Post-acute COVID-19 outcomes in children requiring hospitalisation

Cara J. Bossley*, Ema Kavaliunaite, Katharine Harman, James Cook, Gary Ruiz & Atul Gupta

Post-acute COVID-19 causes long term sequelae in adults. This is less well described in children. We performed clinical assessments on a large cohort of children and young people admitted with a positive SARS-CoV-2 RNA swab. We assessed for symptoms of post-acute COVID-19 syndrome after 4 weeks or more. We found that most (85%) of children made a full recovery following SARS-CoV-2 infection. A small number had symptoms which lasted for more than 4 weeks, most of which had resolved at 3 months. Symptoms included dry cough, fatigue and headache. One patient suffered from anosmia. We conclude that most children and young people do not suffer from post-acute COVID-19 syndrome, and make a full recovery from infection.

Most of our current insights into the long term sequelae of COVID-19 come from adults who have recovered from symptomatic acute SARS-CoV-2 infection often with multiple organ involvement. Children rarely have this typical acute presentation. However, symptomatic acute infection may not be a necessary precursor of the late sequelae of SARS-CoV-2 infection. Post-acute COVID-19 has been defined as symptoms persisting or sequelae developing 4 weeks beyond the initial infection. Recent data from the office of National Statistics in the UK suggest late symptoms occur in children and young people (CYP). We previously reported on children admitted to our hospital with SARS-CoV-2 RNA positivity during the first and second COVID-19 waves in the UK. We aimed to explore whether any of these children might have late symptoms in common with post-acute COVID-19 syndrome in adults.

Methods
The subjects were CYP up to 18 years of age with SARS-CoV-2 RNA positivity who were admitted between 1 March 2020 and 19 January 2021 to King’s College Hospital. None of the children included had PIMS-TS. We assessed symptoms associated with post-acute COVID-19 syndrome, defined as symptoms persisting for 4 weeks or longer. The CYP were aged 18 years or younger admitted between 1 March 2020 and 19 January 2021 to King’s College Hospital with positive SARS-CoV-2 RNA positivity.

The assessment was performed using a standardised clinical proforma (Appendix 1) over the telephone. The telephone review was made by Paediatric Respiratory consultants in March 2021 and therefore from 3–12 months after the admission.

Methods were performed in accordance to the guidelines and regulations of the trust.

This was a prospective observational cohort study. We entered the results of the assessments into an excel database, and analysed the difference between those with and without longer lasting symptoms and the severity of their initial presentation using the Chi squared test or fisher's exact test. A significance of p < 0.05 was deemed significant.

Ethics approval. Approved from the ethics committee of King’s College as a service evaluation project.

Methods and protocols were approved by King’s College audit committee as a clinical audit. Parents/guardian’s of children gave full informed consent to perform the assessment at the time of being assessed.

Results
A total of 88 CYP were admitted with a range of conditions. 30 (34%) were infants, 15 (17%) were of preschool, 12 (13.5%) of primary and 31 (35.5%) of secondary school age. 54 (61%) were male, 43 (49%) had an underlying co-morbidity. Acute disease severity was classified according to modified World Health Organisation classifications. 24/88 (27%) were asymptomatic or had incidental findings and 42/88 (48%) mild, 11/88 (12.5%) moderate, 5/88 (5.5%) severe and 6/88 (7%) critical disease. We were unable to contact 17/88 (19%) at the time of the survey.

There were 71 patients available for follow up, 42/71 (59%) were male and the mean age 6.7 years (range; 11 days–17 years). Most (60/71, 85%) patients had made a complete recovery. A small proportion, namely 11/71
had symptoms beyond 4 weeks of discharge (Tables 1 and 2). These symptoms had resolved in 1–3 months in 5/11 (45%) (Table 1). Four of these 5 patients had an acute respiratory presentation and the fifth had a history of asthma making it difficult to attribute any persistence of symptoms confidently to COVID-19. Most of the more prolonged symptoms in the other patients were similarly unlikely to be due to COVID-19 and some of these patients were under investigation for a specific cause.

There was no association between severity of presentation and probability of more persistent symptoms. The most common prolonged symptom was a dry cough but it was seen in only 5/71 (7%) patients. This has been well described in both paediatric and adult cohorts. Shortness of breath was seen in 4/71 (6%), fatigue in 3/71 (4%) and headaches in 2/71 (3%). One patient (1.4%) suffered from anosmia. None of the 11 symptomatic patients had any symptoms that limited their daily activities like eating, drinking or getting dressed. All the children who were at school or nursery before the hospitalisation, had returned to education.

Discussion

We report the longer term effects of children hospitalised with COVID-19 infection. We have demonstrated that most children make a full recovery from the infection and do not suffer from post-acute COVID-19. A small proportion of children had on-going symptoms post 4 weeks of discharge but then recovered within 3 months. These results are reassuring for children, and underline the fact that children are less likely to be adversely affected by COVID-19 infection.

There was a very small proportion of children who had on going effects, but it is difficult to know if some of the symptoms are directly attributable to the COVID-19 infection, and some effects may be incidental. We do report a post COVID cough, and this seemed to be a consistent finding, however effected only a small proportion of patients. This has been described in adult post-acute COVID infection and more recently in children. In our
A recent narrative review of 14 paediatric studies, it was highlighted that many of the studies included patients who did not necessarily have a positive PCR test, rather self-reported COVID-19 infection, and thus could include problems from other viruses. The review found only 4 studies with control groups. They found that there were major limitations in all of the studies, which probably accounts for the wide prevalence of COVID 19 between the studies of between 4 to 66%. The review concluded the evidence for long COVID in CYP to be limited, with the absence of a control group meaning that it is difficult to differentiate symptoms attributable to COVID-19 vs those related to the pandemic in general. The review did however feel further studies in this group are important, to help guide us as to whether immunisation in this group could be necessary to prevent long COVID.

This follow-up study of a cohort of CYP hospitalised with COVID-19, and demonstrates that the majority of CYP (85%) did not encounter any long-term sequelae. Assuming this data can be generalised globally, it would help to understand the natural history of this virus in CYP and enable prioritisation of follow-up care.

Conclusion
We conclude from our assessments, that most children admitted with COVID-19 make a full recovery. There are very small proportion of children who had longer lasting effects but these could be effects seen commonly following other viral illnesses.

Data availability
We have available data as needed. The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request. All the patients with prolonged symptoms are described in the tables.

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Author contributions
C.J.B. designed the proforma, performed the clinical assessments and wrote the manuscript. E.K., I.C., G.R. and A.G. all performed the clinical assessments. All authors reviewed and contributed to the manuscript. A.G. designed the project and performed final review of the manuscript.

Competing interests
The authors declare no competing interests.

Additional information
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