

Post-acute COVID-19 outcomes in children with mild and asymptomatic disease

Data on the clinical outcomes of children with COVID-19 are scarce, particularly in those with asymptomatic and mild disease.^{1,2} Studies involving adults suggest that long-term multisystem sequelae and complications can occur, even with mild COVID-19.³ We aimed to describe medium-term clinical outcomes 3–6 months after diagnosis in children with COVID-19 presenting to a tertiary paediatric hospital.

We followed children (aged ≤ 18 years) at a dedicated COVID-19 follow-up clinic at the Royal Children's Hospital (RCH) in Melbourne, Australia, between March 21, 2020 and March 17, 2021. Children who tested positive for SARS-CoV-2 at the RCH or externally between March 21 and Oct 28, 2020, were referred to this clinic.

A standardised clinic proforma was used to collect information on acute COVID-19 symptoms, transmission risk factors, medical history, and post-acute COVID-19 symptoms (eg, dyspnoea, fatigue, rash, or abdominal pain; appendix pp 1–2). Acute disease severity was classified according to WHO criteria.⁴ Data were extracted from the RCH electronic medical record. This study was approved by the RCH Human Research and Ethics Committee (HREC QA/63103/RCHM-2020).

A total of 171 children from 137 households attended the clinic (appendix p 3). Most cases of COVID-19 (136 [80%] of 171 children) were identified between July and August, 2020, corresponding with the epidemiological peak in Melbourne during this period.⁵ There have been 3285 reported cases of COVID-19 in children and adolescents (aged 0–19 years) in Victoria to date (March 17, 2021).⁵

Our cohort comprised of 171 children (median age 3 years [IQR 1–8]): 90 (53%) boys and 81 (47%) girls. Most children had mild disease (100 [58%]) or were asymptomatic (61 [36%]), and nine (5%) children had moderate disease. The few hospital admissions (14 [8%] children) were generally brief and were for observation or fluid rehydration. One (1%) child with complex congenital heart disease had severe COVID-19 pneumonitis with acute respiratory failure (appendix p 3). Two (1%) children had post-acute COVID-19 inflammatory conditions temporally associated with SARS-CoV-2: a 7-year-old child with paediatric multisystem inflammatory syndrome who required intensive care management, and an 11-month-old child with Kawasaki disease.

Follow-up data at 3–6 months were available for 151 (88%) of 171 children, of whom 54 (36%) were asymptomatic and 97 (64%) were symptomatic (ie, with mild, moderate, or severe disease) with acute COVID-19. 12 (8%) children had post-acute COVID-19 symptoms, all of whom were symptomatic with acute COVID-19 (table). The most common post-acute COVID-19 symptoms were mild post-viral cough (six [4%] of 151 children), fatigue (three [2%] children) or both post-viral cough and fatigue (one [1%] child). The duration of post-viral cough ranged from 3 weeks to 8 weeks and of post-viral fatigue ranged from 6 weeks to 8 weeks from the time of symptom onset. At the most recent review in March, 2021, all 151 children had returned to their baseline health status and post-acute COVID-19 symptoms had resolved. Follow-up data for 20 children were not available; seven (35%) of these children had asymptomatic COVID-19.

These findings contrast those of studies of COVID-19 in adults, which have identified multisystem complications and a higher prevalence and severity of persistent symptoms.³

Common complications in adults are respiratory sequelae and persistent fatigue (eg, residual dyspnoea ranging from 11% to 43% and fatigue ranging from 35% to 64%).³ In our paediatric cohort, full recovery occurred within weeks of acute symptom onset and reported symptoms were mild in severity.

This study was done at a single centre in a metropolitan tertiary paediatric hospital with predominantly young (median age 3 years [IQR 1–8]) children, which could limit the generalisability of results. Our cohort included a large proportion of



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See Online for appendix

	Children (n=12)
Sex	..
Male	7 (58%)
Female	5 (42%)
Age, years	..
Mean	3.7 (3.5)
Median	2 (1–7)
Age group, years	..
0–2	8 (67%)
6–12 years	4 (33%)
13–18 years	0
Comorbidities	3 (25%)
Congenital cardiac disease	1 (8%)
Chronic respiratory condition	2 (17%)
Symptom duration, days	..
Mean	14.6 (12–8)
Median	11.5 (3.5–25.5)
Acute disease severity	..
Asymptomatic	0
Mild disease	11 (92%)
Moderate disease	0
Severe disease	1 (8%)
Admitted to hospital*	6 (50%)
For observation	2 (17%)
For fluid rehydration	1 (8%)
Received intensive care unit care*	3 (25%)
Post-acute COVID-19 symptoms	..
Post-viral cough	6 (50%)
Fatigue	3 (25%)
Both cough and fatigue	1 (8%)
Inflammatory conditions	2 (17%)

Data are n (%), mean (SD), or median (IQR). *All hospital admissions were for acute COVID-19 illness except for two children who were admitted to the intensive care unit due to post-acute inflammatory conditions.

Table: Demographic and clinical characteristics of children with post-acute COVID-19 symptoms

children with asymptomatic infection (61 [36%] of 171 children), which reflects state government testing guidelines for asymptomatic close contacts of individuals with confirmed COVID-19.

Follow-up was limited to 3–6 months, with outcomes measured with clinical assessments, apart from for two children with post-acute COVID-19 inflammatory conditions who had echocardiograms. As most post-acute COVID-19 symptoms were mild in severity, objective evaluation with lung function tests, a chest CT scan, or both, was not done.

Data on the long-term effects of COVID-19 in children and adolescents are needed, and such data should ideally be nationally representative and include broader demographics. Ongoing follow-up of paediatric patients with COVID-19, including assessment of mental health outcomes, is needed to comprehensively describe long-term outcomes in this population.

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- 1 Göttinger F, Santiago-García B, Noguera-Julian A, et al. COVID-19 in children and adolescents in Europe: a multinational, multicentre cohort study. *Lancet Child Adolesc Health* 2020; **4**: 653–61.
- 2 Denina M, Pruccoli G, Scalfaro C, et al. Sequelae of COVID-19 in hospitalized children: a 4-months follow-up. *Pediatr Infect Dis J* 2020; **39**: e458–59.
- 3 Nalbandian A, Sehgal K, Gupta A, et al. Post-acute COVID-19 syndrome. *Nat Med* 2021; published online March 22. DOI:10.1038/s41591-021-01283-z.

- 4 WHO. Clinical management of COVID-19: interim guidance 27 May 2020. Geneva: World Health Organization, 2020.
- 5 Department of Health and Human Services, State Government of Victoria. Victorian coronavirus (COVID-19) data. 2021. <https://www.dhhs.vic.gov.au/victorian-coronavirus-covid-19-data> (accessed April 1, 2021).