

# CHARACTERISTICS AND TRANSMISSION DYNAMICS OF COVID-19 IN HEALTHCARE WORKERS IN A TERTIARY TEACHING HOSPITAL

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## Abstract

Coronavirus disease-19 (COVID-19) transmission significantly affected Healthcare workers (HCWs) worldwide. As a result, they have paid a heavy toll to the COVID-19 outbreak. However, the literature on its transmission routes and risk factors in HCWs is limited.

**The aim.** The authors seek to characterize and know the transmission dynamics of COVID-19 infection in the HCWs of our hospital.

**Methods:** A cross-sectional descriptive study was conducted by the authors. Staff records and virology testing results were used to identify SARS-CoV-2 positive HCWs and study the demographic characteristics and transmission dynamics over one and a half years. Data were analyzed using SPSS software version 23.

**Results:** A total of 169 healthcare workers were positive for SARS-CoV-2. 6 doctors were positive from non-clinical branches, and 17 were positive from clinical branches. One health worker also died of cardio-pulmonary compromise. 88.2 % of healthcare workers got infected while managing patient's positive for COVID-19. The most frequent clinical manifestation was myalgias in 90.53 % of health workers, followed by arthralgia in 86.98 %. The least common symptoms were loss of taste/smell followed by radiographic changes, and only 19 (11.24 %) presented with shortness of breath. 79.88 % have taken self-medication to relieve COVID symptoms. Maximum number of health workers got infected from July to September.

**Conclusions:** Universal masking, reinforcement of hand hygiene, PPE kits with medical masks, appropriate infection control measures and testing of both clinical and non-clinical staff were essential measures for reducing transmission amongst HCWs.

**Keywords:** COVID-19, healthcare workers, testing, SARS-CoV-2.

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## 1. Introduction

In the coronavirus disease 2019 (COVID-19) pandemic, nosocomial transmission has emerged as a significant concern; almost one-third of an initial cohort of COVID-19 patients were healthcare workers (HCWs) and hospitalized inpatients [1]. The most significant risk to the HCWs may be by their colleagues or patients in the early stages of unsuspected infections when viral loads are high [2]. Hospitals are often the epicentres of newly circulating infections. A study of HCWs reported more work-related contacts than community-based working adults [3]. During the first wave of the pandemic, overstretched healthcare systems left HCWs in hard-hit countries struggling with long working hours, fatigue and extreme psychological stress. Rapidly vanishing supplies, national lockdowns and a feeding frenzy on the open market for personal protective equipment (PPE) led to shortages. HCWs often had to care for patients with suspected or confirmed COVID-19 infection without proper training or inadequate PPE. This contributed to an increased risk to HCWs during the initial phase of the pandemic. Besides that, HCWs have shown remarkable resilience and professional dedication despite the fear of becoming infected and infecting others [4].

## 2. Materials and methods

A cross-sectional descriptive study was conducted in Government Medical College, Doda, Jammu and Kashmir, India among HCWs between April 1<sup>st</sup> 2020 and September 30<sup>th</sup> 2021. The study examined the positivity rate of the different types of Primary HCWs and analyzed the demographic characteristics of the infected persons. For this study, a healthcare worker is defined as any person involved in the provision of care for a COVID-19 patient either directly, hired or a contractual employee. Clinical symptoms were classified as asymptomatic, pre-symptomatic (defined as having a testing date prior to symptoms onset), typical with fever and/or cough, sore throat, body ache, and headache.

The study was approved by the Institutional Ethics Committee GMC Doda/IEC/2020/06 dated 12/03/20, and a number of the protocol 090720-15. Informed consent was obtained from eligible respondents before collecting data about the study. The namelessness of the respondents guaranteed privacy and concealment of the respondents.

All HCWs were tested if any of the symptoms were present 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. HCWs that tested positive were further followed for contact tracing by the hospital infection control committee (HICC) and were kept quarantined for a minimum of 14 days with a repeat SARS-CoV-2 RTPCR done on day 12 or 13 before re-joining work. All positive HCWs followed quarantine guidelines at home or institutional quarantine and re-joined work only after testing negative for SARS-CoV-2. Exposure was defined as hospital exposure when there was contact with a SARS-CoV-2-positive patient or staff in the hospital. Community exposure was defined as any HCW who was SARS-CoV-2 positive with a history of exposure to SARS-CoV-2 in the community, including family members and during travel. Home leave was defined as leave from work for more than 14 days after getting positive for SARS-CoV-2. In addition, PPE donning and doffing training was carried out for HCWs per Ministry of Health and Family Welfare (MOHFW) guidelines [5]. 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.

## 3. Results

### A) General characteristics

A total of 169 HCWs were positive for SARS-CoV-2. Out of which 126 (74.5 %) were males, and 43 (25.5 %) were females, 6 (0.03 %) doctors were positive from non-clinical branches. Out of clinical branches, 9 (0.05 %) doctors were positive from medicine, and allied branches and 7 (0.04 %) were positive from surgical and allied branches. One health worker died of cardio-pulmonary compromise. 149 (88.2 %) health workers have acquired it from patients, 123 (72.8 %) from colleagues while working in a hospital for patient care, 39 (23.1 %) from relatives and 19 (11.2 %) from a source not known (**Table 1**).

**Table 1**

Characteristics of health workers according to the result of the detection test for sars-Cov-2

Gender	Number	Percentage
Men	126	74.5 %
Women	43	25.5 %
Faculty		
Non- Clinical doctors	6	0.03 %
Medicine doctors	9	0.05 %
Surgical doctors	7	0.04 %
Source of contagion (%)		
Colleague	123	72.8 %
Patient	149	88.2 %
Relative	39	23.1 %
Unknown	19	11.2 %

**B) Clinical Picture**

The most frequent clinical manifestation in SARS-COV-2-positive HCWs was myalgias at 90.53 %, followed by arthralgia at 86.98 %. Fever was present in 141 (83.43 %) HCWs. 135 (79.88 %) HCWs have taken self-medication for fever/cough/sore throat. The least common symptoms were loss of taste/smell in 42 (24.85 %), followed by radiographic changes in 38 (22.48 %) health workers and only 19 (11.24 %) present with shortness of breath (**Table 2**).

**Table 2**

Clinical manifestations of health workers with a positive test for sars-Cov-2

Variable	Positive to Covid	Percentage
Fever	141	83.43 %
Headache	107	63.31 %
Cough	137	81.06 %
Sore throat	139	82.24 %
Myalgia	153	90.53 %
Arthralgia	147	86.98 %
Loss of sense of taste or smell	42	24.85 %
Diarrhoea	59	34.91 %
Shortness of breath	19	11.24 %
Self-medication	135	79.88 %
Radiographic changes	38	22.48 %

**C) Risk Factors for COVID-19 in HCWs**

Other factors such as obesity, chronic degenerative diseases (diabetes, hypertension, immunosuppression, asthma, or steroid intake included), and smoking, as shown in **Table 3**, were not significant as risk factors.

**Table 3**

Risk Factors for COVID-19 in Health workers

Variable	Number	Percentage
Obesity	87	51.47 %
Male gender	126	74.55 %
Hypertension	45	26.62 %
Diabetes	33	19.52 %
Asthma	29	17.15 %
Smoking	37	21.89 %
Lack of training	127	75.14 %
No vaccination against influenza	123	72.78 %
No vaccination against pneumococcus	139	82.24 %

**D) Monthly incidence of SARS CoV-2 positivity in HCWs**

The maximum number of health workers got infected from July to Sept. In that period, also September had a maximum number of positive cases. Later, it showed a downward trend, as shown in **Fig. 1**.

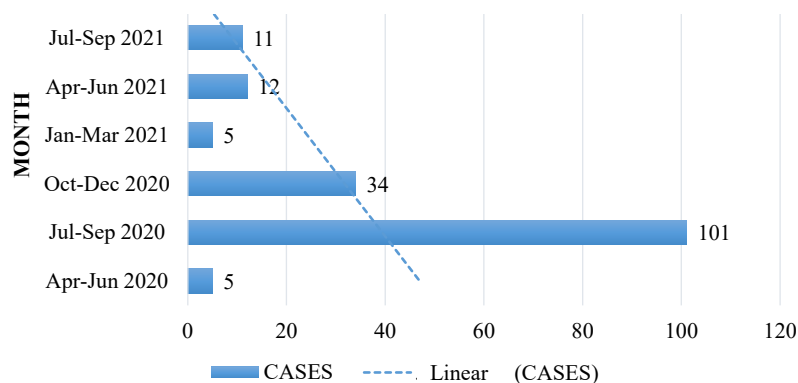


Fig. 1. Shows the monthly incidence of SARS-CoV-2 in healthcare workers

#### 4. Discussion

The COVID-19 pandemic is a dynamic situation, with community transmission occurring in almost all parts of the world. When the COVID-19 pandemic began, there was global concern about the risks to HCWs and the adequacy of PPE. Lack of adequate PPE, inpatient caregivers, high-risk departments, long duty hours and suboptimal hand hygiene have been linked to COVID-19 infections in HCWs in various studies [6]. It is recognized that when health professionals have limited knowledge of infectious disease prevention and its control, it contributes to its nosocomial spread [7, 8]. Other risk factors for HCWs exposure include inadequate social distancing between employees and non-compliance with mask-wearing during breaks [9]. Implementing infection prevention and control (IPC) policies can be challenging during a pandemic. However, in studies where IPC measures were reinforced, the curve flattened in HCWs despite ongoing exposure to COVID-19 patients [9, 10]. Amongst HCWs rate of positive tests was higher for the Emergency department (ED) and acute medicine than for the Intensive care unit (ICU). ICU is often regarded as the highest-risk working environment, with a higher frequency of aerosol-generating procedures. Patients attending ED may also be earlier in their illness, with higher levels of virus shedding [11]. Nevertheless, the delayed peak in clinical staff sickness episodes cannot be ignored. The most plausible explanation is that at least some of the staff infections were related to patient exposure, with some transmission within individual clinical departments. Infected but mildly ill staff members may be tempted to continue working (especially if their roles are highly specialized and cannot be easily covered by a colleague), thus posing an ongoing transmission risk [12]. Despite a significant number of cases reported, very few had severe clinical presentations. During an ongoing outbreak, HCWs may experience anxiety when reporting absence from work due to illness [13] or perceive an obligation to work [14] or work attendance despite illness [15, 16]. Exhaustive testing, surveillance and isolation of potentially exposed HCWs may not be feasible in a healthcare system that is overwhelmed [17]. However, staff surveillance is a crucial component of outbreak control during the containment phase to reduce the likelihood of nosocomial transmission and to sustain confidence and morale in the healthcare system [13, 14, 18]. At our institution, all HCWs with COVID-19 presented with arthralgias and myalgias; a few presented with pneumonia. Monitoring fever was key, like most SARS cases, for temperature monitoring was vital [19]. Interactions between HCWs in the hospital setting are frequent and an important aspect of a functioning team [20]. Physical distancing requires people to interact less or remotely, increasing space between individuals [21]. The importance of physical distancing in the context of containment and mitigation of COVID-19 and other outbreaks has repeatedly been demonstrated [22, 23]. Despite heightened public awareness of the matter, our findings suggest that social interactions in our hospital initially continued without ensuring sufficient physical distancing. We consider that the observed outbreaks almost exclusively consisted of HCWs and the multiple contacts between infected HCWs that were reported, a strong indicator that a majority of the observed SARS-CoV-2 infections were due to HCW to HCW transmission.

**Limitations of our data** include a lack of information on disease severity and clinical outcomes and the effect of staff redeployment to COVID-19 wards and ICUs. We also have fewer data available for contracted services, which include much domestic and cleaning staff. In addition, the true rate of COVID-19 in different staff groups may be masked by selective and changing

testing criteria. This was addressed by analyzing overall staff sickness episodes. Another main limitation of our study is the lack of a control group (i.e. inclusion of HCWs that SARS-Cov-2 did not infect) to compare exposures and assess their respective role in transmission formally. Identification of negative controls is nevertheless difficult. Indeed, the rt-PCR sensitivity on nasopharyngeal swabs is imperfect [24]. Therefore identification of controls only based on a negative rt-PCR result is questionable. The gold standard to rule out the diagnosis of COVID-19 is serologic assessment.

**Prospects for further research.** There are numerous unanswered questions associated with COVID-19. Although massive scientific efforts have been taken to understand COVID-19, there are still many knowledge gaps to be filled. Moreover, current knowledge is just the tip of the iceberg. The animal origin, cross-species infection route of COVID-19, and virus-host interactions/ molecular mechanisms of SARS-Cov-2 are still unclear. Hence, there is a need for enormous research so possible preventive measures and future approaches can be adopted and made available.

## 5. Conclusions

Several conclusions can be drawn from our results:

- (i) HCWs are exposed to emerging viral diseases, particularly in the early phase of the epidemic.
- (ii) Compliance to control measures increased over study period, concomitantly with the containment of the outbreak among hospital staff.
- (iii) Incidence was lower in HCW of the children setting, likely related to better adherence to IPC measures by the pediatric staff.
- (iv) Residual transmissions observed at the late phase of the epidemic among HCW were related to persistent exposures with undiagnosed patients or colleagues.
- (v) PPE places a focus on protecting HCWs from infected patients. Undoubtedly, this represents a key aspect of reducing the spread of SARS-CoV-2 and maintaining HCWs' health.
- (vi) The threat of infection from colleagues, however, might be underestimated by many HCWs. Therefore, increasing awareness of this potential source of infection, i.e. ensuring proper physical distancing measures and wearing protective equipment when interacting with colleagues, must be a primary focus of infection prevention strategies in the COVID-19 pandemic.

## Conflict of interest

The authors declare that there is no conflict of interest concerning this paper, as well as the published research results, including the financial aspects of conducting the research, obtaining and using its results, as well as any non-financial personal relationships.

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