Journal of Public Health | pp. 1–3 | doi:10.1093/pubmed/fdaa269

Secondary attack rate in household contacts of COVID-19 Paediatric index cases: a study from Western India

Komal Shah, Yogini Kandre, Dileep Mavalankar

Department of Public Health, Indian Institute of Public Health at Gandhinagar, Gandhinagar 382042, Gujarat, India
Address correspondence to Komal Shah, E-mail: kshah@iiphg.org

ABSTRACT

Background Role of pediatric cases in secondary transmission of COVID-19 is not well understood. We aim to study secondary attack rate (SAR) of COVID-19 in household contacts of pediatric index cases from Gujarat, Western Indian state.

Methods For this cross-sectional study, details of 2412 paediatric patients were collected from Government records. Through stratified random sampling 10% ($n = 242$) of the patients were selected for the study and were telephonically contacted for obtaining the details of household secondary infection; 72 pediatric index cases having 287 household contacts were included in the study.

Results The SAR in household contacts of pediatric index cases was 1.7% (95% CI: 0.74–4%). Majority of the index cases were males (94.4%) with 66% of the patients being admitted at various hospitals and isolation facilities (45%); 37% were home quarantine. Of 72, 50 (74%) cases were aged between 12 and 18 years. The family size of the index cases causing secondary infection was comparatively larger than index cases without secondary household infection (6.75 ± 2.3 versus 4.9 ± 1.9; $P = 0.034$).

Conclusions The household SAR from pediatric patients is low and is closely associated with the family size of the index cases. Hence, home quarantine should be advocated in smaller families with appropriate isolation facilities.

Keywords COVID-19, pediatrics, secondary attack rate

Introduction

Global statistics highlights that in COVID-19, contribution of paediatric population is only 1–5%[1] with milder diseases with extremely low-case fatality in pediatrics.[2–4] Various attempts were made to understand the transmission trends, clinical characteristics, biomarker profile and radiographical features of COVID-19 in this subset of population.[5,6] However, in contrast to adults, transmission trends are not very clear in paediatrics. It was observed that majority of the paediatrics cases are asymptomatic, hence often remains underdiagnosed. Similar to elderly, this population is also vulnerable and often depends on their caretakers for basics of their needs. This makes it extremely important to study disease transmission when index case is from paediatric age group.

Studies have reported the role of children in transmitting COVID-19 in close contacts. Current cross-sectional study was designed to assess secondary attack rate (SAR) in household contacts of paediatric index cases of COVID-19 in Gujarat State, India.

Methods

For this study, details of COVID-19 positive case of entire Gujarat state were collected from Government records for the month of March to July 2020. An ethical clearance from the Institutional Ethics Committee was obtained before initiation of the study. Total of 68 532 laboratory confirmed cases were identified through provided line listing that included data from 33 districts of Gujarat state. Age-wise assessment showed that 2415 patients were aged 18 years or below. These patients were screened through stratified random sampling 10% of the population was selected for the study. Therefore, the study sample consisted of 242 patients who were either index or secondary case of COVID-19 (as records provided were cumulative). Study protocol and data collection tools were designed to obtain details of household SAR when index

Komal Shah, Assistant Professor
Yogini Kandre, Programe Associate HTA-RRC
Dileep Mavalankar, Director

Table 1 Characteristics of study population and household SAR

Variables	*Number*
Total number of COVID-19 positive patients	68 532
Total number of pediatric patients	2415 (3.5% of total cases)
Total number of patients contacted	242 (10% of the total pediatric cases)
Patients excluded from study	154
Did not pick up the phone in spite of repeated attempt	93
Refused to give consent	3
Corona negative	8
Secondary cases	66
Total patients included in the study	72
Total household contacts of pediatric patients	287
Total secondary cases	5
SAR	1.7 [(5/287)*100] (95% CI: 0.74–4%)

case is from paediatric age group. The family members of the patients were contacted through telephonic interview after taking verbal consent. Household contact was defined as an individual sharing shame postal address, and secondary case was defined as individual developing infection within 14 days from last contact with the index case.

Statistical analysis was performed using SPSS, Version 22.0 (Chicago, IL, USA), where quantitative data were expressed as mean ± SD and qualitative data were expressed as percentage. Characteristics of index cases with and without secondary household infection were compared using chi-square and Mann–Whitney U test. The cutoff value of $P < 0.05$ was considered for the statistical significance.

Results

Paediatric patients accounted for 3.5% of the total COVID-19 cases recorded during the study period. After data collection, final data analysis included 72 paediatric index cases and 287 household contacts. Remaining patients were excluded from the study due to variety of the reasons as mentioned in Table 1. Mean age of the patients was 13.57 ± 5.46 years (ranging from 0.4–18 years). Further categorization of age showed that 10% ($n = 7$) of the patients were between 0 and 5 years of age and 22% ($n = 15$) were between 6 and 12 years, whereas 74% ($n = 50$) were aged more than 12 years. Majority of the index cases were males (94.4%) with 66% of the patients being admitted at various hospitals and facilities (45%). Home quarantine was noted in 37% of the patients. Overall family size of the index cases ranged from 2 to 10 members (including index case) with a mean size of 5 ± 1.9 members. One mortality was found in index case; however, the patient was mentally retarded and was suffering from other conditions as well.

Out of 287 household contacts, 5(0.017%) developed secondary infection. The SAR as calculated by [(secondary cases/total number of household contacts) *100] was found to be 1.7% with a 95% confidence interval of 0.7–4%. Secondary cases were more male (4:1), with 2 elderly cases (grandparents). The family size of the index cases causing secondary infection was comparatively larger than index cases without secondary household infection (6.75 ± 2.3 versus 4.9 ± 1.9; $P = 0.034$). Age and gender were comparable between both the groups ($P > 0.05$). Out of 5 secondary cases, one elderly male (80 years) expired due to variety of comorbid complications aggravated by the COVID infection.

Discussion

Findings of current study indicated that SAR in household contacts of pediatric index cases are low and are directly associated with the family size of the patient. This in comparison to our previous study showing 8% of SAR in household contacts of adult index case is considerably low. Potential explanations could be: (i) due to the asymptomatic nature of the disease in pediatrics, majority of the patients remains undiagnosed, leading lack of active screening. Therefore, first case identified in family might be misunderstood as adult, which could be potentially a secondary case[7]: (ii) lower susceptibility of infection leading to milder course of disease. This is linked with the lack of sufficient viral load to cause secondary infection.[8] (iii) Asymptomatic status of the disease is also associated with low SAR, again possibly due to low viral load.

Only two reports studied the role of pediatrics in COVID-19 transmission among household contacts. The first study was conducted by Kim *et al.*[9] in Korea on 107 pediatric cases. With 248 of household contacts, reported an SAR of 0.5% (95% CI: 0.0–2.6%). Only one secondary case was indexed which was home quarantined but shared meal with family. There is a small study from India presenting data of 19 pediatric index cases.[10] The authors presented that 5 (11.5%) out of 42 close family cases developed secondary infection. However, the generalizability of the findings is limited as the study included primary cases having only inter-state travelling history during particular month. Moreover, as it was conducted in month of May, it reflected screening guidelines and advisories adapted during that period only.

Current study has several strengths. (i) The study sample was selected through stratified randomization, hence representing a true sample from the population. (ii) The index cases selected was conducted over a span of 5 months, hence expected to neutralize the effect of changing advisories. Study had some limitations as well. (i) We were unable to reach all expected sample due to various reasons. (ii) Limitation associated with telephonic interaction restricted us to some critical information only. A larger study with in depth personal interaction with the cases is needed for better understanding of the transmission trends of the disease in paediatric index cases.

Conclusion

The household SAR from paediatric index cases is 1.7% and is closely associated with the family size of the index cases, hence home quarantine should be advocated in smaller families with appropriate isolation facilities.

Acknowledgements

We acknowledge the support from Gujarat government for providing data records.

References

1 Li X, Xu W, Dozier M *et al.* The role of children in transmission of SARS-CoV-2: a rapid review. *J Glob Health* 2020;**10**(**1**):011101. doi: 10.7189/jogh.10.011101.

2 Ludvigsson JF. Systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. *Acta Paediatr* 2020;**109**:1088–95.

3 Wrapp D, Wang N, Corbett KS *et al.* Cryo-EM structure of the 2019-nCoV spike in the prefusion conformation. *Science* 2020;**367**:1260–3.

4 Zhang Y. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) — China, 2020. *Chinese Journal of Epidemiology (by The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team)* 2020.

5 Kermali M, Khalsa RK, Pillai K *et al.* The role of biomarkers in diagnosis of COVID-19 - a systematic review. *Life Sci* 2020;**254**:117788.

6 Kolifarhood G, Aghaali M, Mozafar Saadati H *et al.* Epidemiological and clinical aspects of COVID-19; a narrative review. *Arch Acad Emerg Med* 2020;**8**(**1**):e41.

7 Shah K, Saxena D, Mavalankar D. Secondary attack rate of COVID-19 in household contacts: systematic review [published online ahead of print, 19 July 2020]. *QJM* 2020;hcaa232.

8 Shah K, Desai N, Saxena D *et al.* Household secondary attack rate in Gandhinagar district of Gujarat state from Western India. *medRxiv* 2020.

9 Kim J, Choe YJ, Lee J *et al.* Role of children in household transmission of COVID-19 [published online ahead of print, 7 August 2020]. *Arch Dis Child* 2020; *archdischild*-2020-319910.

10 Gupta N, Saravu K, Varma M *et al.* Transmission of SARS-CoV-2 infection by children: a study of contacts of index paediatric cases in India. *J Trop Pediatr* 2020.