

Clinicoepidemiological Profile and Outcome of COVID-19 Positive Healthcare Workers in a Tertiary Care Centre in South India

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ABSTRACT

Introduction: Coronavirus Disease 2019 (COVID-19) is rapidly spreading in India and all over the world. Being at the frontline in the battle against COVID-19, Healthcare Workers (HCWs) are among the greatest groups at risk of COVID-19 infection. Therefore, it is very important to study the risk and sources of infection and clinical outcome of HCWs.

Aim: To study the clinicoepidemiological profile and outcome of COVID-19 positive HCWs in Government Medical College Thrissur, Kerala, India.

Materials and Methods: This was a hospital based cross-sectional study conducted during the time period from February to December 2020. A semi-structured telephonic interview schedule and hospital based records were used to collect the demographic, epidemiological and clinical information of 235 COVID-19 positive HCWs. Proportions along with 95% Confidence Interval was used to express the results.

Results: Among 235 COVID-19 positive HCWs, 51% were either nurses or auxiliary nursing staff. Non COVID-19 areas had 31.9% infections, while 17.1% of infections occurred in COVID-19 areas. Around 57% acquired infection from healthcare settings. Common symptoms were fever (67.2%), myalgia (40.4%) and headache (39.6%). Around 21.3% subjects remained asymptomatic. Hand hygiene compliance was 96.6%. Among positive HCWs, 57% used N95 mask, 52.8% used gloves, 49.8% used apron and 48.9% used face shield in the hospital. Only 0.85% required Intensive Care Unit (ICU) admission. No mortality was reported in the present study.

Conclusion: There is a considerable risk for COVID-19 infection among HCWs in hospital settings especially from non COVID-19 areas. Present study findings show the risk of exposure and need of infection control measures even outside the healthcare settings. Early identification and isolation of cases is very important. This study will be useful for policy makers in planning control strategies and preventing COVID-19 infections among HCWs.

Keywords: Hand hygiene, Personal protective equipment, Severe acute respiratory syndrome coronavirus-2

INTRODUCTION

In December 2019, a cluster of pneumonia cases of unknown aetiology was reported from the city of Wuhan, Hubei province of China. The causative agent was identified as Severe Acute Respiratory Syndrome- Related Corona Virus-2 (SARS-CoV-2) which was later renamed as 2019 novel Coronavirus (2019-nCoV) [1]. The disease caused by its infection was called COVID-19. SARS-CoV-2 was identified as an enveloped positive sense, single-stranded Ribonucleic Acid (RNA) virus closely related to SARS-CoV virus. On January 30, 2020, the World Health Organisation (WHO) declared the disease a Public Health Emergency of International Concern (PHEIC) and later on March 11, 2020, a pandemic [2]. In India, the first case of COVID-19 was reported on January 30, 2020 in Thrissur district of Kerala [3].

This novel virus remains a highly infectious disease and is transmitted through respiratory droplets and direct contact. Additionally, Aerosol Generating Procedures (AGPs) also play an important role in the transmission of COVID-19 within the healthcare settings [4]. Symptoms of COVID-19 are varying, but frequently include fever, fatigue, dry cough, myalgia and breathing difficulties. Less common symptoms are headache, dizziness, diarrhoea, nausea and vomiting [5]. Majority of SARS-CoV-2 infected patients are asymptomatic, but they are able to transmit the infection [6]. This transmission capabilities of SARS-CoV-2 and lack of an effective antiviral drug or vaccine has aided the rapid and efficient spread of this disease across the globe.

With limited understanding of this novel coronavirus strain and being at the frontline from the very start of this epidemic, HCWs are deemed as one of the groups with the highest risk of exposure

to COVID-19 infection [7]. While HCWs represent less than 3% of the population in the large majority of countries and less than 2% in almost all low and middle income countries, nearly 14% of COVID-19 cases reported to WHO are among HCWs. The proportion can be as high as 35% in some countries [8]. In a prospective cohort of individuals previously undiagnosed with SARS-CoV-2, the baseline prevalence of active SARS-CoV-2 infection was considerably higher among HCWs (7.3%) as compared to non HCWs (0.4%) [9].

Healthcare workers can be exposed to SARS-CoV-2 not only through highly infectious patients, but also through undiagnosed or subclinical cases and also through contact with other infected HCWs [10].

Social distancing, use of face masks and frequent hand washing with alcohol hand rubs or soap and water are the infection control measures suggested for the general population. HCWs required additional protective equipments including fluid resistant aprons/gowns, gloves, goggles, face shields, and N95 respirators to cover their exposed part especially in situations where AGPs are performed [4].

As the war against COVID-19 rages on, HCWs are trying to protect patients, their colleagues, families and communities with available resources. It is vital to protect HCWs not only for efficient patient care but also to prevent transmission of the disease. A knowledge about the epidemiological determinants of COVID-19 among HCWs will go a long way in planning control strategies and preventing infections among them. Thus, the current study was conducted to find out the clinicoepidemiological profile and outcome of COVID-19 positive HCWs in Government Medical College, Thrissur, Kerala, India.

MATERIALS AND METHODS

The present hospital based cross-sectional study conducted at Government Medical College Thrissur, a tertiary care centre in Kerala, India, during the time period from February to December 2020. The study analysis was done in February 2021. The study was approved by the Institutional Ethical Committee (Study No: IEC/GMCTSR/017/2021).

Inclusion criteria: All HCWs of Government Medical College Thrissur who were tested positive for COVID-19 (either by COVID-19 Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) or COVID-19 Rapid Antigen test during the time period from February to December 2020 were included in the study.

Exclusion criteria: Those HCWs who were not willing to be a part of the study were excluded.

Study Procedure

In a systematic review and meta-analysis of COVID-19 in HCWs, the proportion of COVID-19 HCWs reporting malaise was 43% [11]. Using the formula, $n = 4pq/d^2$ and d was taken as 15% of p , minimum sample size calculated for this study was 227.

The list of COVID-19 positive HCWs were obtained from hospital records. Each HCW was informed about the study purpose and an informed verbal consent was obtained. A telephonic semi-structured interview schedule and hospital based case records were used to collect the demographic, epidemiological and clinical information of the HCWs. The information collected included: a) demographic data including age, gender, designation, place of work, and type of test done; b) clinical data including symptoms and signs, co-morbidities, details of hospital admission, time to test negativity, complications developed if any, treatment taken including antiviral drugs, corticosteroids, non invasive or invasive ventilation; and c) epidemiological data including exposure history, travel history, infection control measures followed in the work place and outside the hospital such as hand hygiene, Personal Protective Equipment (PPE) usage and food eating habits etc.

A total number of 245 HCWs were contacted for the purpose of data collection but 10 of them did not give consent for the study and were excluded. Thus, the total sample size for the study was 235.

STATISTICAL ANALYSIS

The data thus obtained was compiled and entered in Excel spread sheet and analysed using Statistical Package for the Social Sciences (SPSS) software version 16.0. Proportions along with 95% confidence interval was used to express the results.

RESULTS

The current study was conducted among 235 HCWs. The age of the COVID-19 positive HCWs ranged from 21-60 years (mean=36.7 years; Standard Deviation (SD)=10.5). The highest frequency of COVID-19 positivity was among the age group of 21-30 years. Out of the total positive HCWs, 160 (68%) were females. The [Table/Fig-1] shows the age and gender wise distribution of COVID-19 positive HCWs.

Age group (years)	Males number (%)	Females number (%)	Total number (%)
21-30	26	53	79 (33.6)
31-40	17	43	60 (25.5)
41-50	14	50	64 (27.3)
51-60	18	14	32 (13.6)
Total	75	160	235 (100%)

[Table/Fig-1]: Demographic features of COVID-19 positive HCWs.

Infection with COVID-19 was confirmed by RT-PCR test in 52 (22.1%) HCWs and by Rapid Antigen Test in 183 (77.9%) HCWs.

Co-morbidities were present among 62 (26.4%) of the positive HCWs, of which diabetes mellitus was the most common in

19 (8.1%), followed by systemic hypertension in 15 (6.4%) and hypothyroidism in 10 (4.3%) HCWs [Table/Fig-2].

Co-morbidities	Number (%)
Diabetes mellitus	19 (8.1)
Systemic hypertension	15 (6.4)
Hypothyroidism	10 (4.2)
COPD	7 (3.0)
Others *	11 (4.7)
No co-morbidities	173 (73.6)
Total	235 (100)

[Table/Fig-2]: Co-morbidities of COVID-19 positive HCWs (N=235).

*Others included malignancy, coronary artery disease, chronic liver disease, chronic kidney disease, dyslipidaemia and migraine; COPD: Chronic obstructive pulmonary disease

Majority of HCWs positive for COVID-19 infection were either nurses or auxiliary nursing staff. The [Table/Fig-3] shows the occupation of COVID-19 positive HCWs. Majority of infections occurred to those working in non COVID-19 areas 75 (31.9%) compared to those in COVID-19 areas 40 (17.1%). There were 62 (26.4%) cases from the casualty or outpatient departments [Table/Fig-4].

Occupation	Number (%)
Nurses	75 (31.9)
Residents, interns and other doctors	46 (19.6)
Auxiliary nursing staff	45 (19.1)
Paramedical and laboratory staff	29 (12.3)
Security staff	22 (9.4)
Other staff*	18 (7.7)

[Table/Fig-3]: Occupation of COVID-19 positive HCWs (N=235).

*Other staff included clerical office staff, CSSD (Central Sterile Supply Department) and laundry services), lift operator, laundry staff, water house pump operator, electrician, ambulance driver

Place of work	Number (%)
Non COVID-19 ward	48 (20.4)
Non COVID-19 ICU/Operation theatre	27 (11.5)
COVID-19 ward	38 (16.2)
COVID-19 ICU/Operation theatre	2 (0.9)
Casualty/Triage	43 (18.3)
Outpatient department	19 (8.1)
Office	9 (3.8)
Other hospital areas*	49 (20.9)

[Table/Fig-4]: Place of work of COVID-19 positive HCWs (N=235).

*Other hospital areas included academic areas of college, laboratory services, scanning rooms, pharmacy, CSSD (Central Sterile Supply Department) and laundry services

History of exposure to a COVID-19 confirmed case in the hospital was reported by 134 (57%) while 61 (26%) had contact outside the hospital and 40 (17%) reported no known contact with any positive case [Table/Fig-5].

Type of exposure	Number (%)
Contact with positive patient	63 (26.8)
Contact with positive HCW	71 (30.2)
Contact with positive household member	57 (24.3)
Contact with positive case (others outside hospital)	4 (1.7)
No known history of exposure	40 (17)

[Table/Fig-5]: Type of exposure to COVID-19 positive cases among the HCW (N=235).

The common symptoms were fever in 158 (67.2%) followed by myalgia in 95 (40.4%) and headache in 93 (39.6%) COVID-19 positive HCWs. There were no symptoms for 50 (21.3%) COVID-19 positive HCWs [Table-Fig-6].

Symptoms	N (%)
Symptomatic	185 (78.7%)
Fever	158 (67.2)
Myalgia	95 (40.4)
Headache	93 (39.6)
Loss of smell	73 (31.1)
Sore throat	59 (25.1)
Rhinitis	58 (24.7)
Loss of taste	52 (22.1)
Cough	38 (16.2)
Fatigue/malaise	27 (11.5)
Chills	25 (10.6)
Diarrhea	21 (8.9)
Difficulty in breathing	15 (6.4)
Nausea/vomiting	9 (3.8)
Chest pain	4 (1.7)
Asymptomatic	50 (21.3%)

[Table/Fig-6]: Symptom profile of COVID-19 positive HCWs (N=235).

Among the positive HCW patients, 74 (31.5%) had hospital admission and the duration of their hospital stay ranged from 7-30 days (mean=10.8 days; SD=2.72). Admission to ICU was required for 2 (0.85%) patients with multiple co-morbidities. Majority of the patients required only symptomatic treatment and treatment for pre-existing diseases was continued on a case to case basis. Antihistamines were prescribed to 44 (18.7%), vitamins including vitamin B-complex, C, D3 and zinc to 219 (93.2%) and paracetamol to 180 (76.6%) of positive HCWs. As per our institutional policy, antibiotics were prescribed to 137 (58.3%) patients with respiratory symptoms. None required mechanical ventilation. The time to COVID-19 test negativity ranged from 10-16 days (mean=10.63 days; SD=1.4). The clinical outcome of COVID-19 positive HCWs was favourable in all cases.

Regarding infection control measures, hand hygiene practices were followed by 227 (96.6%) positive HCWs. Inside the hospital, 134 (57%) HCWs used N95 mask at all times, 124 (52.8%) used gloves, 117 (49.8%) used apron/gown and 115 (48.9%) used face shield. The [Table/Fig-7] shows the PPE usage of COVID-19 positive HCWs. Those working in the COVID-19 designated areas and casualty/triage areas had used full PPE protection. Breach in PPE during covid duty was reported by 25 (6.4%) HCWs.

PPE usage in hospital	Number (%)	PPE usage outside hospital	Number (%)
N95 mask	134 (57)	N95 mask only	108 (46.0)
Triple layered surgical mask	21 (8.9)	Triple layered surgical mask only	102 (43.4)
Triple layered surgical mask over N95 mask	29 (12.3)		
Cloth mask	0 (0)	Cloth mask only	23 (9.8)
No mask	0 (0)	No mask	3 (1.3)
Gloves	124 (52.8)		
Gown/fluid resistant apron	117 (49.8)		
Face shield	115 (48.9)		
Goggles	3 (1.3)		
Head cap	15 (6.4)		
Shoe cover	59 (25.1)		
Full PPE	48 (20.4)		

[Table/Fig-7]: PPE usage of COVID-19 positive HCW (N=235).

Among the positive HCWs, 184 (78.3%) had to travel daily for work. Out of them, 105 (44.6%) had used public transport, rest used their own vehicle. 51 (21.7%) were staying in the hospital premises.

16 (6.8%) of the positive HCWs had travelled inter district while none of them had interstate travel. 181 (77%) of the positive HCWs ate home prepared food while rest depended on hospital canteen or hotels outside the hospital campus. Sharing of food was common among 117 (49.8%) of the positive HCWs.

DISCUSSION

In this hospital based study done among 235 COVID-19 positive HCWs, nurses were the group most affected. Majority of infections were acquired from non COVID-19 areas of the hospital. The highest rate of COVID-19 positivity was found among female HCWs of 21-30 years of age. In a meta-analysis of 97 studies conducted by Gomez-Ochoa SA et al., COVID-19 infection was reported among 69.98% of female HCWs [11]. A dominance of female COVID-19 positive cases among HCWs were also reported in another study by Sabetian G et al., in Southwest Iran [12]. The most probable reason for this female preponderance could be the fact that the majority of HCWs around the world are females [13].

Nurses had the highest rate COVID-19 positivity (31.9%) in the present study. As per the study conducted among 1799 HCWs in Qatar by Alajmi J et al., the highest rate of infection was among nurses (33.2%) [14]. In another study, among HCWs in Mumbai by Mahajan N et al., 29% physicians, 26% nurses and 46% healthcare assistants were COVID-19 positive [15]. Similar findings have also been shown in multiple studies around the world [9,11,12]. This higher infection rate in nurses could be due to their more direct and prolonged contact with COVID-19 cases at the bed side compared to other HCW.

It was interesting to note that, 31.9% of positive HCWs were working in non COVID-19 areas of our hospital when they got infected, while 17.1% were working in COVID-19 designated areas. The lowest rate of infection among HCWs was reported from the COVID-19 ICU (0.9%). This could be explained by the more consistent use of PPE in COVID-19 isolation wards and ICUs compared to non COVID-19 assigned areas. A similar pattern of distribution was reported by Wang D et al., in a study among 40 medical staff infections in a hospital in Wuhan, China where 77.5% of COVID-19 infections were found in HCWs who worked in general wards, 17.5% in emergency room, and 5% in ICUs [16]. In a follow-up survey of 393 HCWs in Qatar by Alajmi J et al., only 5% acquired the virus from a COVID-19 designated facility and the rest 95% acquired the infection at a non COVID-19 facility by accidental exposure to a co-worker (45%) or a patient (29%) [14]. Barrett ES et al., had observed low rates of infection in ICU workers (2.2%) than those working in other units (4.9-9.7%). The adherent use of PPE by ICU workers explained why they were protected despite providing frontline care for confirmed COVID-19 cases [9].

In the present study, history of a known exposure to COVID-19 was identified in 83% of HCWs. Among 57% of HCWs who acquired COVID-19 infection from the healthcare settings, 30.2% acquired infection from a positive colleague and 26.8% from patients. Several studies have traced the reasons for COVID-19 acquisition by HCW within healthcare settings. Shortage of PPE, low adherence to stipulated PPE at non COVID-19 areas, prolonged exposure to patients, unidentified COVID-19 cases as well as AGPs and insufficient training and complacency with infection control measures have been implicated as the most important causes [14,16-18]. At the work place, HCWs might remain susceptible to COVID-19, as they were not compliant with social distancing and universal masking especially during leisure time or when having food with co-workers, or in meetings as COVID-19 transmission could be facilitated at these gatherings [19].

As per the study of COVID-19 infected HCWs of United States by Burrer SL et al., 55% of exposures occurred only in the healthcare settings, 27% only in the household, 13% only in the community

and 5% in multiple settings and concluded that there is a potential for exposure in multiple settings as community spread increases [20]. But, exposure from family/household was more prevalent (27.8%) among COVID-19 infected HCWs in Singapore than from workplace (16.7%) and social interactions (15.3%) [21].

As reported by Al Maskari Z et al., from a tertiary care centre in Oman, 61.3% of COVID-19 infections among HCW infections were community acquired, while 25.5% were hospital acquired. Among the hospital acquired, 65% acquired the infection from patients and 35% from a COVID-19 positive colleague [19]. It becomes very difficult to determine whether the HCWs acquire infection from the hospital or from the community settings in a situation when community transmission of COVID-19 goes on rising [17].

In this study, among 78.7% of symptomatic HCWs, the common symptoms were fever (67.2%), myalgia (40.4%) and headache (39.6%). Varying symptoms of COVID-19 has been reported in many studies [5,11]. Fever (38.9%), cough (38.6%) and myalgia (13.9%) were the symptoms commonly reported among COVID -19 patients in a hospital based study in Delhi [22].

Fever (98.6%), fatigue (69.6%), dry cough (59.4%), myalgia (34.8%), and dyspnea (31.2%) were commonly reported among hospitalised COVID-19 patients in Wuhan, China [16]. Sabetian G et al., has reported myalgia (46%) and cough (45.5%) as the most frequent symptoms [12].

Among the HCWs of United States, Burrer SL et al., reported at least one of fever, cough and shortness of breath (92%), myalgia (66%), headache (65%) and loss of smell or taste (16%) [20].

In this study, 21.3% of COVID-19 positive HCWs experienced no symptoms at all. Varying degrees of asymptomatic infection has been reported among COVID-19 infected HCWs [12,15]. This finding becomes important as asymptomatic carriers can serve as a source of COVID-19 infection [23].

The current study data demonstrated that hand hygiene practices were better followed by the HCWs. Information about PPE usage inside the hospital revealed that N95 masks and gloves were the protective equipments used mostly by the HCWs. It was worth noting that 43% of COVID-19 positive HCWs did not use N95 masks, 47% did not use gloves and 51% did not use face shields in the hospital. While outside the hospital, 46% used N95 masks and 43.4% used triple layered masks.

Studies on COVID-19 positive HCWs regarding PPE compliance revealed data of 1.5% HCWs not using masks, 18.7% not using gloves, 65.9% without goggles and 58.2% without face shields while, 43.2% used N95 masks, 55.3% used surgical masks, 42.1% used gowns, 26% used special clothing and 22.3% used shoe covers in the work environment [12].

Among HCW patients in present study, 31.5% had hospital admission and only 2 (0.85%) HCW patients needed ICU admission. It was worth mentioning that all of the COVID-19 positive HCWs had a favourable outcome. The relatively younger age of HCWs and lesser co-morbidities might explain this good outcome. Also, HCWs were motivated by the authorities to report any COVID-19 symptoms immediately to the hospital infection control team and get tested for COVID-19 on a priority basis. This could avoid unnecessary delay and helped to identify even less severe illness. They were ensured to stay away from their work while being ill and were also well isolated to prevent further spread of infection. The better outcome in the HCWs was also attributed to the early accessibility of HCWs to the hospital and their better knowledge of the disease [24].

Only 5.5% of hospital admissions with duration of hospital stay ranging from 0.5-8 days and no ICU admission or deaths was reported by Sabetian G et al., [12]. Burrer SL et al., has reported only 8-10% of hospitalisation and 2-5% of ICU admission but severe

outcomes, including death (0.3-0.6%) among all age groups of the HCW in United States [20].

In a study by Gholami M et al., 15.1% prevalence of hospitalisation and 1.5% death among HCW was reported [25]. But, a notable feature of the 54 HCW infections in Wuhan Tongji Hospital in Hubei was the high rate (79%) of severe and critical cases [26]. There is considerable risk of acquiring COVID-19 infection among HCWs in the hospital settings, but the occurrence of severe disease and deaths was found to be significantly low. Early recognition and isolation of cases is important.

Limitation(s)

The data was collected from hospital based medical records of those who were admitted and information gathered from telephonic interview for those who were isolated at home. This could have resulted in some amount of recall bias especially with respect to use of PPE in the work place.

CONCLUSION(S)

Among COVID-19 positive HCWs, nurses comprised the most affected group. In this study, all the categories of HCWs were included ranging from auxiliary healthcare professionals to doctors. This study will add to the limited literature on the job descriptions and type of COVID-19 exposures among HCWs. Present study stressed on the significance of following strict infection control policies at all places and all times especially in times of a critical need like this COVID-19 pandemic. This study will be useful for policy makers in the efforts to contain the transmission of infectious diseases.

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- Manual Googling: May 17, 2021
- iThenticate Software: Jun 03, 2021 (16%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

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