

## Characteristics and Transmission Dynamics of COVID-19 in Healthcare Workers in a Pediatric COVID-Care Hospital in Mumbai

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**Objective:** To evaluate if Healthcare workers (HCWs) at the frontline of COVID-19 response in a pediatric hospital are at an increased risk of acquiring SARS-CoV-2. **Methods:** The Hospital Infection Control Committee (HICC) and virology testing records were combined to identify SARS-CoV-2 positive HCWs and study the transmission dynamics of COVID-19 over 6 months. **Results:** COVID-19 cases in our HCWs cohort rose and declined parallel to community cases. Forty two out of 534 HCWs (8%) were SARS-CoV-2 positive with no fatalities. No clinical staff in the special COVID ward or ICU was positive. Significant proportion of non-clinical staff (30%) were SARS-CoV-2 positive. About 70% of SARS-CoV-2 positive staff had likely community acquisition, with a significant proportion having travelled by public transport or having a contact history with a positive case in the community. Twenty four percent of positive staff were asymptomatic and detected positive on re-joining test. **Conclusions:** Sustained transmission of SARS-CoV-2 did not occur in our cohort beyond community transmission. Appropriate PPE use, strict and constantly improving infection control measures and testing of both clinical and non-clinical staff were essential methods for restricting transmission amongst HCWs.

**Keywords:** COVID-19, Healthcare workers, Testing, SARS-CoV-2.

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The coronavirus disease 2019 (COVID-19) pandemic started in Wuhan, China in December, 2019. Nosocomial transmission has been a significant concern right from the start of the pandemic with one-third of the initial cohort of COVID-19 patients being healthcare workers (HCWs) and hospitalized patients [1]. In publications so far, healthcare workers (HCW) infection rates in China, Italy and USA have been reported as 3.8%, 10% and 19%, respectively with fatality up to 1.2% [2]. Union health ministry data shows that the positivity rate amongst HCWs in Maharashtra was 16%. Mumbai was one of the first cities significantly affected by the pandemic in India. Our hospital is a 200-bedded tertiary level pediatric centre. Healthcare workers showing any symptoms were tested for SARS-CoV-2 from late March, 2020. All routine work was suspended and only emergencies were managed from 20 March, 2020, when Mumbai had recorded 50 cases of COVID-19. Our center was designated as a pediatric COVID care centre from 6 April, 2020 onwards. The present study was aimed to analyze the characteristics and transmission dynamics of COVID-19 in HCWs over first 6 months of the pandemic at a tertiary pediatric COVID care setup in Mumbai.

## METHODS

Any employee who was working in hospital premises with or without direct patient contact was included as a HCW. This included individuals employed directly by the hospital or via a company in contract with the hospital. All HCWs – both clinical and non-clinical, were tested if any of the following symptoms were present- fever, cough, sore throat, body ache, headache, vomiting and diarrhoea; or if re-joining work after a leave of more than 14 days. Testing was done with a nasopharyngeal swab for SARS-CoV-2 RT-PCR by an ICMR approved kit having 99% sensitivity and specificity. Healthcare workers were encouraged to self-test, if required under supervision to minimize exposure to other HCWs. Self-collection has been found to be an appropriate and reliable alternative to HCW collection [3,4]. Awaiting results, HCWs were sent for home isolation or quarantined in the hospital staff quarters. Healthcare workers that tested positive were evaluated by a member of the hospital infection control committee (HICC) for contact tracing. Those at high risk exposure (exposure >15 min without mask, less than a meter distance) were quarantined for 14 days with a repeat SARS-CoV-2

RTPCR done on day 12 or 13 before re-joining work [5]. All positive HCWs followed Municipal Corporation of Greater Mumbai (MCGM) guidelines for home or institutional quarantine and re-joined work after testing negative for SARS-CoV-2. Once travel restrictions were lifted, details of travel i.e.; self-driven vs public transport were documented at the time of contact tracing. The virology laboratory data of HCWs tested and HICC team data for category of staff and contact tracing from March, 2020 to August, 2020 was retrospectively analysed after approval. Exposure was defined as hospital exposure when there was contact with a SARS-CoV-2 positive patient or staff in hospital premises and for individuals working in areas of the hospital like Emergency room, radiology etc. where exposure to SARS-CoV-2 unknown status is high, and community exposure was defined as any HCW who was SARS-CoV-2 positive with history of exposure to SARS-CoV-2 in the community including family members and during travel. Exposure was considered likely community acquired if there was no exposure to SARS-CoV-2 positive or unknown status patient without breach in social distancing measures with colleagues. Home leave was defined as leave from work for more than 14 days and new employees. Hostel exposure included nurses who were residing in the hostel and also staff who preferred not going home during the pandemic and were residing in hospital quarters. Individuals exposed to positive staff residing in the same room/flat were considered as high risk exposure.

Personal protective equipment (PPE) donning and doffing training was carried out for HCWs. PPE use was

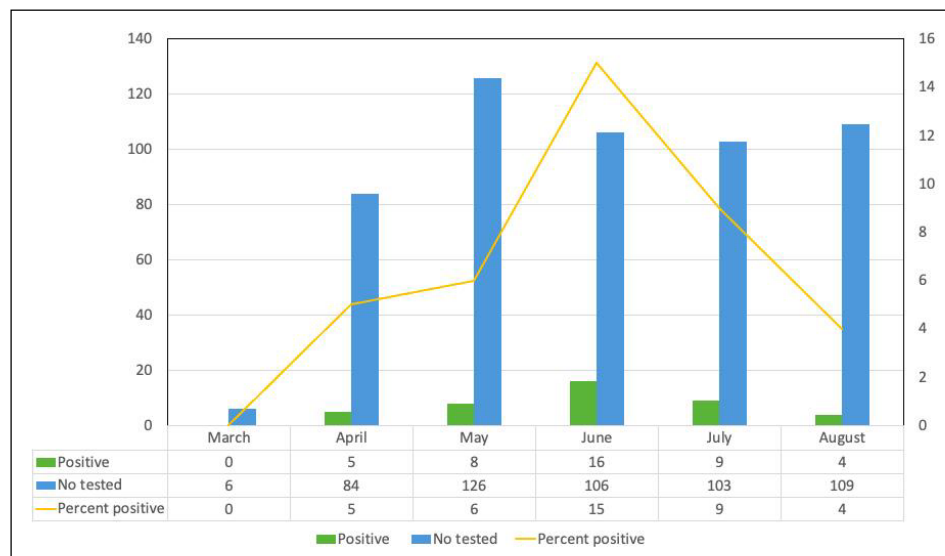
decided based on location and risk category as per Ministry of Health and Family Welfare (MOHFW) guidelines [6]. As the pandemic progressed and we learnt more about the transmission dynamics, changes were made to infection control protocols and staff were briefed about it.

**RESULTS**

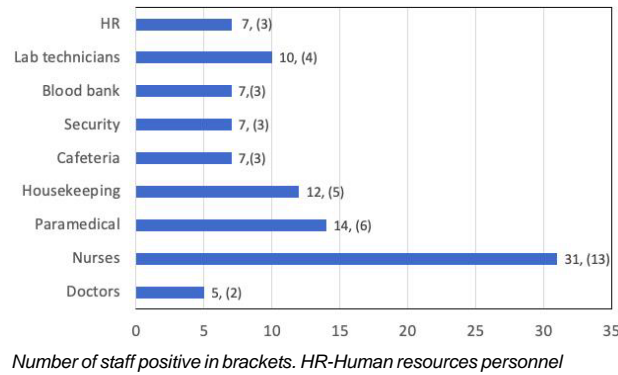
Five hundred and thirty four HCWs were tested during 6 months with 42 HCWs (8%) positive for SARS-CoV-2 without any fatalities. The monthly incidence of SARS-CoV-2 positivity in HCWs is depicted in Fig. 1. Peak incidence of cases in Mumbai was seen in June [7]. Cases in HCWs rose and fell parallel to community incidence.

Nurses had the highest incidence of SARS-CoV-2 positivity; 13 out of 42 (31%) although only 3 out of 13 (23%) had direct high risk patient exposure in the emergency room and day care unit (Fig. 2). Fourteen percent (6 out of 42) positive cases were seen in cafeteria and human resource personnel. Clustering of cases was seen in blood bank and amongst laboratory technicians. Doctors were least positive in our cohort (2 out of 42).

Almost 70% (29 out of 42) of the positive cases had no high risk exposure in the hospital and were classified as likely community acquired (Fig. 3). Amongst high risk exposure areas- day care area, suspected and positive COVID ward, and COVID ICU had the least SARS-CoV-2 positivity. No doctor or nursing staff working in COVID wards or ICU tested positive for SARS-CoV-2. After a nursing staff tested positive in day care area, PPE used while managing day care patients was modified with



**Fig. 1** Healthcare workers tested Monthly for SARS-CoV-2 in the first six months of the pandemic.



**Fig. 2** Percentage positivity in the category of staff tested.

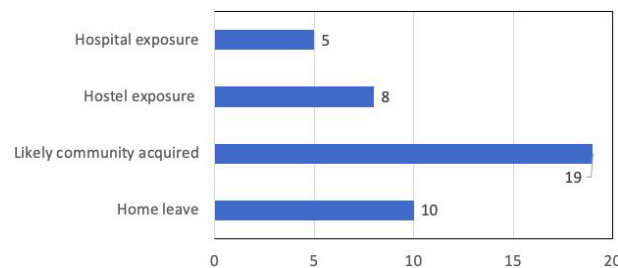
no further cases noted. Two nursing staff working in the emergency room tested SARS-CoV-2 positive.

Amongst positive staff with likely community acquired transmission (**Fig. 3**), 21% (4 out of 19) had history of SARS-CoV-2 positive contact and 37% (7 out of 19) travelled by public transport. Nearly one fourth of SARS-CoV-2 positive staff were returning from home leave (10 out of 42) and almost all were asymptomatic at the time of testing (**Fig. 3**).

**DISCUSSION**

The present study analyses the transmission dynamics of the first HCW cohort from India. In a pediatric cohort, risk of asymptomatic SARS-CoV-2 carriage is compounded by presence of caregivers. Other risk factors for HCW exposure include inadequate social distancing between employees and non-compliance of mask wearing during breaks [8].

Contact tracing for a SARS-CoV-2 positive HCWs, showed that 2 staff had to be quarantined for having lunch together. Cafeteria tables were re-arranged to ensure not more than 2 people could sit at a table at a time at adequate distance and leaflets emphasising social distancing amongst HCWs were put up in the staff cafeteria. HCWs were encouraged to have meals on their



**Fig. 3** Likely source of SARS-CoV-2 transmission to healthcare workers.

own in their respective areas whenever possible, which was similar to Contejean, et al. [9]. This significantly reduced the incidence of high risk exposure amongst HCWs during meals. Clustering of cases seen in blood bank were considered hospital acquired as individuals were on same shift and hence in contact.

Zheng, et al. [2] had an incidence of 7.3% clinical HCWs being SARS-CoV-2 positive and 2.8% of non-clinical staff. In our cohort, we had similar findings with 2% non-clinical staff being SARS-CoV-2 positive emphasising the need of testing non-clinical symptomatic staff (**Fig. 2**). Non clinical staff access common areas and testing all staff groups has key infection control implications. Doctors were least positive in our cohort.

Twenty percent (8 out of 42) SARS-CoV-2 of HCWs were positive as a consequence of sharing rooms in the hostel with a SARS-CoV-2 positive staff despite immediate isolation of HCWs at symptom onset indicating transmission of the virus before onset of symptoms. Our findings were similar to He, et al. [10], who reported that 9% of transmission could occur 3 days prior to symptom onset and presymptomatic transmission to be 44%. Nearly one fourth of SARS-CoV-2 positive staff were returning from home leave and almost all were asymptomatic at the time of testing. Though highly debatable, we preferred testing HCWs returning from home leave in view of high incidence of community transmission during the first few months of the pandemic. Testing policy on re-joining work was modified as per community transmission dynamics. HCWs who preferred travelling by public transport to the hospital had increased community exposure. Almost 70% of SARS-CoV-2 positive staff had likely community acquisition with 7 out of 19 (37%) travelling by public transport and 4 out of 19 (21%) having a contact history with a positive case in the community.

Implementing infection prevention and control (IPC) policies can be challenging during a pandemic but in studies where reinforcement of IPC measures was done, the curve flattened in HCWs despite ongoing exposure to COVID-19 patients [8,9].

We improvised infection control measures and reinforced basic preventive measures throughout the pandemic. In presence of adequate PPE and good adherence to infection control practices, nosocomial acquisition or transmission was less likely, similar to previous reports [2,11]. HCWs face a significant risk of SARS-CoV-2 exposure while providing care to suspected or confirmed COVID-19 patients. It is though important to remember that transmission may occur in non-patient-care areas while having meals or talking or from the

### WHAT THE STUDY ADDS?

- Most SARS-CoV-2 positive healthcare workers had likely community transmission with public transport being a possible high-risk exposure.
- Testing nonclinical symptomatic staff is essential to reduce transmission as they share common areas.

community. Lack of adequate PPE, inpatients caregivers, high risk departments, long duty hours and suboptimal hand hygiene have been linked to COVID-19 infections in HCWs in various studies [12]. Hand hygiene, inpatient caregivers and duty hours could have confounded our findings. Doctors tested least positive in our study which is similar to Zheng, et al. [2]. Doctors in highly specialized roles who cannot be replaced by other colleagues, may continue working with mild and non-specific symptoms, which is a limiting factor in our study too.

*Ethics approval:* IEC, SRCC-CH; R-202019, November, 2020.  
*Contributors:* AP, SU: designed the retrospective study and wrote the manuscript; MB: wrote the contact tracing guidelines for HCWs; SS, SK: were involved in testing and tracing positive HCWs. All authors approved the final version of manuscript, and are accountable for all aspects related to the study.  
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### REFERENCES

1. Huang CL, Wang YM, Li XW, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020 [Epub ahead of print]. doi: 10.1016/S0140-6736(20)30183-5.
2. Zheng C, Hafezi-Bakhtiari N, Cooper V, et al. Characteristics and transmission dynamics of COVID-19 in healthcare workers at a London teaching hospital. *J Hosp Infect*. 2020;106:325-29.
3. Wehrhahn MC, Robson J, Brown S, et al. Self-collection: An appropriate alternative during the SARS-CoV-2 pandemic. *J Clin Virol*. 2020;128:104417.
4. Rivett L, Sridhar S, Sparkes D, et al. Screening of healthcare workers for SARS-CoV-2 highlights the role of asymptomatic carriage in COVID-19 transmission. *Elife*. 2020;9:e58728.
5. MOHFW advisory for managing HCWs working in COVID and non- COVID areas of the hospital. Accessed May 15, 2020. Available from: <https://www.mohfw.gov.in/pdf/AdvisoryformanagingHealthcareworkersworkinginCOVIDandNonCOVIDareasofthehospital.pdf>.
6. MOHFW COVID-19: Guidelines on rational use of Personal Protective Equipment. Available from: <https://www.mohfw.gov.in/pdf/GuidelinesonrationaluseofPersonalProtectiveEquipment.pdf>.
7. MCGM stop coronavirus in Mumbai, Daily updates. Available from: <https://stopcoronavirus.mcg.gov.in>.
8. Çelebi G, Piskin N, Çelik Bekleviç A, et al. Specific risk factors for SARS-CoV-2 transmission among healthcare workers in a university hospital. *Am J Infect Control*. [Epub ahead of print]. 2020:S0196655320307653. doi: 10.1016/j.ajic.2020.07.039
9. Contejean A, Leporrier J, Canoui E, et al. Comparing dynamics and determinants of SARS-Cov-2 transmissions among healthcare workers of adult and pediatric settings in Central Paris. *Epidemiology*. 2020.doi: 10.1101/2020.05.19.20106427
10. He X, Lau EHY, Wu P, et al. Temporal dynamics in viral shedding and transmissibility of COVID-19. *Nat Med* 2020. doi: 10.1038/s41591-020-0869-5.
11. Wee LE, Sim XYJ, Conceicao EP, et al. Containment of COVID-19 cases among healthcare workers: The role of surveillance, early detection, and outbreak management. *Infect Control Hosp Epidemiol*. 2020:1-7. [Epub ahead of print]
12. Sahu AK, Amrithanand VT, Mathew R, et al. COVID-19 in health care workers – A systematic review and meta-analysis. *Am J Emerg Med*. 2020;38:1727-731.