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## Do suicide rates in children and adolescents change during school closure in Japan? The acute effect of the first wave of COVID-19 pandemic on child and adolescent mental health

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## ABSTRACT

**Background:** The coronavirus disease 2019 (COVID-19) has severely impacted the lives of children and adolescents. School closure, one of the critical changes during the first COVID-19 wave, caused decreases in social contacts and increases in family time for children and adolescents. This can have both positive and negative influences on suicide, which is one of the robust mental health outcomes. However, the impact of the COVID-19 crisis on children and adolescents in terms of suicide is unknown.

**Objective:** This study investigates the acute effect of the first wave of the COVID-19 pandemic on suicide among children and adolescents during school closure in Japan.

**Data:** Total number of suicides per month among children and adolescents under 20 years old between January 2018 and May 2020.

**Methods:** Poisson regression was used to examine whether suicide increased or decreased during school closure, which spanned from March to May 2020, compared with the same period in 2018 and 2019. Robustness check was conducted using all data from January 2018 to May 2020. Negative binomial regression, a model with overdispersion, was also performed.

**Results:** We found no significant change in suicide rates during the school closure (incidence rate ratio (IRR) = 1.15, 95% confidence interval (CI): 0.81 to 1.64). We found the main effect of month, that is, suicides significantly increased in May (IRR: 1.34, 95% CI: 1.01 to 1.78) compared to March, but the interaction terms of month and school closure were not significant ( $p > 0.1$ ).

**Conclusions:** As preliminary findings, this study suggests that the first wave of the COVID-19 pandemic has not significantly affected suicide rates among children and adolescents during the school closure in Japan.

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## 1. Introduction

The coronavirus disease 2019 (COVID-19) has affected the lives of children and adolescents in various ways in Japan, just as in other countries around the world. The COVID-19 pandemic itself can cause fears of COVID-19 infection, uncertainty, and potential economic problems (Sher, 2020). The state of emergency declared by the government of Japan in April and May requested citizens to stay home and maintain social distancing, which has limited peer contacts and places for play for children and adolescents. This may discourage child development, deprive opportunities for stress regulation, and lead to social isolation (Fegert, Vitiello, Plener, & Clemens, 2020). Family life and relationships can also be influenced by remote work lifestyles of parents. All of these factors can bring about anxiety and distress to the children and their families. Increased anxiety and distress in children and adolescents are demonstrated in qualitative data from Childline, a free and anonymous telephone counseling service for children in Japan which receives approximately 200,000 calls per year. Childline Support Center Japan reported more than 60% of the children who called Childline and talked about issues related to COVID-19 from 28 February 2020 to 30 April 2020 (Total No. = 730) expressed negative emotions, including anxiety, anger or irritability, and sadness (Childline Support Center Japan, 2020a). Similarly, an online survey conducted by the National Center for Child Health and Development during 30 April 2020 to 5 May 2020 revealed that 39% of the children aged between 7 and 17 years (Total No. = 1,292) felt uncomfortable when thinking about COVID-19 and 32% were easily irritated (National Center for Child Health & Development, 2020).

School closure is an additional major change during the first wave of the COVID-19 pandemic that can affect children and adolescents. Before a state of emergency was declared in early April, the Japanese government mandated the closing of all elementary, junior high and high schools to prevent further spread of COVID-19. For most schools, school closure began on 2 March 2020 and continued until the end of May. School closure means that children have no social contacts and activities at school (i.e., unable to meet with friends and teachers, no class activities, etc.). On the other hand, children have increased family time during school closure. Spending time at home, and not at school, can have both positive and negative influences on child mental health because children may get a reprieve from problems at school (e.g., bullying), or feel distressed from relationships with family members (i.e., family violence) (Hoekstra, 2020). Data from Childline also show that children were more concerned about themselves, especially their mental state, and less concerned about school, including relationships at school and bullying during March 2020 compared with the same month the previous year (Childline Support Center Japan, 2020b).

Suicide in children and adolescents has been a social issue in Japan because it is the highest cause of death among this demographic group, with the rate remaining stable as opposed to the decreasing trend in adults (Ministry of Health Labor & Welfare, 2019). Unchanged child and adolescent suicide rates for more than 20 years indicate that suicide among children and adolescents is not largely affected by society, including recessions, changes in industrial structure (e.g., increases in non-regular employment), and suicide prevention policies. Major risk factors for suicide and suicidal behaviors in children and adolescents identified in previous studies include: individual psychological factors (e.g., depression and other mental health) (Carballo et al., 2020; Dilillo et al., 2015; Picazo-Zappino, 2014), family factors (e.g., family dysfunction, often characterized by conflicts, poor communication, a lack of cohesion, and poor connection) (DeVillie et al., 2020; Gunn, Goldstein, & Gager, 2018; Picazo-Zappino, 2014; Ruiz-Robledillo, Ferrer-Cascales, Albaladejo-Blazquez, & Sanchez-SanSegundo, 2019), and school factors (e.g., school connectedness and school climate, including peer relationships and bullying) (Gunn et al., 2018; Marraccini & Brier, 2017; Picazo-Zappino, 2014; Ruiz-Robledillo et al., 2019). Furthermore, it is reported in Japan that the frequency of suicides in middle- and high school students are the highest at the beginning of the school semester (i.e., early April and early September) and the lowest during the summer break (i.e. late July to early August), which implies the importance of school-related factors (Matsubayashi, Ueda, & Yoshikawa, 2016).

Given that the COVID-19 crisis may affect children and adolescents at multiple levels, including at the individual-, family-, and school-level, risk factors for suicide can deteriorate or lessen. Furthermore, the number of suicides in children is the only available robust data that can objectively and accurately monitor child mental health during the COVID-19 crisis, as it is difficult to examine whether child maltreatment increased during the school closure in Japan because the number of child maltreatment reports handled by child guidance centers (similar to Child Protection Service in other countries) does not necessarily reflect the actual number of child maltreatment cases and it has been rapidly increasing in recent years regardless of the COVID-19 crisis. However, the impact of COVID-19 crisis on suicide in children and adolescents is unknown.

This study aims to investigate the acute effect of the first wave of the COVID-19 pandemic on suicide in children and adolescents, by examining whether suicide rates changed before the COVID-19 crisis and during the school closure (i.e., March-May 2020) in Japan.

## 2. Methods

### 2.1. Data

The total number of suicides per month among children under 20 years old between January 2018 and May 2020 was obtained from public data on suicide statistics compiled by the Ministry of Health, Labor and Welfare (Ministry of Health Labor and Welfare, 2020a). This official report did not report further breakdown of age categories, such as <10 years old, 10-14 years old, and 15-19 years old. The total population of children under 20 years old in each of the months was obtained for the same period from public data on population estimates compiled by the Statistics Bureau of Japan (Statistics Bureau of Japan, 2020).

Approval from the institutional review board was not obtained because this study used aggregate data which are accessible to the public.

## 2.2. Statistical analysis

Poisson regression was used to examine whether suicide rates among children and adolescents increased or decreased during the school closure due to the COVID-19 crisis, which spanned from March to May, 2020, compared with the same months in 2018 and 2019. That is, the number of suicides was regressed by month, whether the school closure due to COVID-19 crisis happened or not, and their interaction terms. The total population of children under 20 years of age was converted into a logarithm and controlled as an offset variable, which was constrained to be 1. For robustness check, Poisson regression using all data from January 2018 to May 2020 was conducted. Negative binomial regression, which models overdispersion, was also performed.

## 3. Results

The suicide rates among children under 20 years old from January 2018 to May 2020 are shown in Fig. 1. In 2018 and 2019, suicide rates tend to increase from March to May; however, suicide rates from March to May in 2020, which was during the school closure, seems to decrease slightly (March 0.229, April 0.201, May 0.216 per 100,000).

Poisson regression using data of suicides from March to May for the three years found no significant change of suicide rates during the school closure (incidence rate ratio (IRR) = 1.15, 95% confidence interval (CI): 0.81 to 1.64) (Table 1). We found the main effect of the month, that is, suicides significantly increased in May (IRR: 1.34, 95% CI: 1.01 to 1.78) compared to March. The interaction terms of school closure and month were not statistically significant (April:  $p = 0.136$ , May:  $p = 0.157$ ). The same associations were confirmed by Poisson regression using all monthly data of suicides from January 2018 to May 2020 (Supplementary Table 1). Further robustness check revealed that similar results were obtained from negative binomial regression, which indicates that overdispersion was not observed in this data and Poisson regression is appropriate (data not shown).

## 4. Discussion

This paper examined whether the first wave of the COVID-19 pandemic acutely affected suicide rates in children and adolescents under 20 years of age in Japan, using monthly data on the total number of suicides before the COVID-19 crisis and during the school closure. The findings from our Poisson regression analysis suggested that the first wave of the COVID-19 pandemic has not significantly affected the suicide rates among children and adolescents during the school closure in Japan.

Our null findings are in line with previous studies which pointed out that changes in children's lives due to the COVID-19 crisis, including school closures, may have both positive and negative influences on child mental health and suicidality (Fegert et al., 2020; Hoekstra, 2020). The COVID-19 crisis can cause anxiety, distress, and potentially depression among children because of fears related to COVID-19, family economic hardship, limited access to basic services (i.e., schools and medical services), and limited social contacts and social activities (Fegert et al., 2020). These situations may also increase parental stress, in addition to stressful situations of parents themselves (i.e., supporting their children while working from home, lack of social support due to social isolation). Increased parental stress could lead to the deterioration of family or parent-child relationships, and in turn cause conflicts and violence between family members (Brown, Doom, Watamura, Lechuga-Pena, & Koppels, 2020; Chung, Lanier, and Ju, 2020; Fegert et al., 2020). Taken together, they may impact negatively on the mental health of children and adolescents, leading to an increased risk of suicide.

On the other hand, the COVID-19 crisis may affect child mental health positively because some families might develop strong connections and cohesion, and social support with their children by spending more time together (Fegert et al., 2020). These family relationships may help children reduce their anxiety and distress caused by the COVID-19 crisis, and prevent them from developing depression (Brown et al., 2020; Klasen et al., 2015; Ruiz-Robledillo et al., 2019). Furthermore, staying home may relieve stress and pressure from academic or peer problems experienced at school (Fegert et al., 2020; Hoekstra, 2020). These positive influences can

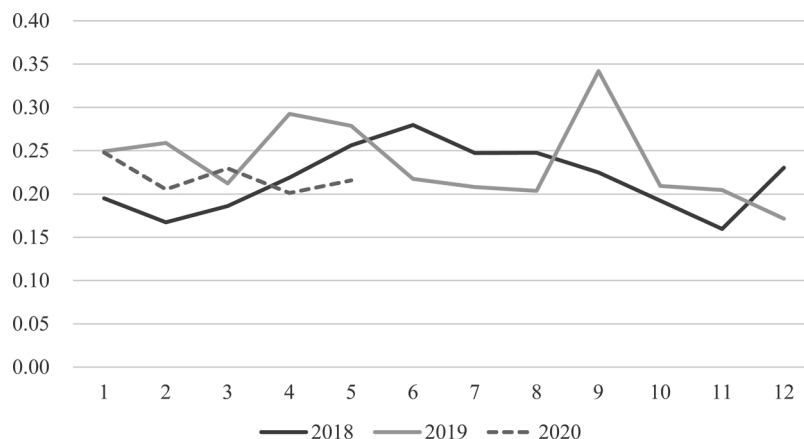


Fig. 1. Monthly suicide rates among children under 20 from January, 2018 to May, 2020 (per 100,000 population).

**Table 1**

Comparison of the number of suicides from March to May in 2020 and in 2018-2019.

		IRR	95%CI
School closure due to COVID-19	No	Reference	
	Yes	1.15	0.81, 1.64
Month	March	Reference	
	April	1.28	0.97, 1.70
	May	<b>1.34</b>	<b>1.01, 1.78</b>
Interaction of school closure and month			
	School closure*March	Reference	
	School closure*April	0.68	0.41, 1.13
	School closure*May	0.70	0.43, 1.15
Ln (Population)		1	

IRR: Incidence-rate ratios, **Bold**:  $p < 0.05$ .

reduce risk of suicide in children, given that family and school factors are considered as major risk factors (Hoekstra, 2020; Ruiz-Robledillo et al., 2019). Thus, it can be assumed that the positive and negative impacts of COVID-19 crisis on child mental health cancelled each other out, leading to the main finding that suicide did not significantly change before COVID-19 crisis and during the school closure in Japan.

The qualitative data from Childline Japan, one of the hotlines for children, also support our findings, in that changes in children's concerns were mixed. Children were less concerned about matters at school, including relationships with peers and teachers and bullying, in March 2020 compared to March 2019 (Childline Support Center Japan, 2020b). Surprisingly, an increase in the number of children talking about child maltreatment, poverty, and suicidality was not observed in the data from Childline (Childline Support Center Japan, 2020b). Although these trends seem relatively positive, it does not necessarily mean that children's mental health is better than before the COVID-19 crisis. During the crisis, children were more worried about their mental state, and more children reported that they felt confused or puzzled, or unsure of how they felt (Childline Support Center Japan, 2020b). Hence, the data from Childline also imply that the impact of the COVID-19 crisis on child mental health and suicide cannot be elucidated simply.

Trends in Japanese suicide rates among children and adolescents suggest that their suicide is not largely influenced by society, such as recessions, changes in industrial structure (e.g., increases in non-regular employment), and suicide prevention policies. On the other hand, previous research has reported that celebrity suicides that generated massive public reaction on social media (e.g., Twitter) could subsequently increase suicides compared to those covered by traditional media (Ueda, Mori, Matsubayashi, & Sawada, 2017). A celebrity suicide that received a large reaction in social media during this study period may have affected suicide rates among children and adolescents in late May 2020. However, we assume that this study exclusively examined the acute effect of the first wave of the COVID-19 pandemic on suicides among children and adolescents. In addition, all suicides in children and adolescents during the first wave of the COVID-19 pandemic are most likely to be included in our data, considering that the number of excess deaths in January-April 2020 ( $N = 138$ ) was smaller than the number of deaths from COVID-19 (Ministry of Health Labor and Welfare, 2020b).

There are several limitations to this study. First, it should be noted that this is a preliminary finding on the acute effect of the first wave of the COVID-19 pandemic on suicides among children and adolescents during the school closure. Data on suicide among children for a longer time span should be collected and examined in future research when available. Given that suicides among children and adolescents reportedly peak at the beginning of school semesters in Japan, suicide rates may have increased when school restarted in June 2020. Also, future studies should consider a long-term impact of the COVID-19 pandemic on child mental health. Second, we did not investigate suicidality, such as suicide attempts or suicidal thoughts among children and adolescents, due to a lack of data on periodical monitoring of children and adolescents' suicidality, including hospitalization rates for suicide attempts. Finally, motives of suicide are not available in this publicly available aggregated data. Therefore, suicides that occurred during the school closure could be influenced by other factors that are not directly related to the COVID-19 crisis, such as prior trauma, personality and temperament, and prior suicide attempts (Carballo et al., 2020; Hoekstra, 2020).

Despite these limitations, this paper revealed that the first wave of the COVID-19 pandemic did not acutely affect suicide rates among children and adolescents during the school closure in Japan, suggesting that the first wave of the COVID-19 pandemic may not affect the mental health of this demographic group greatly enough either to warrant suicide or to prevent suicide in the short term. Nonetheless, it is important to closely monitor suicide rates in children as the COVID-19 crisis continue to evolve, particularly after the reopening of schools in June 2020.

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The authors have no financial relationships relevant to this article to disclose.

## Declaration of Competing Interest

The authors report no declarations of interest.

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