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Bonnie M Macfarlane, Yee Sum Li, Christian James, Khin Chaw, Satyamurthy Anuradha

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Communicable Diseases Intelligence (CDI)
Health Security & Emergency Management Division
Department of Health and Aged Care
GPO Box 9848, CANBERRA ACT 2601

Website: www.health.gov.au/cdi

Email: cdi.editor@health.gov.au

Original article

Symptom profile of COVID-19 in children in the Metro South area of Brisbane, during the first SARS-CoV-2 Omicron wave: a population-based survey

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Abstract

Background

An increase in gastrointestinal infections in Early Childhood Education and Care notified to the public health unit in the Metro South area of Brisbane, Australia, coincided with the peak of the first Omicron wave in 2022. This made public health messaging and advice on outbreak management challenging. We hypothesised that gastrointestinal symptoms were a feature of the Omicron variant infection. At the time, there was a paucity of data on presenting symptoms of coronavirus disease 2019 (COVID-19) by the Omicron variant of SARS-CoV-2 among Australian children.

Objectives

To describe the symptom profile of COVID-19 in children residing in a large Metropolitan area in Queensland during the first Omicron wave.

Methods, setting, and participants

Participation was invited from cases of COVID-19 notified in those 17 years or younger via the Queensland Notifiable Conditions System between 7 February and 13 March 2022. A retrospective self-reported survey of these children was conducted at the end of May 2022 to understand the symptom profile and severity of infection.

Results

Of the 285 responses received, 91% reported being symptomatic; the most common symptoms noted were fever (75%), fatigue (57%), sore throat (55%), headache (55%), cough (50%) and runny nose (48%). Gastrointestinal symptoms were reported in 33% of cases. A majority of the children had either fever (31%) or respiratory symptoms (40%) as the first symptom, with only 7% reporting gastrointestinal symptoms as their first symptom. Close to three-quarters of the children had symptoms that lasted for four days or less. Medical advice/treatment was sought by 17% of symptomatic cases.

Conclusions

The majority of children with COVID-19 during the Omicron wave had fever or respiratory related symptoms as their first symptoms. Gastrointestinal symptoms were uncommon as the first symptom or in conjunction with other symptoms. Understanding the symptom profile in children helps inform institutional settings of their infection control practices and public health messaging.

Keywords: COVID-19; children; symptoms; Omicron; gastrointestinal; SARS-CoV-2

Introduction

The state of Queensland, Australia, observed a steady rise in the number of cases of coronavirus disease 2019 (COVID-19) among all age groups after the opening of state and international borders in late 2021. The state had been in an elimination phase until this time, keeping disease transmission in the community close to zero through intense contact tracing and other public health measures. In addition, all cases of COVID-19 were admitted to hospital for clinical monitoring and care. These measures significantly dropped at the beginning of 2022, given the increasing case numbers and mild course of illness for the Omicron variant (B.1.1.529) of SARS-CoV-2.

Although predominantly a respiratory disease, a meta-analysis including 1,810 COVID-19 polymerase chain reaction (PCR) positive paediatric patients demonstrated a prevalence of gastrointestinal symptoms of 6%.[1] However, that meta-analysis included studies which had looked at clinical presentations in children before the advent of the Omicron variant. While most of the studies included in that review had smaller sample sizes (ranging from 3 to 291 children), a large population-based survey in the UK involving 1,734 children aged 5–17 years showed that 21.6% had loss of appetite and 20.6% had abdominal pain.[2] Evidence from this study also pointed out that COVID-19 in children is usually of short duration with a low symptom burden. However, the study covered the period from September 2020 to January 2021, before the incursion of the Delta and Omicron variants. A large Australian study from New South Wales analysed the symptomatology of 11,985 children under 16 years of age with the Delta variant.[3] It concluded that most children had asymptomatic or mild disease, with rhinorrhoea the most common clinical feature.

Although the clinical course of the Alpha (B.1.1.7) and Delta (B.1.617.2) COVID-19 variants in children had been rigorously followed up by clinicians through hospital programs, little was known about the symptom complex concerning the Omicron variant in children in Australia. Anecdotal evidence from school nurses and Early Childhood Education and Care (ECEC) staff indicated that children were presenting with gastrointestinal symptoms and subsequently testing positive for COVID-19 by rapid antigen test (RAT) or polymerase chain reaction (PCR). There were 49 outbreaks of viral gastroenteritis in ECEC in the Metro South area of Brisbane notified to the public health unit between January and March 2022, which was a notable increase compared to preceding years. This increase coincided with the first Omicron wave in Queensland, leading to concerns that inadequate public health measures in ECEC may lead to inadvertent spread of COVID-19 in the community. It was thought gastrointestinal symptoms may be the presenting feature of Omicron variant infections and were mimicking gastrointestinal outbreaks in childcare centres and schools usually induced by other viruses. To address the gap in published literature on children, we conducted a population-based survey to understand the symptom profile of COVID-19 in children in the Metro South area of Queensland, Australia, in February–March 2022.

Methods

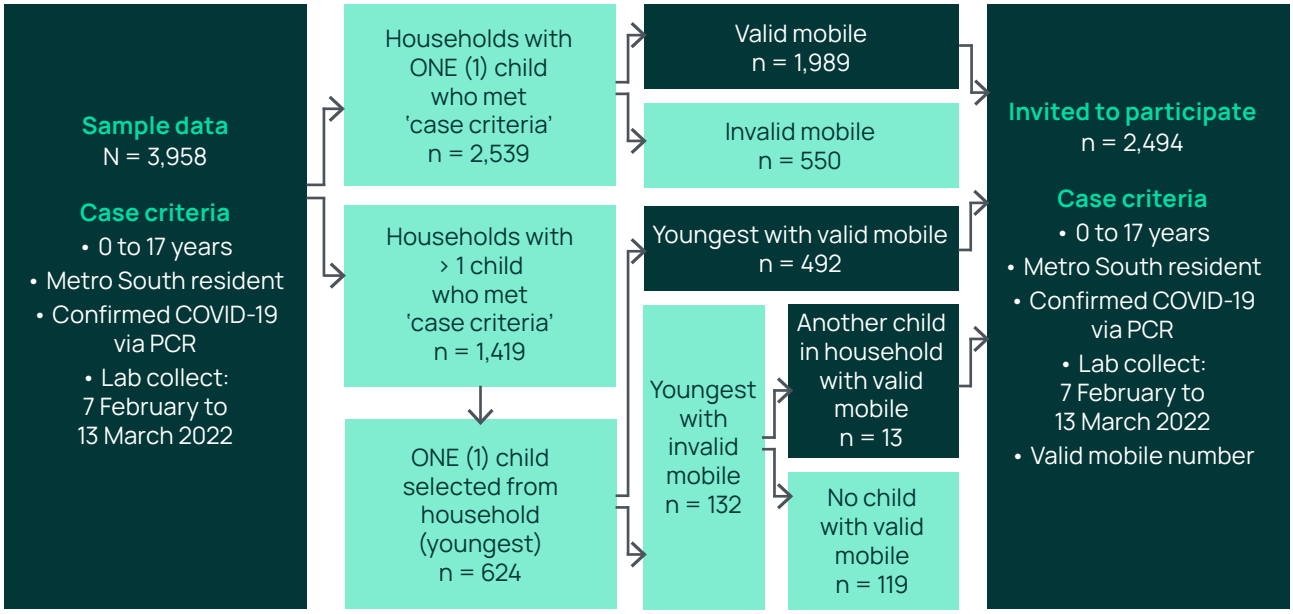
Study population

The Metro South area referred to in this study is the Metro South Hospital and Health Service (HHS) catchment area. It is one of 16 Hospital and Health Services within Queensland Health and provides health services to 23% of the Queensland population.[4]

As a notifiable condition under the *Public Health Act 2005*, all PCR positive detections for SARS-CoV-2 must be notified to Queensland Health via the Queensland state-wide register known as the Notifiable Conditions System (NoCS). The notification includes patient demographics, contact details and the test result. Children chosen for the survey were those aged 0 to 17 years who tested positive on a PCR test for SARS-CoV-2 infection over a five-week period between 7 February and 13 March 2022 and notified via NoCS. The study was done at a time when health messaging recommended COVID-19 testing for children with symptoms and COVID-19 RATs were not widely available or recommended for use in children.

Additional inclusion criteria were a valid residential address geocoded under the Metro South HHS catchment and a valid mobile number. Figure 1 shows the sampling methodology for the study. A total of 3,958 children met the initial eligibility case criteria—the sampling strategy aimed to select one eligible child from each household with a valid Metro South address and a valid mobile number.

Figure 1: Flow chart of sampling methodology



In households with multiple eligible children, the youngest child was selected; if a valid mobile was unavailable, another child of the same household with a valid mobile number was selected. The sampling methodology resulted in 2,494 children invited to participate.

Survey instrument

It was assumed the mobile number used for the survey belonged to an adult parent or guardian of the child who was selected. An initial SMS message was sent introducing the study with an invitation to complete an online survey regarding their child's COVID-19 illness. The survey was created in Microsoft Forms, with a link to the survey sent as a separate SMS message.

Survey questions

The survey consisted of ten questions. Respondents were asked to provide the mobile number that they received the survey for verification purposes and the date the child was tested. The remaining eight questions related to the child's age when they tested positive for COVID-19 (in whole years); symptoms experienced; illness duration; reason for testing; and information about medical advice/treatment sought. It was made clear at the beginning of the survey it was to be completed by an adult, aged 18 years or over, in case the mobile number was used by a child under the age of 18 years. In addition, there were clear instructions at the beginning of the survey asking all respondents to complete the survey questions for their youngest child who tested positive for COVID-19 during the study period.

Survey timeline

The initial SMS message was sent on 26 May 2022. A reminder SMS message was sent on 1 June 2022. The survey portal was open for 9 days and closed at the end of 3 June 2022.

Ethical approval

Ethical approval was sought from Metro South Health Ethics Committee and approved under HREC/2022/QMS/84981.

Statistical analyses

Microsoft Excel was used for data management and statistical analysis. All categorical fields are presented as counts and percentages (%). Median (range) was used for age. Subgroup analysis by age groups (0–4 years, 5–11 years, and 12–17 years) was performed.

Results

Of the 2,494 invited to participate, 285 unique responses were received (11.4% response rate). The final analysis included 285 participants, with a minimum age of less than one year and a maximum age of 17. The number of responses received for 0–4 years, 5–11 years and 12–17 years were 78 (27.4%), 152 (53.3%) and 55 (19.3%) respectively.

Reason for testing

Forty-two per cent (42%) of parents/guardians reported their child had symptoms but no known contact with a person with COVID-19; 31% reported their child had close contact with a household member with COVID-19, and 24% reported close contact with a COVID-19 case from outside the home. Ten responses provided other reasons not captured in the categories above.

Reported symptoms

Ninety-one 91% of participants (n=258) reported at least one COVID-19 symptom in their child. The most frequently reported symptom was fever (75%) (Table 1). Around half of the symptomatic children reported respiratory symptoms; sore throat 55%, cough 50% and runny nose 48%. Other common symptoms were fatigue (57%), and headache (55%). Gastrointestinal symptoms were reported less frequently (33%) and included nausea (17%), vomiting (16%), abdominal pain (14%), and diarrhoea (9%). Other less commonly reported symptoms included dizziness (10%), loss of taste (8%), loss of smell (5%), and body aches (3%).

Table 1: First symptom and all symptoms reported during COVID-19[a]

	First symptom reported during COVID-19[b]		All symptoms reported during COVID-19[c]	
Symptoms	**n**	**%**	**n**	**%**
Fever	80	31.0	194	75.2
Sore throat	49	19.0	142	55.0
Headache	31	12.0	141	54.7
Cough	28	10.9	130	50.4
Runny nose	27	10.5	123	47.7
Fatigue	17	6.6	149	57.4
Abdominal pain	6	2.3	37	14.3
Vomiting	6	2.3	40	15.5
Nausea	5	1.9	44	17.1
Dizziness	3	1.2	26	10.1
Loss of taste	1	0.4	21	8.1
Body aches	1	0.4	8	3.1
Diarrhoea	0	0	23	8.9
Loss of smell	0	0	13	5.0
Other[d]	4	1.6	15	5.8

a All counts and percentages in Table 1 were calculated only for those who reported any COVID-19 symptoms (n = 258 participants).

b Only one 'first symptom' allowed per participant.

c Participants asked to report all symptoms experienced during COVID-19, with multiple responses permitted.

d Other symptoms: burning eyes, conjunctivitis, sneezing, laboured breathing, loss of appetite, rash, congested nose, croup, fast heartbeat, delirium, sweating.

First symptoms

Fever was the most common first symptom (31%), followed by sore throat (19%), headache (12%), cough (11%), and runny nose (11%). Seventeen children (7%) reported fatigue as the first symptom; however, fatigue was frequently reported as an additional symptom (Table 1). Seven per cent (7%) reported gastrointestinal symptoms as the first symptom.

The results indicated that fever was the most common first symptom in the 0–4 and 5–11 age groups, and sore throat the most common symptom in the 12–17 age group.

It is important to note none of the respondents reported diarrhoea as their first symptom. For children 0–4 years of age, parents/caregivers did not report abdominal pain or nausea, and only 3.2% reported vomiting as their first symptom.

Duration of symptoms and medical advice

For close to three-quarters of cases surveyed (73%), the reported duration of symptoms was in the range 1–4 days. Medical advice/treatment for their symptomatic child was sought by 17%, with emergency department and telehealth services those most frequently sought (Table 2).

Subgroup analysis indicated that the duration of symptoms did not differ across age groups.

Table 2: Duration of symptoms and medical advice/treatment sought during COVID-19[a]

Category	Value	n	%
Duration of symptoms	1–2 days	89	34.5
	3–4 days	99	38.4
	5–6 days	40	15.5
	7–8 days	15	5.8
	9 days or more	15	5.8
Medical advice/treatment was sought?	No	213	82.6
	Yes[b]	45	17.4
Type of medical advice/treatment[c]	Emergency department (ED presentation)	19	42.2
	Telehealth (GP/Specialist)	17	37.8
	Telehealth services (13 Health, Health Direct)	11	24.4
	Face to face (GP/Specialist)	6	13.3
	Hospital admission	6	13.3
	COVID-19 virtual ward	4	8.9
	Other	2	4.4

a All counts and percentages in Table 2 were calculated only for those who report any COVID-19 symptoms (n = 258 participants).

b Three asymptomatic participants reported seeking medical advice/treatment (ED presentation & Telehealth), not included in Table 2.

c Participants asked to report all types of medical advice/treatment sought, with multiple responses permitted (n = 45 participants).

Discussion

To our knowledge, our study is the first study to present the symptom profile of the Omicron variant of COVID-19 among children in Queensland, a state which had seen very few cases of Alpha and Delta variants among children due to stringent public health measures. Our findings showed that the majority of children with PCR-confirmed COVID-19 during the first Omicron wave were symptomatic predominantly with respiratory symptoms lasting from 1 to 4 days. Fever and respiratory symptoms were the most prevalent symptoms. This is consistent with international studies.[5,6] Those symptoms relating to the gastrointestinal tract were uncommon as the first symptom (7%); 33% of children reported at least one gastrointestinal symptom. These were noted in even fewer children aged 0–4 years as first symptom compared to older age groups; this may be related to the fact that gastrointestinal symptoms are difficult to objectively assess in the very young.

Gastrointestinal symptoms are known to occur with COVID-19. The SARS-CoV-2 virus acts directly on the enterocytes that have angiotensin-converting enzyme 2 and transmembrane serine protease 2 binding receptors, leading to gastrointestinal symptoms when the virus invades the digestive tract.[7] Reports of the prevalence of gastrointestinal symptoms in children infected with the Omicron variant have been variable. A study from Shanghai found only 4.3% of symptomatic children with COVID-19 due to Omicron reported nausea, vomiting or diarrhoea.[8] An even lower percentage was reported in Shanghai (1.7% diarrhoea and vomiting).[5] In a smaller cohort of children studied in Spain, just over a fifth were reported to have diarrhoea or vomiting during their illness,[9] which is similar to our findings. Interestingly, Taytard et al. have noted that the Omicron variant caused significantly more gastrointestinal symptoms than did the Delta variant among hospitalised children.[10] This may reflect the fact that these children had more severe infection or associated comorbidities, whilst our cohort was representative of children with milder infection as the majority were managed at home. The ancestral variant of COVID-19 was noted to cause gastrointestinal symptoms in 27% of children in a retrospective review from 2020.[11]

Our findings are consistent with international evidence that disease in children due to the Omicron variant is generally mild.[6,8,12,13] The majority of children had symptoms that lasted four days or less and only six children were admitted to hospital in our study. Asymptomatic infection was noted in only 9% of the children, compared to 50% during the same period in Shanghai.[5] Our study could have underestimated asymptomatic infection prevalence, given that the majority of our cohort sought testing due to clinical symptoms or being a close contact of a case. Asymptomatic infection has been found to be more common in vaccinated compared with unvaccinated children.[8] Determining vaccination status of the children was beyond the scope of our study.

Between January and March 2022, there was an increase in the number of viral gastroenteritis outbreaks in ECEC in the Metro South area of Brisbane compared to preceding years. It was hypothesised that the increased use of hand sanitiser in place of handwashing during the pandemic was responsible for a rise in gastrointestinal outbreaks in ECEC.[14] Our finding that children with proven COVID-19 infrequently display gastrointestinal symptoms gave more confidence in helping to manage the common viral infections (such as norovirus) that affect ECEC and rapidly spread in these high-risk environments. The public health significance of thorough hand washing to reduce the spread of gastrointestinal infections in this high-risk environment was reiterated.

A major strength of our study is that the survey was done through the community and reflects the symptom complex for the Omicron variant among all children, including those not requiring medical care or hospitalisation. Our study was done during a time when PCR was the recommended testing method for children with COVID-19 symptoms in Queensland, which meant that our recruitment protocol was highly representative of paediatric COVID-19 cases in our region during this period. Our study has filled an important gap in the literature on understanding the clinical presentation and course of the first Omicron wave among children. This is useful in informing the management of ECEC gastroenteritis outbreaks as we could be more confident that the gastrointestinal illnesses were not strongly suggestive of an early COVID-19 infection course.

Limitations on generalisability of data are imposed by the response rate of 11%, despite multiple attempts to improve this. We acknowledge the low response rate may have impacted on the validity of this study. The convenience sampling approach of selecting the youngest case, where multiple cases in the same household were notified, could have introduced selection bias. The study was also subject to potential recall bias due to the lag time between survey administration and occurrence of infection. Attendance at ECEC was not explicitly asked, so the association between ECEC attendance and gastrointestinal symptoms due to COVID-19 cannot be deduced from this study.

ECECs commonly experience outbreaks of gastroenteritis. The first Omicron wave of the COVID-19 pandemic posed a challenging time as there was a rapid increase in case numbers and a poor understanding of the clinical course of COVID-19. This study has clearly shown that gastrointestinal symptoms were infrequent in children as a first symptom or in conjunction with other symptoms of COVID-19 during the early 2022 SARS-CoV-2 Omicron wave. It was predominantly a respiratory illness with a mild clinical course. A clear understanding of the symptom profile in children of various infections is important to provide appropriate public health messaging, including infection control practice advice to families and management of institutional settings.

Acknowledgments

We would like to acknowledge and extend our gratitude to all the parents and guardians who participated in our survey. The survey responses have provided valuable insights into the symptom profiles of children mainly unexposed to COVID-19 for two years in Queensland. This information will contribute to the growing body of evidence to characterise the clinical spectrum and severity of COVID-19 in children across Australia.

Author details

Ms Bonnie M Macfarlane,[1]

Dr Yee Sum Li,[1]

Mr Christian James,[1]

Dr Khin Chaw,[1]

Dr Satyamurthy Anuradha[1,2]

1. Metro South Public Health Unit, Metro South Health, Queensland, Australia
2. School of Public Health, The University of Queensland, Queensland, Australia

Corresponding author

Ms Bonnie M Macfarlane

Metro South Public Health Unit, Metro South Health, Garden City Office Park, Eight Mile Plains, Queensland

Email: bonnie.macfarlane@health.qld.gov.au

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