 4.11 (between $M \pm 0.5SD$ school adjustment), and the low school adjustment group if school adjustment T1 was lower than 3.17 ($<M - 0.5SD$ school adjustment). A repeated-measures t-test revealed that only children with in the medium school adjustment group had significant deterioration in emotional symptoms between T1 ($M = 2.64$, $SD = 2.63$) and T2 ($M = 3.16$, $SD = 2.48$; t (86) = 2.00, $p < .05$), children in the high school adjustment group did not experience significant changes in emotional symptoms between T1 (M = 2.00, SD = 2.48) and T2 (M = 2.01, SD = 1.99; t (86) = 0.12, *ns*), and children in the low school adjustment group maintained a higher level of emotional symptoms between T1 (M = 3.23, SD = 2.49) and T2 (M = 3.20, SD = 2.29; t (86) = 0.04, *ns*) (see Table 3).

Table 3
Changes in emotional symptoms between T1 and T2 for children with different school adjustment levels at T1.

		T1		T2			
	n	M	SD	M	SD	t	p
High school adjustment	97	2.00	2.48	2.01	1.99	.12	.90
Medium school adjustment	87	2.64	2.63	3.16	2.48	2.00	.05
Low school adjustment	87	3.23	2.49	3.20	2.29	.04	.99

3.4. Relationship between emotional and behavioral functioning and frequency of engagement in lifestyle activities at T2

The frequency of engagement in lifestyle activities is summarized in Table 4. Studying, watching news media regarding COVID-19, spending time outside the house, and exercise were the four lifestyle activities both girls and boys engaged in most frequently during school closures. On average, children engaged in these activities at least three or four times per week during school closures. In contrast, eating meals alone, contacting friend(s) by smartphone/PC, spending time at a daycare center, and playing with friends were the lifestyle activities engaged in least frequently across all grades. On average, children engaged in these activities less than once or twice per week during school closures.

A MANOVA revealed a significant effect of grade level (F (39, 564) = 1.80, $p = .001$: Wilk's $\Lambda = 0.706$). There was significant effect of grade level on staying up late (F (3, 202) = 2.64, $p < .05$), playing video games (F (3, 202) = 2.52, $p < .05$), contact friend(s) by smartphone/PC (F (3, 202) = 7.15, $p < .01$), watching news media (F (3, 202) = 3.01, $p < .03$), and going to an afterschool daycare center (F (3, 202) = 2.89, $p < .03$). Post-hoc comparisons using the Tukey HSD test revealed that fifth graders played video games significantly more frequently compared with children in all other grades, third graders contacted friend(s) by smartphone/PC significantly less than fifth and sixth graders, third graders watched news media significantly less frequently than fifth graders, and fourth graders went to an afterschool daycare center significantly more than fifth graders.

A MANOVA also revealed a significant effect of gender (F (13, 563) = 1.11, $p = .04$: Wilk's $\Lambda = 0.804$). Compared with boys, girls went out with family members (F (1, 202) = 3.14, $p < .05$), contacted friends via smartphones/PCs (F (3, 202) = 3.03, $p < .01$), and watched news media significantly more (F (3, 202) = 4.17, $p < .03$), while boys played video games significantly more compared with girls (F (3, 202) = 4.84, $p < .03$). There was no interaction between age and gender among these variables (F (39, 563) = 1.11, *ns*; Wilk's $\Lambda = 1.107$).

The Pearson correlational analysis revealed that staying up late at night at T2 had a significant positive relationship with total difficulties ($r = 0.12$, $p < .05$), emotional symptoms ($r = -0.20$, $p < .001$), conduct problems ($r = 0.13$, $p < .05$), hyperactivity/inattention ($r = 0.26$, $p < .01$), anxiety related to infection ($r = 0.11$, $p < .05$), and anxiety related returning to school ($r = 0.21$, $p < .05$) at T2. Similarly, the frequency of waking up late had a significant positive relationship with total difficulties ($r = .12$, $p < .05$), hyperactivity/inattention ($r = 0.14$, $p < .05$), and anxiety related to returning to school ($r = 0.14$, $p < .05$). Pearson correlational analysis also revealed that the frequency of playing video

Table 4
Engagement in different social activities among boys and girls in different grade levels.

		Grade 3		Grade 4		Grade 5		Grade 6		Total	
	Gender	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
Going to extracurricular lessons	Male	1.82	(0.80)	2.15	(1.06)	2.04	(1.04)	2.33	(0.62)	2.07	(0.94)
	Female	2.23	(0.91)	2.20	(0.98)	2.42	(0.83)	2.33	(0.90)	2.27	(0.91)
	Total	2.07	(0.88)	2.18	(1.00)	2.21	(0.96)	2.33	(0.76)	2.18	(0.93)
Playing with friends	Male	2.05	(1.05)	1.81	(1.04)	1.64	(0.68)	1.67	(0.72)	1.79	(0.90)
	Female	1.66	(0.87)	1.82	(0.92)	1.54	(0.83)	1.80	(0.77)	1.71	(0.87)
	Total	1.81	(0.95)	1.82	(0.96)	1.60	(0.75)	1.73	(0.74)	1.75	(0.88)
Going outside	Male	3.05	(0.95)	2.96	(0.94)	2.96	(0.84)	3.00	(0.93)	2.99	(0.90)
	Female	2.91	(0.89)	3.05	(0.78)	3.04	(0.91)	3.00	(1.00)	3.00	(0.86)
	Total	2.96	(0.91)	3.01	(0.84)	3.00	(0.86)	3.00	(0.95)	3.00	(0.87)
Studying	Male	3.41	(0.91)	3.74	(0.45)	3.68	(0.72)	3.67	(0.49)	3.63	(0.67)
	Female	3.71	(0.62)	3.61	(0.65)	3.83	(0.38)	3.80	(0.41)	3.71	(0.57)
	Total	3.60	(0.75)	3.66	(0.58)	3.75	(0.59)	3.73	(0.45)	3.68	(0.62)
Waking up late	Male	2.59	(1.18)	2.78	(0.97)	2.57	(0.96)	2.47	(0.92)	2.62	(1.00)
	Female	2.57	(0.95)	2.48	(0.95)	2.38	(1.06)	2.60	(1.12)	2.50	(0.98)
	Total	2.58	(1.03)	2.59	(0.96)	2.48	(1.00)	2.53	(1.01)	2.55	(0.99)
Staying up late at night	Male	2.86	(1.04)	2.33	(1.00)	2.64	(1.22)	1.93	(0.80)	2.49	(1.08)
	Female	2.46	(1.04)	2.36	(0.99)	2.63	(0.92)	2.27	(1.16)	2.43	(1.01)
	Total	2.61	(1.05)	2.35	(0.99)	2.63	(1.09)	2.10	(0.99)	2.46	(1.04)
Eating meals alone	Male	1.32	(0.72)	1.30	(0.67)	1.29	(0.66)	1.40	(0.74)	1.32	(0.68)
	Female	1.17	(0.51)	1.25	(0.69)	1.54	(1.02)	1.33	(0.62)	1.30	(0.72)
	Total	1.23	(0.60)	1.27	(0.68)	1.40	(0.85)	1.37	(0.67)	1.30	(0.70)
Going out with family	Male	2.18	(0.91)	2.11	(0.89)	2.25	(0.70)	2.33	(0.62)	2.21	(0.79)
	Female	2.43	(0.61)	2.55	(0.76)	2.29	(0.75)	2.40	(0.83)	2.44	(0.72)
	Total	2.33	(0.74)	2.38	(0.83)	2.27	(0.72)	2.37	(0.72)	2.34	(0.76)
Playing games for more than 1 h	Male	2.50	(0.96)	2.56	(1.12)	3.11	(1.10)	1.73	(0.88)	2.58	(1.12)
	Female	1.89	(1.13)	1.89	(1.06)	2.25	(1.19)	2.47	(1.19)	2.03	(1.13)
	Total	2.12	(1.10)	2.14	(1.12)	2.71	(1.21)	2.10	(1.09)	2.27	(1.16)
Contacting friend(s) by smartphone/PC	Male	1.00	(0.00)	1.26	(0.59)	1.43	(0.92)	1.27	(0.80)	1.25	(0.69)
	Female	1.09	(0.28)	1.11	(0.39)	1.29	(0.75)	2.13	(1.30)	1.27	(0.71)
	Total	1.05	(0.23)	1.17	(0.48)	1.37	(0.84)	1.70	(1.15)	1.26	(0.70)
Watching news media on COVID-19	Male	2.91	(1.19)	3.07	(1.14)	3.43	(0.74)	3.27	(1.03)	3.17	(1.03)
	Female	3.11	(0.96)	3.39	(0.92)	3.58	(0.83)	3.73	(0.59)	3.39	(0.90)
	Total	3.04	(1.05)	3.27	(1.01)	3.50	(0.78)	3.50	(0.86)	3.30	(0.96)
Exercising	Male	2.64	(1.09)	3.04	(0.98)	2.86	(0.93)	2.80	(0.86)	2.85	(0.97)
	Female	2.74	(0.85)	2.93	(0.76)	3.21	(1.06)	2.87	(1.06	2.92	(0.90)
	Total	2.70	(0.94)	2.97	(0.84)	3.02	(1.00)	2.83	(0.95	2.89	(0.93)
Going to an afterschool daycare center	Male	1.45	(0.86)	1.52	(1.12)	1.00	(0.00)	1.00	(0.00	1.26	(0.77)
	Female	1.40	(0.88)	1.59	(1.19)	1.25	(0.74)	1.33	(0.82	1.43	(0.97)
	Total	1.42	(0.86)	1.56	(1.16)	1.12	(0.51)	1.17	(0.59	1.36	(0.89)

games had a significant positive relationship with total difficulties ($r = 0.17, p < .03$), emotional symptoms ($r = 0.12, p < .05$), conduct problems ($r = 0.19$, $p < .03$), and hyperactivity/inattention ($r = 0.16$, $p < .03$).

In contrast, Pearson correlational analysis revealed that exercise frequency had a significant negative relationship with total difficulties ($r = -0.20$, $p < .05$), emotional symptoms ($r = -0.20$, $p < .05$), hyperactivity/inattention ($r = -0.12$, $p < .05$), and anxiety related to returning to school ($r = -0.17, p < .05$; Table 5). The frequency of studying also had a significant negative relationship with total difficulties ($r = -0.20$, $p < .05$), conduct problems ($r = -0.22$, $p < .05$), and hyperactivity/inattention ($r = -0.24, p < .05$), and significant a positive relationship with prosocial behavior ($r = 0.18$, $p < .05$). The frequency of engaging in extracurricular activities had a significant negative relationship with total difficulties ($r = -0.13$, $p < .05$), conduct problems ($r = -0.12$, $p < .05$), and hyperactivity/inattention ($r = -0.19, p < .05$), and a significant positive relationship with prosocial behavior ($r = 0.11$, $p < .05$). The

Table 5
Relationships between children's social activities and emotional and behavioral functioning during school closures.

		TDS	ES	CP	HI	PP	PB	AI	AR	AA
1	Going to extracurricular lessons	-.13*	-.03	-.12*	-.19**	-.03	.11*	-.09	-.13*	-.14*
2	Playing with friends	-.02	-.01	-.01	-.02	-.05	.05	.02	.06	.08
3	Going outside	-.02	-.04	.02	.02	-.07	-.05	.01	.01	.06
4	Studying	-.20**	-.07	-.22**	-.24**	-.02	.18**	-.03	-.06	-.0
5	Waking up late	.12*	.02	.13*	.14**	.01	-.06	-.00	.14*	.04
6	Staying up late at night	.32**	.20**	.33**	.26**	.07	-.15**	.11*	.21**	.07
7	Eating meals alone	.09	.10*	.02	.04	.05	-.01	-.02	-.04	-.01
8	Going out with my family	-.07	.08	-.03	-.08	-.02	.16**	.07	-.02	-.02
9	Playing video games for more than 1 h	.17**	.12*	.19**	.16**	-.04	-.03	.02	-.02	-.03
10	Contacting my friend(s) by smartphone or PC	.03	.03	.05	.01	-.07	-.03	-.01	-.04	-.07
11	Watching news media on COVID-19	.15**	-.07	-.05	-.16**	-.15**	.05	-.01	-.15*	-.00
12	Being physically active	-.20**	-.20**	-.10	-.12*	-.10	.03	-.09	-.17**	-.01
13	Going to an afterschool daycare center	.00	-.01	.01	-.01	.03	.13*	.06	.06	.09

Note. TDS = total difficulties score, ES = emotional symptoms, CP = conduct problems, PB = prosocial behavior, AI = anxiety related to infection, AR = anxiety related to returning to school, AA = anxiety related to academic delay.

frequency of meeting friends, contacting friends via online communication, and going outside had no relationship with total difficulties or any of the SDQ subscales.

3.5. Impact of social interactions on emotional and behavioral functioning at T2

The primary relationships for social interactions among children at T2 is summarized in Table 6. Their sibling(s), mother, and grandmother were the three individuals with whom children spent the most time during school closures. Their grandfather, other family member(s), and others were the people children spent the least amount of time with during school closures. These results were consistent across genders and grade levels.

An independent samples *t*-test revealed that children who frequently spent time alone ($M = 3.32$, $SD = 1.89$) had significantly higher emotional symptoms compared to children who did not ($M = 2.69$, $SD = 2.31$) at T2 ($t(284) = 1.759$, $p < .05$). Children who frequently spent time alone ($M = 3.54$, $SD = 1.57$) also had significantly higher anxiety related to infection compared to children who did not ($M = 3.15$, $SD = 1.53$) at T2 ($t(290) = 1.745$, $p < .05$). Children who frequently spent time with their mother ($M = 10.13$, $SD = 4.99$) had significantly fewer total difficulties compared to children who did not ($M = 11.18$, $SD = 5.46$) at T2 ($t(271) = 1.658$, $p < .05$). Children who frequently spent time with their mother ($M = 1.88$, $SD = 1.51$) had significantly fewer conduct problems compared to children who did not ($M = 2.25$, $SD = 1.64$) at T2 ($t(285) = 1.972$, $p < .05$). Children who frequently spent time with their mother ($M = 3.26$, $SD = 2.04$) also had significantly less hyperactivity/inattention compared to children who did not ($M = 3.89$, $SD = 2.16$) at T2 ($t(289) = 2.581$, $p < .05$). Finally, children who frequently spent time with their mother ($M = 6.43$, $SD = 1.86$) displayed significantly more prosocial behavior compared to children who did not ($M = 5.72$, $SD = 2.17$) at T2 ($t(285) = 1.972$, $p < .05$).

Children who frequently spent time with their father ($M = 6.41$, $SD = 1.71$) displayed significantly more prosocial behavior compared to children who did not ($M = 5.95$, $SD = 2.17$) at T2 ($t(289) = 1.828$, $p < .05$; Table 6). Children who frequently spent time with their grandfather ($M = 2.69$, $SD = 2.29$) displayed significantly fewer emotional symptoms compared to children who did not ($M = 3.40$, $SD = 2.53$) at T2 ($t(284) = -1.903$, $p < .05$). Children who frequently spent time with their grandfather ($M = 3.00$, $SD = 1.52$) also experienced significantly less anxiety related to academic delay compared to children who did not grandfather ($M = 3.56$, $SD = 1.60$) at T2 ($t(288) = -2.370$, $p < .01$). Children who frequently spent time with their grandmother ($M = 2.98$, $SD = 1.49$) experienced significantly less anxiety related to infection compared to children who did not ($M = 3.33$, $SD = 1.57$) at T2 ($t(290) = 1.788$, $p < .05$). Children who frequently spent time with other family members ($M = 3.04$, $SD = 1.54$) experienced significantly less anxiety related to academic delay compared to children who did not frequently spend time with their father ($M = 3.68$, $SD = 1.52$) at T2 ($t(288) = -1.869$, $p < .05$).

4. Discussion

4.1. Impact of the COVID-19 pandemic on children's emotional functioning

The present study provided evidence that major life changes related to the COVID-19 pandemic resulted in mental health deterioration among children, especially those with mid-level school adjustment pre-pandemic. Furthermore, children with lower school adjustment pre-pandemic were likely to display more severe emotional symptoms pre-pandemic and maintain that symptom level after the start of pandemic. The findings also revealed that younger boys had lower school adjustment than older girls pre-pandemic, which could have contributed to higher emotional symptoms before the start of pandemic among younger boys compared to older girls.

The present study also provided evidence that, during the pandemic, younger Japanese children have experienced more severe total difficulties, emotional symptoms, hyperactivity/inattention, peer problems,

Table 6
Summary of social interactions during school closures.

		Grade 3		Grade 4		Grade 5		Grade 6		Total	
	Gender	F	NF	F	NF	F	NF	F	NF	F	NF
Alone	Male	23%	77%	14%	86%	31%	69%	17%	83%	22%	78%
	Female	16%	84%	17%	83%	27%	73%	11%	89%	18%	82%
	Total	19%	81%	16%	84%	29%	71%	14%	86%	20%	80%
Mother	Male	63%	37%	58%	42%	56%	44%	61%	39%	59%	41%
	Female	48%	52%	57%	43%	55%	45%	41%	59%	51%	49%
	Total	54%	46%	58%	42%	56%	44%	50%	50%	55%	45%
Father	Male	22%	78%	44%	56%	38%	62%	39%	61%	38%	62%
	Female	32%	68%	41%	59%	21%	79%	22%	78%	31%	69%
	Total	29%	71%	42%	58%	31%	69%	30%	70%	34%	66%
Grandmother	Male	23%	77%	22%	78%	41%	59%	9%	91%	26%	74%
	Female	36%	64%	30%	70%	30%	70%	19%	81%	17%	83%
	Total	31%	69%	27%	73%	36%	64%	14%	86%	28%	72%
Grandfather	Male	23%	77%	11%	89%	26%	74%	4%	96%	17%	83%
	Female	20%	80%	19%	81%	21%	79%	4%	96%	17%	83%
	Total	21%	79%	16%	84%	24%	76%	4%	96%	17%	83%
Siblings	Male	57%	43%	50%	50%	51%	49%	57%	43%	53%	47%
	Female	50%	50%	44%	56%	48%	52%	37%	63%	46%	54%
	Total	53%	48%	47%	53%	50%	50%	46%	54%	49%	51%
Other family members	Male	3%	97%	8%	92%	13%	87%	0%	100%	7%	93%
	Female	6%	94%	13%	87%	3%	97%	7%	93%	8%	92%
	Total	5%	95%	11%	89%	8%	92%	4%	96%	8%	92%
Friends	Male	10%	90%	17%	83%	10%	90%	9%	91%	12%	88%
	Female	10%	90%	17%	83%	6%	94%	15%	85%	12%	88%
	Total	10%	90%	17%	83%	8%	92%	12%	88%	12%	88%
Extracurricular activities teacher	Male	13%	87%	14%	86%	10%	90%	0%	100%	10%	90%
	Female	16%	84%	20%	80%	15%	85%	11%	89%	16%	84%
	Total	15%	85%	18%	82%	13%	88%	6%	94%	14%	86%
Other	Male	7%	93%	6%	94%	8%	92%	0%	100%	5%	95%
	Female	2%	98%	7%	93%	9%	91%	0%	100%	5%	95%
	Total	4%	96%	7%	93%	8%	92%	0%	100%	5%	95%

Note; F = frequently spent time with, NF = did not frequently spent time with.

and anxiety related to infection, returning to school, and academic delay compared with older children. The present study further showed that during the pandemic, Japanese boys have experienced more severe total difficulties, conduct problems, hyperactivity/inattention, and peer problems, compared with older Japanese girls, while girls have experienced more anxiety related academic delay. However, there were no gender differences in the level of emotional symptoms, rate of infection, or returning to school after school closure. The present study also demonstrated that girls displayed more prosocial behavior during the COVID-19 pandemic. These findings indicate that, despite differences in circumstances across different countries, the COVID-19 pandemic has commonly had a negative impact children's mental health. This study also provided support that younger boys are the highest risk group overall and have experienced the most severe emotional and behavioral problems during the COVID-19 pandemic.

These findings are consistent with international studies reporting the negative impact of the COVID-19 pandemic, such as increased incidents of depression, anxiety, suicide, self-harm, and other maladaptive behaviors (O'Sullivan et al., 2021; Ravens-Sieberer et al., 2021). These findings are also consistent with findings from previous studies that younger boys present greater total difficulties, conduct problems, hyperactivity/inattention, and peer problems, and less prosocial behavior, among children in a large national sample compared to before the COVID-19 pandemic (Moriwaki & Kamio, 2014). As consistent with the previous studies, the present study also found more severe emotional symptoms among girls than boys pre-pandemic. However, unlike previous studies, the present study found no gender differences in levels of emotional symptoms during the pandemic. This difference in findings may be potentially explained by boys' slower development in the prefrontal cortex region of the brain and lower self-control ability in reaction to stressful situations, as indicated by previous studies (Koolschijn & Crone, 2013; Tao et al., 2014). The difference may also be attributable to the unique circumstances during the pandemic or unique sample population in the present study. Future research needs to investigate if higher emotional symptoms among boys can be found in other regions of Japan and explore factors that could contribute to differences in emotional symptoms during the COVID-19 pandemic.

The implication from these findings is that the Japanese government must acknowledge the risk created by the pandemic for the development of emotional and behavioral problems among children and provide better psychological support for children, such as providing more online support materials and improving access to online counseling services. The Japanese government should also acknowledge that, while it is important to support all children, young boys are the most at risk for developing emotional and behavioral problems during the pandemic, thereby making it important to provide the necessary care to young boys during and after the COVID-19 pandemic.

4.2. Impact of pre-pandemic school adjustment on emotional functioning

To our knowledge, the present study was the first to provide evidence that pre-pandemic school adjustment could indirectly influence the degree of deterioration of emotional functioning between pre- and mid-pandemic levels via its influence on pre-pandemic emotional functioning, regardless of gender or grade level. This is consistent with findings from previous studies conducted pre-pandemic indicating that better school adjustment is significantly related to reduced risk of depression and anxiety disorders (Chui & Chan, 2017), reduced risk of attention problems (Seo, 2015), and better self-concept and empathy (Veiga et al., 2015). Furthermore, also consistent with previous studies (Ewing & Taylor, 2009; Weis et al., 2013), the present study provided evidence that older girls show higher school adjustment than younger boys.

The findings from the present study indicate that higher pre-pandemic school adjustment was an important protective factor for helping children maintain adequate emotional functioning pre-pandemic, and that children with higher pre-pandemic school adjustment experienced fewer negative effects on their emotional functioning from the life transitions caused by the COVID-19 pandemic. The findings also suggest that poorer emotional and behavioral functioning among younger boys during the pandemic was partly caused by lower school adjustment at pre-pandemic compared to older girls.

A notable implication from the present study is that higher school adjustment is a protective factor for moderating the negative impact of the COVID-19 pandemic, and that promoting school adjustment during the pandemic may also mitigate the impact of pandemic-related distress. The Japanese government may need to consider implementing school-based interventions to promote school adjustment among Japanese children, as the COVID-19 pandemic may continue for a longer period in future and could cause further deterioration in children's emotional and behavioral functioning without adequate intervention.

4.3. Impact of engagement in different social/lifestyle activities on emotional and behavioral functioning during the pandemic

To our knowledge, the present study is the first to provided evidence that, regardless of gender or grade level, lifestyle activities could influence Japanese children's emotional and behavioral functioning during the COVID-19 pandemic. The present findings indicate that regulated sleep patterns and adequate exercise may be important protective factors that can mitigate the negative impact caused by the COVID-19 pandemic. Among boys in particular, frequently playing video games was found to be a potential risk factor for exacerbating the negative impact of the pandemic on emotional and behavioral functioning. The present study also provided evidence that educational and social activities, such as studying and attending extracurricular lessons, could mitigate the negative effects of the COVID-19 pandemic.

These findings from the present study were consistent with pre-pandemic studies indicating that regulated sleep patterns and adequate exercise have positive effects on children's cognitive, emotional, and behavioral functioning (Itagaki et al., 2017; Matricciani et al., 2019). The present findings were also consistent with previous studies reporting that playing video games is strongly linked to increased risk of social isolation, depression, anxiety disorders, and poor academic achievement (Coyne & Stockdale, 2021), and that video gaming addiction is more prevalent among boys (National Hospital Organization Kurihama Medical and Addiction Center, 2017).

An implication from the present study is that, to effectively promote children's emotional and behavioral functioning amid the COVID-19 pandemic, the Japanese government, schools, and caregivers could focus on promoting regulated sleep patterns and adequate exercise and controlling video game engagement, especially among boys.

4.4. Impact of interpersonal interactions on emotional and behavioral functioning during the pandemic

To our knowledge, the present study was the first to show that loneliness may exacerbate the negative impact of the COVID-19 pandemic on Japanese children's emotional and behavioral functioning. The present study also provided evidence that children frequently spending time with their mother can be a particularly important protective factor for mitigating the negative impact of the pandemic on their emotional and behavioral functioning. Furthermore, for Japanese children, spending time with other family members, such as their father, grandparents, and siblings, may also mitigate the pandemic's negative impact on their emotional and behavioral functioning.

These findings are consistent with previous studies suggesting that loneliness and disconnection from others can increase the risk of physical and mental health issues by increasing distress (Hawkley & Cacioppo, 2010; Maydych, 2019), and that social connectedness via social interactions generates a positive feedback loop of social, emotional, and physical well-being (Sandstrom & Dunn, 2014). The present findings are

also consistent with previous studies indicating that mothers are primary attachment figures for children, and that the absence of mother−child interactions can negatively impact children's cognitive and emotional development and increase their risk of poor emotional regulation (Lincoln et al., 2017; Takeuchi et al., 2015). However, the present study was not consistent with previous studies suggesting that boys tend to experience more social isolation owing to finding social interactions to be less rewarding and have lower socioemotional skills compared with girls across different age groups (Abdi, 2010; Borland et al., 2019). A lack of gender differences in loneliness in the present study may be explained by the unique circumstances during the COVID-19 pandemic in which all members of Japanese families, including parents and children, were forced to stay home together to avoid the risk of infection.

The implication from these findings is that it would be useful for the Japanese government and schools to encourage caregivers to ensure that their children do not spend time alone often and to spend more time together to effectively mitigate the negative impact of the COVID-19 pandemic.

4.5. Limitations of present study

The participants in the present study were children residing in regional cities with fewer cases of COVID-19 infection compared with large cities. Hence, the results might have overrepresented the experience of children in a relatively safe region of Japan and may not be generalizable to children who reside in regions with a higher risk of COVID-19 infection, such as Tokyo and Osaka. Furthermore, the present study was conducted in February 2020, only two months after the start of the COVID-19 pandemic in Japan, and the results may represent only the short-term impact on children. Therefore, the study's results do not provide information regarding the COVID-19 pandemic's mid- and long-term psychological impact on children.

5. Conclusions

To our knowledge, this was the first quantitative study to provide evidence that major life changes associated with the COVID-19 pandemic could result in decreased emotional and behavioral functioning among Japanese children, especially those with mid-level school adjustment, and that there are age and gender differences in children's emotional and behavioral problems during the pandemic. The present study was also the first to indicate that higher school adjustment, spending time with one's mother and other family members, and lifestyle activities, such as regulated sleep patterns and adequate exercise, may be important protective factors for mitigating the distress caused by the COVID-19 pandemic among Japanese children. The present study also suggests that playing video games can be a potential risk factor for decreased emotional and behavioral functioning during the COVID-19 pandemic among Japanese children.

These findings indicate the importance of the Japanese government, schools, and caregivers providing adequate psychological support to Japanese children, especially younger boys, during the COVID-19 pandemic. The Japanese government, schools, and caregivers should ensure that children do not frequently spend time alone and that they spend more time with their mothers, have regulated sleep patterns, engage in adequate exercise, and limit how frequently they play video games. Nevertheless, the present findings need to be confirmed by future studies with a larger sample of school children from more regions in Japan, including children from large cities with a high risk of COVID-19 infection. Future studies may also replicate the present study to investigate the long-term impact of the COVID-19 pandemic, as the present study only investigated the short-term impact among Japanese children.

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Informed consent

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study.

Declaration of interest

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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