

BRIEF REPORT

Day care study showed no differences in long-term symptoms in children who were and were not infected during COVID-19 outbreaks

COVID-19 has tended to be mild in children, but the risk of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) being transmitted in day care centres has been high.¹ Our aim was to fill the gap in the research on the long-term symptoms experienced by young children after becoming infected.

The Corona outbreak-related examinations in day care centres (COALA) study enrolled children aged 1–8 years from 30 day care centres that had SARS-CoV-2 outbreaks from October 2020 till June 2021, regardless of whether they had positive test results.¹ A follow-up survey was conducted in February 2022, (7–14 months) after the outbreaks, and asked parents if their children had recurrent or persistent symptoms for at least 2 months after enrolment. We listed 24 different symptoms, based on Stephenson et al.,² and recorded whether they were present or absent and light to very severe. We also asked whether the child was receiving medical or psychological treatment for them. The questionnaire also asked about any SARS-CoV-2 infections diagnosed after the outbreak. Children with positive viral tests <3 months before the survey were excluded, in line with the World Health Organization's case definition for post-COVID-19 condition in children and adolescents.³

The prevalence of long-term symptoms was calculated using descriptive statistics. *p*-Values were calculated on the differences between children who had tested positive for SARS-CoV-2 and controls, using chi-squared or Fisher's exact tests, with *p* < 0.05 considered significant. Odds ratios (OR) were calculated to examine the associations between different factors and long-term symptoms. All analyses were performed with Stata, version 17.0 (StataCorp LLC).⁴

There were 30 children who tested positive for SARS-CoV-2 during the COALA outbreak investigations and one child after that point, but more than 3 months before the follow-up survey. The controls were 158 children who had not tested positive by the follow-up survey.

We found that 68/189 (36%) of the total cohort had one or more recurrent or persistent symptom/s for at least 2 months: 8/31 (26%) in the COVID-19 group and 60/158 (38%) of the controls (Table 1). The difference was not significant. The most common symptoms in both groups were respiratory, followed by general, neuropsychiatric and

gastrointestinal. Rhinitis was the most frequent long-term symptom among both groups (5/31 [16%] in the COVID-19 group and 46/158 [29%] among controls). Group differences in individual symptoms or symptom categories were not statistically significant. Specific symptoms in the COVID-19 group, but not the control group, included palpitations/chest pain and hair loss (each mentioned for one child [3%]). Conversely, symptoms such as sore throats (16/158 [10%]), skin rashes (9/158 [6%]), sleep disturbance (8/158 [5%]), headache (5/158 [3%]), vertigo (5/158 [3%]), loss of appetite (5/158 [5%]) and paresthesia (2/158 [1%]) were observed in the control group, but not in the COVID-19 group.

Among children showing long-term symptoms (*n* = 68), the number who had experienced at least one long-term symptom of high or very high severity was 5/8 (63%) in the COVID-19 group and 21/60 (35%) among the controls (data not shown). We found that 5/8 (63%) symptomatic children received medical or psychological treatment in the COVID-19 group and 31/60 (52%) of the controls. Children in the COVID-19 group tended to have three or more symptoms more often than the controls. None of the above-mentioned differences were significant.

When comparing children with long-term symptoms to those without, the 68 children with long-term symptoms were much more likely to be aged 1–4 years than the 121 without symptoms (38% vs. 21%, OR 2.4, *p* < 0.05; data not shown). Symptomatic children were also significantly more likely to have had acute symptoms (54% vs. 35%, OR 2.7, *p* < 0.05; data not shown) during the initial SARS-CoV-2 outbreaks.

Comparable studies on younger children are rare. A Norwegian study of 706 885 children aged 1–19 years observed increased primary care use by children aged 1–5 years up to 6 months after a SARS-CoV-2 infection.⁵ Our study did not observe any difference in the use of medical or psychological treatment, but children in the COVID-19 group experienced more symptoms and greater severity, suggesting a similar trend.

Our study had some limitations. First, the sample size was small, especially with the low prevalence of long-term symptoms in younger children. Second, all symptoms were reported by parents,

Abbreviations: COALA, Corona outbreak-related examinations in day care centres; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

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TABLE 1 Sample description of exposed children with a history of SARS-CoV-2 infection and the controls.

	History of SARS-CoV-2 infection		Controls	
	Case number (n)	Percentage (%)	Case number (n)	Percentage (%)
Total	31	100.0	158	100.0
Age—Mean (range)	5.7 (2.9–7.5)		5.0 (1.9–8.0)	
Sex				
Female	16	51.6	77	48.7
Days since SARS-CoV-2 day care centre outbreak—Mean (range)	328 (236–433)		353 (241–465)	
SARS-CoV-2 virus variant				
Wild type	3	10.0		
Alpha variant	21	67.5		
Unknown	7	22.5		
Not applicable			158	100.0
Long-term symptoms				
Respiratory symptoms	7	22.5	44	27.8
Rhinitis	5	16.1	46	29.1
Cough ^a	3	9.7	6	3.7
Difficulty breathing when exerted	2	6.5	3	1.9
Difficulty breathing at rest	1	3.3	5	3.2
Sore throat	0	0	16	10.1
Neuropsychiatric symptoms	4	12.9	17	10.8
Concentration problems	3	9.7	5	3.2
Psychological symptoms ^a	3	9.7	5	3.2
Headache	0	0	5	3.2
Paresthesia (arms or legs)	0	0	2	1.3
Gastrointestinal symptoms	3	9.7	24	15.1
Abdominal pain	2	6.5	17	10.8
Diarrhoea	1	3.3	11	7.0
Nausea	1	3.3	5	3.2
Vomiting	1	3.3	5	3.2
Loss of appetite	0	0	8	5.1
Dermatological symptoms	1	3.3	9	5.7
Rash	0	0	9	5.7
Hair loss ^a	1	3.3	0	0
General symptoms	6	19.4	24	15.1
Exhaustion/fatigue	2	6.5	13	8.2
Limb pain	2	6.5	5	3.2
Limited physical resilience	2	6.5	3	1.9
Fever	1	3.3	11	7.0
Sleep disturbance	0	0	8	5.1
Earache	1	3.3	9	5.7
Palpitations/chest pain	1	3.3	0	0
Vertigo	0	0	5	3.2

^aBased on remarks in free-text information; not explicitly asked for during the interview. Symptoms of three children with pre-existing diseases were excluded: (1) difficulty breathing at exertion and rhinitis in a child with a known bronchial asthma, (2) earache in a child with recurrent otitis media and (3) rhinitis and sore throat in a child with a known bronchial asthma and a subglottic laryngitis. Loss of smell/loss of taste and blue/reddened fingers/toes were not mentioned.

which may not have always accurately reflected the children's subjective experiences. Third, symptoms frequently observed by adults after COVID-19, including loss of smell and taste, may not be adequately described by young children and go underreported. Fourth, the follow-up duration was relatively long due to organisational circumstances. Lastly, the controls may have included children with undiagnosed or undocumented SARS-CoV-2 infections. A strength of the study was that the children were not recruited from medical settings, but after outbreaks in day care centres. Therefore, the sample was not biased towards children with more severe acute COVID-19. A further strength was that we recruited controls from the same day care centres, who were exposed to similar local pandemic conditions.

Our small, community-based study demonstrated no significant differences in the occurrence of long-term symptoms in young children with and without a history of SARS-CoV-2 infections. As research on post-COVID-19 conditions progresses, it is critical to standardise health outcome criteria and assessment tools, to identify affected children, provide treatment and understand underlying mechanisms.

AUTHOR CONTRIBUTIONS

Juliane Wurm: Conceptualization; formal analysis; visualization; writing – original draft; writing – review and editing. **Bianca Finkel:** Conceptualization; writing – original draft. **Helena Iwanowski:** Conceptualization; writing – original draft. **Susanne Jordan:** Conceptualization. **Anna Sandoni:** Writing – original draft. **Ulrike Kubisch:** Writing – original draft. **Anja Schienkewitz:** Conceptualization. **Marcel Hintze:** Data curation; software. **Barbara Wess:** Data curation; software. **Matthias Wetzstein:** Data curation; software. **Christina Poethko-Müller:** Conceptualization; supervision. **Christa Scheidt-Nave:** Conceptualization; supervision. **Julika Loss:** Conceptualization; funding acquisition; supervision; writing – original draft; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

None.

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