



“USE OF PERSONAL PROTECTIVE EQUIPMENT AND COVID 19 INFECTION AMONG HEALTH CARE WORKERS IN SOUTH GUJARAT”

General Medicine

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ABSTRACT

Background: The major reason of spread of COVID-19 disease is its high infectivity via spread through respiratory droplets and contact routes. Also lack of definite anti-viral treatment contributed to global spread of pandemic. We assessed the compliance of HCWs toward rational and recommended use of personal protective equipment with the help of WHO standardized questionnaire in health-care settings.

Methods: A cross sectional study with a sample size of 200 was performed in a tertiary care hospital of South Gujarat. The standard WHO survey questions are overall based on the risk of infection by respiratory droplets in air and fomites and HCWs' consistency in Infection Control Practices. Exposed high-risk HCWs were advised to quarantine for 14 days and infected workers with Covid-19 virus were diagnosed by a positive RTPCR test.

Results: A total of 200 study participants took part in the study out of which 180 were included in study analysis and 28 (16.8%) found out to be positive for COVID-19 infection. Young age (18-28, $p=0.031$) and doctor as occupation ($p=0.037$) were found to be associated with covid 19 infection.

Conclusion: Efficient and correct use of Personal Protective Equipment (PPE) by healthcare workers (HCWs) has received a lot of attention and critique in the COVID-19 pandemic. HCQ prophylaxis can be a major preventive tool against covid 19. Our study concludes the group with the highest risk of acquiring infection in our healthcare setting is young doctors.

KEYWORDS

Healthcare worker, COVID-19, personal protective equipment (PPE), hand hygiene

INTRODUCTION

Novel corona virus disease (COVID-19) soon becomes pandemic and spread in over 200 countries after its global recognition in December 2019. Major reason behind this is the high infectivity and its ability to spread efficiently through respiratory droplets and contact routes¹. Dry cough, fever, myalgia and dyspnea were the common presenting symptoms while some also reported with the nausea, vomiting diarrhea, alteration in taste and smell sensation. Though majority of covid 19 infected individual also reported asymptomatic. Inadequate understanding, lack of definite antiviral treatment and high infectivity played an important role in spread of covid 19.

Direct contact with covid 19 patients and high infectivity of covid 19 make health care workers vulnerable to covid 19. Risk of spread further increases once it affects health care workers. In a country like India where patient load is very high per health care worker increases the chances of infection due to repeated contact with exposure². Use of aerosol generating procedures like HFNO, Non invasive ventilation, nebulization and endotracheal intubation in covid 19 patients further elevate the risk of exposure and infection³. The high density of patients in the clinics and wards is also a huge barrier to sufficient sanitisation and social distancing in and around the hospitals in India. Personal protective equipment plays a vital role in protecting HCWs to get covid 19 infections. Use of facemask, gloves, hand sanitizer and face shields can minimize the risk of exposure⁴. WHO and ICMR recommend specific guidelines for a respiratory infection outbreak, which are mandatory to be adopted by all institutions and individual HCWs⁴.

Apart from PPE, chemoprophylaxis can be an important weapon against spread of covid 19. Though no specific antiviral is effective against SARS-covid 19 hydroxychloroquine has come in to picture and its ability to inhibit the infection by SARS-CoV-2, as well as viral replication in cell cultures in a time- and dose-dependent manner made it a primary choice⁵.

Adherence with facemask and its use is traditionally low as compared to other personal protective equipment. Mere formulation of guidelines for use of masks in health-care settings does not ensure the compliance toward its use. It is important to continuously supervise and monitor HCWs to ensure the rational use of facemasks and respirators during this COVID-19 pandemic. We assessed the compliance of HCWs toward rational and recommended use of personal protective equipment with the help of WHO standardized questionnaire health-care settings in the context of the ongoing COVID19 pandemic.

METHODOLOGY:

This is a cross sectional study carried out in a tertiary care hospital of South Gujarat with a sample size of 200. It aims to survey the demography, work profiles and current practices of HCWs to categorise risk, recommend a standard working plan for hospitals in our region as well as draw conclusions of overall HCW infection rate and pattern. We also screened and identified HCWs who acquired the disease to establish a correlation between risk of exposure and Covid-19 infection.

The participants included in the study are Healthcare workers who were working in close contact with COVID-19 patients. After informed consent was obtained, questionnaires were used to collect cross-sectional data regarding the areas of hospital and staff most exposed to the virus. The standard WHO questionnaire (in English) was adopted for surveying the infection risk of healthcare workers in the COVID-19 hospital of our institution³. Data was collected in person during breaks in the duty hours and also by online google forms sent over mobile-devices. Investigators helped translate the form to workers not versate in English. A total of 200 healthcare workers (HCWs) like residents, interns, nurses, cleaning staff and ward boys who consented to participate were included in this study.out of which 20 did not answered all the questions and remaining 180 were included for data analysis. Participants were questioned regarding the socio-demographic information including gender, age, residence, contact information, category of work, type of healthcare setting, number of shifts, and duration of work in dedicated COVID-19 units.

All participants were enquired about the number of patients being taken care of in each COVID-19 facility, as an indirect way of quantifying viral load. Regarding type of patient care duty questions like - degree of close contact with infected patients and their body-fluids, and HCW presence during heavy aerosol generating procedures and HCW contact with patients' environment and personal equipment, were included.

The survey questions are overall based on the risk of infection by respiratory droplets in air and fomites and HCWs' consistency in Infection Control Practices. The survey has a total of 7 sections: 1) Interviewer information, 2) Participants' information, 3) HCW interactions with COVID-19 patient, 4) Aerosol generating procedures information 5) Questions regarding adherence to IPC measures in healthcare activities and 6) during aerosol generating procedures, 7) Biological accidents by contact with patient's body fluids. Based on this information HCW who were exposed to COVID-19 were identified and they were further categorized into high risk and low risk. The practice-based questions had a range of 4 responses consisting of: "Always as recommended", "Most of the time", "Occasionally" and "Rarely". This practise based questions were asked for adherence of HCW towards Personal protective equipment and based on this they were categorised in to high risk and low risk workers. The end section of the survey included a special note of "Accidents with biological material". Questions regarding the Influenza vaccine and Hydroxychloroquine use are added, for local standard care and prophylaxis monitoring.

Those who were having a high risk of getting COVID-19 infection were advised for quarantine for 14 days and were asked to get themselves tested for COVID-19.

All participants of the study were followed up, to identify individuals who got infected with Covid-19 virus, which was diagnosed by a positive RTPCR test. This data was then retrospectively correlated with risk stratification data to calculate p-value using Chi-square and Fisher's test.

Data was entered in to M S excel spreadsheet and Chi-Square ad fisher exact test by SPSS version-17 was applied for data analysis.

RESULT:

A total of 200 HCW gave consent and took part in this study based on their responses 180-study participant were evaluated, Out of which 92(51.11%) were male and 88(48.89%) were female. Table 1.0 represents distribution of HCW according to gender, age, occupation and health care setting. Majority of this HCW were among age group of 18-28 years (45.56%) followed by 28-38 years (22.22%). Table-1 also shows that majority of HCW who took part were doctors (67.22%) followed by nurse (22.78%) and cleaner (7.22%), while most of health care workers (91.11%) belonged to hospital.

Table-1: Distribution of HCW according to gender, age, occupation and health care setting

Gender	Frequency	Percentage (%)
Male	92	51.11%
Female	88	48.89%
Total	180	100%
Age		

18-28	82	45.56%
28-38	40	22.22%
38-48	30	16.67%
48-58	18	10%
Equal or more than 58	10	5.56%
Total	180	100%
Type of health care personnel		
Doctor	121	67.22%
Nurse	41	22.78%
Lab. tech	5	2.78%
Cleaner	13	7.22%
Total	180	100%
Type of health care setting		
Hospital	164	91.11%
Opd	12	6.67%
PHC	4	2.22%
Total	180	100%

Table-2: Distribution of HCW according to provision of care, face to face contact with Covid-19 patients and procedure preformed

Did you provide direct care to a confirmed Covid-19 patient	Frequency	Percentage
Yes	166	92.22%
No	14	7.78%
Total	180	100%
Did you have face-to-face contact (within 1 metre) with a confirmed Covid-19 patient in a health care facility?		
Yes	166	92.22%
No	14	7.78%
Total	180	100%
Were you present when any aerosol-generating procedures were performed on the patient?	Frequency	Percentage
Yes	73	40.56%
No	107	59.44%
Total	180	100%

Table-2 shows that around (92.22%) of HCW were involved in providing direct health care to Covid-19 patients and around (92.22%) of them had direct face-to-face contact (within 1 metre) with a confirmed Covid-19 patient. So 166 HCWs were considered as exposed to Covid-19 infection. Table-2 also shows that around 73 (40.56%) were present when any aerosol-generating procedures were performed on the patient.

Figure-1: Distribution of HCW according to accident with respiratory secretion/body fluid

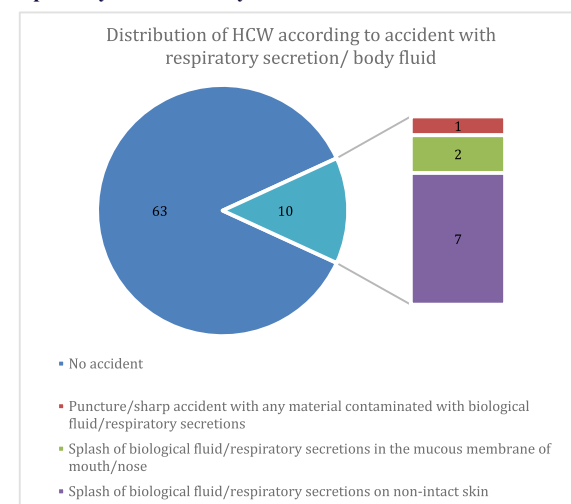


Figure-1 shows that, out of 73 HCWs who were present when any aerosol generating procedure was performed on the patient, around 10 health care workers had some kind of accident with body fluid /respiratory secretion, most of it (7,70%) were related to Splash of biological fluid/respiratory secretions on non-intact skin.

Table 3: PPE use among HCWs during direct interaction with a Covid-19 patient

	Single use gloves N=166 (%)	Medical mask N=166 (%)	Face shield or goggles N=166 (%)	Disposable gown N=166 (%)	Waterproof apron N=166 (%)
Always as recommended	142 (85.54)	150 (90.36)	83 (50.00)	105 (63.25)	74 (44.57)
Most of the time	20 (12.05)	13 (7.83)	29 (17.47)	29 (17.47)	28 (16.86)
Occasionally	3 (1.81)	1 (0.60)	22 (13.25)	8 (4.82)	35 (21.08)
Rarely	1 (0.60)	2 (1.20)	32 (19.28)	24 (14.46)	29 (17.46)
Always as recommended - >95% of the time; Most of the time - 50% or more but < 95%; Occasionally - 20% to < 50%; Rarely - < 20%;					

Table 3 shows that medical mask (90.36%) and Single use gloves (85.5%) were used most of the time by HCWs during interaction with covid 19 patients while other PPE like face shield (50%), disposable gowns (63.25) and waterproof apron (44.57) were less used.

Table-4: Association of age, sex and occupation with Covid-19 status

Age	Covid-19 positive	Covid-19 negative	Covid-19 status Unknown	Chi square p-value
18-28	12 (42.86%)	30 (34.88%)	16 (30.77%)	0.031
28-38	2 (7.14%)	21 (24.42%)	14 (26.92%)	
38-48	11 (39.29%)	27 (31.40%)	9 (17.31%)	
Equal or more than 48	3 (10.17%)	8 (9.30%)	13 (25.00%)	
Total	28 (100%)	86 (100%)	52 (100%)	
Sex				
Male	18 (64.29%)	46 (53.49%)	28 (53.85%)	0.585
Female	10 (35.71%)	40 (46.51%)	24 (46.15%)	
Total	28 (100%)	86 (100%)	52 (100%)	
Occupation				
Doctor	12 (42.86%)	55 (63.95%)	43 (82.69%)	0.037
Nurse	9 (32.14%)	19 (22.09%)	7 (13.46%)	
Lab technician	5 (17.86%)	8 (9.30%)	1 (1.92%)	
Cleaner and others	2 (7.14%)	4 (4.65%)	3 (5.77%)	
Total	28 (100%)	86 (100%)	52 (100%)	

Table-4 shows that majority of health care workers who came positive for covid 19 belonged to age group of 18-28 (42.86%) and were doctors (42.8%) which came out to be significant with p value of <0.05. It was also found that majority of them were male (64.29%) though it was not significant.

Table 5: Association of health care facility with Covid-19 status

Type of health care setting	Covid-19 positive	Covid-19 negative	Covid-19 status Unknown	Chi square p-value
Hospital	14 (50.00%)	69 (80.23%)	40 (76.92%)	0.024
OPD	10 (35.71%)	10 (11.63%)	9 (17.31%)	
PHC	4 (14.29%)	7 (8.14%)	3 (5.77%)	
Total	28 (100%)	86 (100%)	52 (100%)	
Multiple Covid-19 patients in health care facility				Fisher's exact p-value
Yes	23 (82.14%)	74 (86.05%)	45 (86.54%)	0.872
No	5 (17.86%)	12 (13.95%)	7 (13.46%)	
Total	28 (100%)	86 (100%)	52 (100%)	

Table 5 shows that higher numbers of HCWs (50.00%) who were working in hospitals got covid 19 infection in compare to OPD and PHC and it was significant with p value of <0.05.

Table 6: association of covid 19 status with HCQ prophylaxis.

HCQ prophylaxis	Covid-19 positive	Covid-19 negative	Covid-19 status Unknown	Chi square p-value
Yes	13 (46.42%)	49 (56.97%)	30 (57.69%)	0.574
No	15 (53.57%)	37 (43.0%)	22 (42.3%)	
Total	28 (100%)	86 (100%)	52 (100%)	

As shown in table 6, majority of covid 19 negative HCWs (56.97%) had taken HCQ prophylaxis but it was not significant. We found that in HCWs, young doctors working in hospital were more infected with covid 19 in comparison of other HCWs.

DISCUSSION:

Health care workers plays an very important role in treatment and prevention of spread of covid 19 infection and its very important to provide PPE to them to save themselves from getting covid 19 infection.

In our study out of 200 participants, 51% were male and 49% were female with the majority of them being in the age group of 18-28(40%). The majority of study participants were doctors, working in hospitals where multiple patients of COVID-19 were receiving treatment.

A total of 200 study participants took part in the study out of which 180 were included in study analysis. 166(92.3%) study participants found to be exposed to covid 19 and 28 (16.8%) found out to be positive for covid 19 infection. In systemic review by A.K. Sahu et al, proportion of HCW who were SARS-CoV-2 positive among all COVID-19 patients was 10.1% (95% CI: 5.3–14.9). This proportion were different according to the country i.e. China (7 studies) - 4.2%, 95% CI:2.4–6.0; United States (3 studies) – 17.8%, 95%CI:7.5–28.0; and Italy (1 study) – 9.0%, 95%CI:8.6–9.4⁶. In a cross sectionl study, Reina S Sikkema et al 96 (5%) HCWs tested positive for SARS-CoV-out of 1796 (15%) screened health worker. While Shuai Zhang, Mengfei Guo et al found that out of 424 identified HCWs 276 (65.1%) were symptomatic and 148 (34.9%) were asymptomatic. Fifty-five (19.9%) families of the symptomatic HCWs and 16 (10.8%) families of the asymptomatic HCWs were infected with SARS-CoV-2.

High adherence to medical mask (85.54%) and single use gloves (90.36%) were found among HCWs while adherence to face shields (50%), disposable gowns (63.25) and waterproof apron (44.57) were less as shown in Table 3. Similar results were found in SB Bavdekar et al where exceptionally high use (always or most of the time) of common PPEs such as single-use gloves (95%), mask (100%), face shield (86.7%) and disposable gown (76.6%) were found among HCWs¹⁰. Sakshi Supheial et al found that 64.9% of HCWs were using face masks rationally as mentioned per risk area categorization with a predominance of triple-layered mask.¹¹ Similar results were found in Diedo delgado et al that out of 899 health care workers around 889 (99%) had Access to gel hand sanitizer, disposable gloves ($n = 853$; 91.1%), disposable gowns ($n = 630$; 67.3%), disposable surgical masks (785; 83.9%), N95 masks ($n = 516$; 56.1%), and facial protective shields ($n = 305$; 32.6%)¹². In Alexis Tabah et al. (1557, 58%) HCW reportedly used FFP2/N95 masks, waterproof long sleeve gowns (1623; 67%), and face shields/visors (1574; 62%) and HCWs reported widespread shortages, frequent reuse of PPE¹³.

We also found that (table. 4) majority HCWs who came positive for covid 19 were doctors (42.86%, $p < 0.05$) between age group of 18-28 (42.86%, $p < 0.05$). It was also found that male HCWs had higher chances of infection but was not significant. Kasper Iversen, Henning Bundgaard et al found that Seroprevalence was higher in male health-care workers (331 [5-45%] of 6077) than in female health-care workers (832 [3-66%] of 22 715; RR 1.49 [1.31–1.68]; $p < 0.001$)¹⁴. Chatterjee et al also mentioned that cases were slightly older (34.7 vs. 33.5 yr) and had more males (58 vs. 50%)¹⁵.

As shown in table 4, it was also found majority of covid positive health care workers (50%, $p < 0.05$) were working in a hospital where multiple covid 19 patients were admitted. Similar results were found in Kasper Iversen, Henning Bundgaard et al where they found Frontline health-care workers working in hospitals had a significantly higher seroprevalence (779 [4-55%] of 16 356) than health-care workers in other settings (384 [3-29%] of 11 657; RR 1.38 [1.22–1.56]; $p < 0.001$). Health-care workers working on dedicated COVID-19 wards (95 [7-19%] of 1321) had a significantly higher seroprevalence than other frontline health-care workers working in hospitals (696 [4-35%] of 15 983; RR 1.65 [1.34–2.03]; $p < 0.001$)¹⁰.

We also found that among covid 19 negative health care workers 56.97% had taken HCQ prophylaxis, while among covid 19 positive HCWs 46.42% had taken HCQ prophylaxis. Though it was not significant, HCQ dose offer protection against Covid 19 virus. In case

control study by Chatterjee et al, they found Consumption of four or more maintenance doses of HCQ was associated with a significant decline in the odds of getting infected (AOR: 0.44; 95% CI: 0.22-0.88)¹⁵. In a systemic review carried out by shah et al, pre-clinical studies showed the prophylactic effects of CQ and HCQ against SARS-CoV-2¹⁶.

It is clear that HCWs played a major role in prevention and treatment of covid 19 during this pandemic. HCWs have been proven vital during any epidemics and pandemics. It is important to protect them from getting infection during this time and PPE are the single best measure to do so. Along with the guidelines for the usage of PPE, adherence towards its usage is also very important and monitoring must be there to make sure this guidelines are followed.

CONCLUSION:

Efficient and correct use of Personal Protective Equipment (PPE) by healthcare workers (HCWs) has received a lot of attention and critique in the COVID-19 pandemic. HCWs have played a crucial role in the mitigation of the pandemic; for prevention and treatment of patients. Our study concludes the group with the highest risk of acquiring infection in a healthcare setting are **young doctors**. High density of patients, long work hours, autonomous working conditions of young training residents and less trained staff for respiratory epidemic/pandemic etc. are some of the reasons for the same. We also found that HCQ prophylaxis can offer protection against covid 19. Prevention of infection of this profound work force is the safest and best bet over controlling the pandemic burden.

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