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Immediate impact of the COVID-19 pandemic on the socio-emotional and digital skills of Japanese children

AUTHOR(S):

Moriguchi, Yusuke; Sakata, Chifumi; Meng, Xianwei; Todo, Naoya

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Did the COVID-19 Pandemic Have Immediate Impacts on the Socio-Emotional Behaviors of Japanese Children

1 Yusuke Moriguchi^{1*}, Chifumi Sakata¹, Xianwei Meng², Naoya Todo³

2 ¹Graduate School of Letters, Kyoto University, Yoshidahoncho, Kyoto, Japan

3 ²Center for Baby Science, Doshisha University, Kizugawadai, Kizugawa, Kyoto, Japan

4 ³Faculty of Human Sciences, University of Tsukuba, Tsukuba, Japan

5 * **Correspondence:**

6 Yusuke Moriguchi

7 moriguchi.yusuke.8s@kyoto-u.ac.jp

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9 behaviors

10

11 Abstract

12 A novel coronavirus, SARS-CoV-2, has spread widely throughout the world. To reduce the spread of
13 infection, children are prevented from going to school and have fewer opportunities for in-person
14 communication. Although the pandemic has impacted the everyday lives of children, its impact on
15 their development is unknown. This cross-sectional study compared Japanese children's socio-
16 emotional behaviors before and during the pandemic. Parents completed a web-based questionnaire
17 before and during the pandemic for children ages 4-9. Children's socio-emotional development in an
18 everyday context was assessed using the Strengths and Difficulties Questionnaire (SDQ). The results
19 indicated that during the pandemic, children were more prosocial and experienced more problems in
20 their peer relationships, but no differences were found in emotional symptoms, conduct problems,
21 hyperactivity between before and during the pandemic. Overall, our results suggest the pandemic
22 may have immediate impact on children's socio-emotional behaviors. We discussed the results in
23 terms of behavioral immune system.

24 Trial registration: We pre-registered our hypotheses, method, primary analyses, and sample size
25 (<https://osf.io/c7p6b>)

26 1 Introduction

27 A novel coronavirus, SARS-CoV-2, has now spread widely throughout the world. Due to the virus'
28 high transmission rate, relatively long incubation period, and increased mortality rate in people with
29 certain conditions (e.g., older people), the World Health Organization (WHO) has provided
30 guidelines to help prevent the public from becoming infected with the virus (World Health
31 Organization, 2020). Common strategies include asking or ordering people to stay at home, avoid
32 crowds or large gatherings, and practice social distancing. Consequently, people in several countries
33 have been prevented from going to work or school including kindergarten and have fewer
34 opportunities for in-person communication with others. The clinical course of the coronavirus

35 disease, COVID-19, appears to be relatively mild in children compared to other populations (Pathak
36 et al., 2020; Wu & McGoogan, 2020), although infants were found to be at high risk of becoming
37 severely or critically ill (Dong et al., 2020). Nevertheless, the effects of the societal changes
38 implemented to decrease the likelihood of SARS-CoV-2 infection on children's cognitive, social, and
39 emotional development are unknown. According to Bronfenbrenner (Bronfenbrenner, 1979), child
40 development is a function of the interaction between several systems and includes culture, parental
41 occupations, schooling, peer relationships, and parenting. Thus, changes in one system can directly or
42 indirectly affect children's development. In the case of COVID-19, the pandemic can affect parents'
43 work, and children's schooling by both children and adults, which may in turn have significant
44 effects on children's cognitive, social, and emotional development.

45 Although several psychological studies have examined the effect of the COVID-19 pandemic on
46 children's mental health (Golberstein et al., 2020; Orgilés et al., 2020; Pisano et al., 2020; Xie et al.,
47 2020), it remains unclear whether the pandemic affects children's socio-emotional behaviors. One
48 study in Italy and Spain reported that children experienced emotional and behavioral problems (e.g.,
49 difficulty concentrating) after the pandemic outbreak (Orgilés et al., 2020), but this study did not
50 assess the population before the pandemic and thus the change in emotional problems could not be
51 compared. Therefore, the present study examined differences in children's socio-emotional behaviors
52 before and during the pandemic.

53 We assessed whether children's socio-emotional behaviors (emotional symptoms, conduct problems,
54 hyperactivity, peer problems, and prosocial behavior) differed by their experience of the pandemic by
55 comparing their socio-emotional behaviors before and during the pandemic. In terms of prosocial
56 behavior, a previous study reported that experiencing a natural disaster (an 8.0 magnitude earthquake
57 in China) affected children's prosocial behaviors. The researchers compared the prosocial behaviors
58 of two groups: a group 6- and 9-year-old Chinese children who lived near the epicenter of the
59 earthquake before the disaster and a second group of Chinese children matched by age and school of
60 attendance after the earthquake. The results suggested that 6-year-old children became more selfish
61 whereas 9-year-old children became more prosocial immediately after the disaster. Although the
62 COVID-19 pandemic may be different from the earthquake in several ways, e.g., children may feel
63 more anxiety about being infected by the virus, the results from the previous study suggest that
64 experiencing an adversity can have differential effects by age on children's prosocial behaviors.
65 Thus, we hypothesized that children would experience differences in their social relationships during
66 the pandemic that would show the differences in their socio-emotional behaviors. Moreover, based
67 on the previous study, we expected children's age to moderate the effect of the pandemic on prosocial
68 behaviors. To assess the differences in social relationships, we assessed the durations for children's
69 schooling, outside play, and lessons (e.g., music, dance).

70 **2 Materials and Methods**

71 **2.1 Participants**

72 In Japan, the first infected person infected with SARS-CoV-2 was identified in January 2020, and the
73 number of infected people has since increased although the growth rate was lower than in many other
74 countries (Worldometer, 2020). On 27th February 2020, the government asked all schools across the
75 country to close until March 2020, and the vast majority of schools complied (but nursery schools did
76 not). School started to re-open at the beginning of April 2020, but the government declared a state of
77 emergency covering seven prefectures including Tokyo and Osaka on 7th April 2020. Thus, most of
78 the schools in seven prefectures closed whereas about 80 % of the kindergartens and half of

79 elementary schools in the other prefectures started to open on 10th April 2020 (Ministry of
 80 Education, Culture, Sports, Science and Technology, 2020). Subsequently, the declaration to close
 81 schools was extended to all regions on 16th April 2020, and most of the schools in all prefectures
 82 closed until 6th May 2020. Thus, data for the During-pandemic sample was collected when most of
 83 the schools were closed and children had less time for schooling and meeting with friends. For this
 84 study, we preregistered our hypotheses, method, primary analyses, and sample size
 85 (<https://osf.io/c7p6b>).

86 We conducted two cross-sectional studies in which we administered an internet-based survey to
 87 parents at two time periods, before and during the pandemic. Our Before-pandemic sample
 88 comprised primary caregivers of children ages 0-9 who were randomly selected from the population
 89 of a database (Cross Marketing Inc. Tokyo, Japan). The Before-pandemic sample completed the
 90 survey 26 – 30 September 2019. A total of 1215 participants completed the questionnaire, but 293
 91 participants were excluded, of which 255 participants incorrectly answered trap questions and 38
 92 participants inappropriately answered questions (e.g., participants who chose “1” in a series of
 93 questions). Out of 922 participants (who included parents of children ages 0-9), we assigned the first
 94 70 participants in each age group (4 to 9 years of age) to this study (for a total 420 participants).
 95 Sample characteristics are presented in Table 1 and S1.

96 Our During-pandemic sample was selected in the same way as our Before-Pandemic sample. No
 97 participants were the same between the Before- and During- pandemic phases. The During-pandemic
 98 sample completed the survey 28 – 30 April 2020. During recruitment, 1045 participants completed
 99 the questionnaire, but 152 participants were excluded, of which 81 participants incorrectly answered
 100 trap questions and 71 participants answered inappropriately. After assigning parents to the studies,
 101 we had a total of 420 parents.

102 2.2 Stimuli and Procedure

103 The online questionnaire consisted of two parts. In the first part, parents were asked to complete
 104 background information about themselves and their children. In the second part, parents were given a
 105 questionnaire about their children’s socio-emotional development and their social life.

106 2.2.1 Background information

107 In the first part, parents answered questions about their background. Background information
 108 included parental age, parental education, family size, children’s age, children’s sex, and children’s
 109 sleep hours (when children get up and go to sleep). Parental education level was assigned a value
 110 from 1 to 5 (1=less than high school, 2=high school, 3=some college, 4=undergraduate degree,
 111 5=graduate level).

112 2.2.2 Socio-emotional behaviors

113 In the second part, parents answered questions about their children’s socio-emotional behaviors.
 114 Children’s socio-emotional behaviors in an everyday context was assessed using the SDQ (Strengths
 115 and Difficulties Questionnaire) (Goodman, 1997; Matsuishi et al., 2008; Moriguchi et al., 2020). The
 116 SDQ is a screening measure of social, emotional, and behavioral functioning. The 25-item SDQ is
 117 divided into five subscales, namely, emotional symptoms, conduct problems, hyperactivity, peer
 118 problems, and prosocial behavior. Emotion symptoms include five items, such as “Often complains
 119 of headaches, stomach-aches or sickness.” Conduct problems include five items such as “Often fights
 120 with other children or bullies them.” Hyperactivity includes five items such as “Restless, overactive,

121 cannot stay still for long.” Peer problems include five items, such as “Has at least one good friend.”
 122 Prosocial behavior includes five items such as “Shares readily with other children, for example, toys,
 123 treats, pencils.” The parents answered whether each item applied to a child on a three-point scale
 124 from 0 “not true” to 2 “certainly true.”

125 2.2.3 Social life

126 To assess the differences in children’s social lives, questions were asked regarding the duration of
 127 time that, children’s schooling, children’s outside play, and children’s lessons (e.g., music, dance).
 128 We asked the number of days of children’s schooling per week, and the average hours of outside play
 129 and lessons per day.

130 2.3 Analytic plan

131 Analyses were conducted in R (version 3.6,1). We conducted two analyses. First, we examined
 132 dependent variables that may be different before and during the pandemic. In our preregistration for
 133 the study, we planned to assess whether period and children’s age affected their social life and socio-
 134 emotional behaviors using a MANOVA. The analysis included period (Before-pandemic vs. During-
 135 pandemic) and age (4 to 9) as independent variables and durations of, children’s schooling, children’s
 136 outside play and lessons, along with sub-scale scores for the SDQ as dependent variables. However,
 137 not all dependent variables were normally distributed, and we could not conduct the planned
 138 MANOVA. Instead, we conducted MANOVA within the framework of structural equation modelling
 139 (SEM). That is, we applied the MANOVA model to the data and estimated the parameters
 140 corresponding to the main effects using maximum likelihood estimation with robust (Huber-White)
 141 standard errors and a scaled test statistic that is (asymptotically) equal to the Yuan-Bentler test
 142 statistic using the “lavaan” package (Rosseel, 2012).

143 Second, we conducted a planned SEM analysis to assess the relationships between period and SDQ
 144 sub-scale scores, which were mediated by parents’ and children’s social lives. Specifically, we used
 145 variables indicative of children’s and parent’s social lives if we found significant main effects of
 146 period in the preceding analyses. We used background information as control variables for the
 147 analyses if we found significant differences in the Before-pandemic and During-pandemic samples.

148 3 Results

149 The descriptive data are reported in Table 1. Children’s age in months, parental age, sex ratio (ratio
 150 of boys to girls), the number of family members, and parental education did not differ by period,
 151 Before-pandemic vs. During-pandemic. Children’s sleeping time was higher During-pandemic than
 152 Before-pandemic ($t(838) = -3.453, p = .001, d = .24$). Thus, Before-pandemic and During-pandemic
 153 samples were generally matched. We included demographic variables as control variables in our
 154 subsequent analyses.

155 First, we assessed whether period and children’s age impacted children’s socio-emotional behaviors
 156 and social lives. Period was significantly associated with children’s peer problems ($\beta = 0.264, p$
 157 $= .033$) as well as durations of, children’s schooling ($\beta = -4.233, p < .001$), children’s outside play (β
 158 $= 0.185, p = .001$), and children’s lessons ($\beta = -0.052, p = .032$) (Positive values represent increases
 159 during the pandemic compared to before the pandemic). We found a significant interaction between
 160 period and age in prosocial behavior ($\beta = 0.080, p = .001$). The effects of period were significant in
 161 5- ($\beta = 1.000, p = .009$) and 7-year-old ($\beta = 0.843, p = .036$) children. Children’s prosocial behavior
 162 and peer problems are displayed as a function of age in Figure 1.

163 Next, we conducted SEM analyses to assess whether the effects of period and children's age on peer
 164 problems and prosocial behavior were mediated by differences in children's social lives. Specifically,
 165 we used durations of children's schooling, children's outside play, and children's lessons as
 166 mediation variables and children's sleeping time as a control variable (Figure 2). We selected the
 167 model that included direct paths between period and peer problems and between interaction and
 168 prosocial behavior ($\chi^2 = 62.304$, RMSEA = .047, CFI = .966) because fit indices indicated that it
 169 provided a better fit to the data than a model without the direct path ($\chi^2 = 80.494$, RMSEA = .053,
 170 CFI = .952). In this model, period was positively ($\beta = 0.491$, $p = .022$) and negatively ($\beta = -2.843$, p
 171 $< .001$) associated with durations of outside play and schooling, respectively. Interaction between age
 172 and period negatively associated with schooling ($\beta = -0.214$, $p < .001$). In addition, the duration of
 173 play negatively associated with peer problems ($\beta = -0.261$, $p = .001$). However, schooling was not
 174 significantly associated with prosocial behavior ($\beta = 0.113$, $p = .070$).

175 Finally, we evaluated the mediation effects of outside play on the relationship between
 176 period and peer problems using Sobel tests. The estimated mediation effect of duration of outside
 177 play was significant ($\beta = -0.051$, $p = .014$ 95% CI [-0.092 -0.010]). The estimated direct effect of
 178 period on peer problems was also statistically significant ($\beta = 0.316$, $p = .011$ 95% CI [0.073 0.558]).

179 4 Discussion

180 The results revealed that peer problems and prosocial behavior, but not emotional symptoms, conduct
 181 problems, hyperactivity, differed between before and during the pandemic. Although there were no
 182 mediation effects on the relationship between period and prosocial behavior, we found an interaction
 183 effect between the pandemic and age in prosocial behavior. The results were partially consistent with
 184 our hypothesis that age may modulate the effect of the pandemic on prosocial behavior. Specifically,
 185 4-year-old children scored equally before and during the pandemic, but older children showed more
 186 prosocial behavior during the pandemic compared to those before it. One possible interpretation for
 187 the increase in prosocial behavior was in-group favoritism. Items used to assess prosocial behavior
 188 included children's behavior towards in-group members, such as parents, siblings, or peers. Research
 189 on the behavioral immune system suggests that a pathogen infection can induce in-group favoritism
 190 and out-group aversion (Ackerman et al., 2018). The behavioral immune system refers to a
 191 motivational system that helps minimize infection risk by changing cognition, affect, and behavior to
 192 avoid infection with a pathogen. It has been consistently reported that the behavioral immune system
 193 in individuals at risk of infection facilitates stereotypes and prejudicial attitudes toward outgroup
 194 members and increases in-group favoritism, such as greater conformity to social norms and increased
 195 collectivism (Murray & Schaller, 2012; Wu & Chang, 2012). Such in-group favoritism may motivate
 196 cognitions and behaviors for the avoidance of novel parasites contained in out-groups and for the
 197 management of local infectious disease (Thornhill & Fincher, 2014; Wu & Chang, 2012). Thus,
 198 children in this study may have increased prosocial behavior toward in-group members at the risk of
 199 pathogen infection to avoid infection by out-group members.

200 Children also showed more problems in their peer relationships during than before the pandemic.
 201 Although we found a mediation effect of outside play, the direct effect between the pandemic and
 202 peer problems was larger. Other factors, such as level of children's stress, can mediate the
 203 relationship between the pandemic and peer problems. Nevertheless, we need to be careful about the
 204 interpretation of the results, because some items in peer problem (e.g., "tends to play alone") could
 205 be increased during the pandemic compared to before pandemic unless children played with siblings
 206 as much as they used to play with peers, and the increased scores did not necessarily mean the

207 children were having trouble with peers. Taken together, our results showed that children's some of
208 the socio-emotional behaviors differed before and during the pandemic.

209 Our results showed that children exhibited better and worse socio-emotional behaviors during the
210 COVID-19 pandemic compared to before the pandemic. To our knowledge this is one of the first
211 studies to conduct a pre- and post-assessment of the impact of the COVID-19 pandemic on children's
212 behaviors. Although we assessed children's behavior using an online questionnaire, most of the
213 available research did not utilize the same method of assessment both before and during the
214 pandemic, which results in the difficulty of not having a valid comparison group. It is possible that
215 parents' answers to the surveys can reflect differences in parents, not in children, and we need to be
216 careful about the interpretations of the results. Nevertheless, we believe that web-based surveys may
217 be one of the best methods for addressing the effects of the pandemic on child development.

218 Another limitation in this study was that we compared the different sample before and the during
219 pandemic. We matched several background information that may affect socio-emotional behaviors
220 across samples, but we need to conduct longitudinal research to examine how children change their
221 behaviors across different time points. Moreover, it remains unclear whether the results from this
222 population can be generalized to other populations, because the growth rate in the number of infected
223 persons and deaths in Japan was lower than in other countries (Worldmeter, 2020). Moreover,
224 children's social-emotional development could be more severely impaired due to the pandemic,
225 particularly if this difficult situation continues for a long period. Future research should address these
226 issues.

227 **5 Conflict of Interest**

228 The authors declare that the research was conducted in the absence of any commercial or financial
229 relationships that could be construed as a potential conflict of interest.

230 **6 Author Contributions**

231 YM and NY developed the study concept. All authors contributed to the study design. Data
232 collection was performed by YM. All authors performed the data analysis and interpretation. YM
233 drafted the manuscript. CS, XM, and NY revised the manuscript. All authors approved the final
234 version of the manuscript for submission.

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287 **10 Data Availability Statement**

288 The datasets [GENERATED/ANALYZED] for this study can be found in the [NAME OF
289 REPOSITORY] [LINK]. Please see the [Data Availability section of the Author guidelines](#) for more
290 details.

291 **11 Ethics Statement**

292 The study was conducted in accordance with the principles of the Declaration of Helsinki and the
293 procedure of the study was approved by the local ethics committee. Written informed consent
294 (including study purpose, methodology, risks, right to withdraw, duration of the experiment, handling
295 of personal information, and voluntary nature of participation) was obtained from all participating
296 parents prior to administering the survey.

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310 **Table 1. Descriptive Statistics**

Parent Measure	BEFORE (N = 420)		DURING (N = 420)	
	Mean	SD	Mean	SD
Parent's age	39.74	5.81	40.44	5.38
Number of family members	3.99	0.94	4.04	1.05
Parental level of education	3.22	0.89	3.17	0.91
Children Measure				
Children's age in months	83.37	20.37	83.95	20.90
Sleeping hours	9.35	0.81	9.54	0.77
Days of schooling per week	4.95	0.49	0.72	1.73
Hours of outside play per	0.64	0.67	0.83	0.89
Hours of lessons per day	0.26	0.35	0.21	0.37
Conduct problems	2.45	1.73	2.37	1.82
Emotional symptoms	2.10	2.11	2.19	2.14
Hyperactivity	4.03	2.19	4.07	2.42
Peer problems	2.24	1.75	2.50	1.84
Prosocial behavior	5.38	2.45	5.90	2.43
Categorical Measure	%		%	
Children's sex (ratio of	50%		50%	
Respondent (ratio of	91%		88%	

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320 **Figure Legends.**321 *Figure 1.* Children's prosocial behavior and peer problems as a function of age322 *Figure 2.* Effects of pandemic (period), age and the interaction on children's prosocial behavior and

323 peer problems. We included sleeping time, children's sex, parental age, the number of family

324 members, and parental education as control variables. For visibility, the non-significant paths, error

325 variances, and covariances were removed and reported in Table S2. * $p < .05$, ** $p < .01$, *** p 326 $< .001$

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