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Original Research Article

Use of personal protective equipment among doctors deployed in COVID-19 duty and factors affecting it

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ABSTRACT

Context: COVID 19 or Severe acute respiratory syndrome coronavirus 2 continues to spread globally due to its high transmissibility. The rapid and extensive spread of the COVID-19 pandemic has become a major cause of concern.

Aims: The aim of this study was to determine the use of Personal Protective Equipment among the doctors deployed in COVID-19 duty in the state of Maharashtra, India and the factors affecting it.

Settings and Design: This was a cross sectional, questionnaire-based study. The study population consisted of doctors including residents and interns who were engaged in the government and private practice in the state of Maharashtra.

Materials and Methods: 146 health professionals participated in the study, out of which 122 were considered for analysis. A self-designed, pre-validated questionnaire was administered to them. The questionnaire was divided into 3 sections which included questions regarding professional details, the use of Personal Protective Equipment (PPE) and factors affecting it.

Statistical Analysis used: Statistical analysis was done using Descriptive statistical test such as Chi square test and Odds ratio (OR).

Results: 84.4% of the participants were using PPE appropriately as per guidelines by the Indian Ministry of Health and Family Welfare on "The Rational Use of Personal Protective Equipment". 86.8% had awareness regarding these guidelines. 62.3% of the health professionals had received training regarding its usage. 17.2% reported that PPE were rarely available in the hospital, while for 44.3% PPEs were provided sometimes. There was a statistically significant association of appropriate use of PPE with awareness (p=0.026) training (p=0.025), and availability (p=0.001).

Conclusion: Significant association of use of PPEs with their availability in the hospital, awareness about the guidelines and training provided was seen. There is an urgent need to promote a strong culture of safety in the health care system via educational and training programs.

Key Message: The present study shows that most of the subjects were using PPE appropriately as per the guidelines issued by Indian Ministry of Health and Family Welfare, yet there were significant gaps in some of the important aspects such as availability in hospital, awareness about the guidelines and training provided. These findings clearly indicate the importance of promoting a strong culture of safety via health education and training programs across all healthcare professionals.

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1. Introduction

Coronaviruses are a large family of viruses which cause illness in the animals as well as humans. In humans, several coronaviruses are known to cause respiratory infections ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS).[1]

COVID-19 (Coronavirus Disease, 2019 & SARSCoV-2) is the newly discovered respiratory disease caused by a new coronavirus (2019-nCoV).[2] The outbreak of COVID-19 began in Wuhan, the largest metropolitan area in China's Hubei province in late December 2019 and on 11 March 2020, WHO announced COVID-19 outbreak as a pandemic.[3] According to the recent research, similar to Severe Acute Respiratory Syndrome (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV), COVID-19 is zoonotic, with Chinese horseshoe bats (Rhinolophus sinicus) being the most probable origin and pangolins as the most likely intermediate host.[4] Two main features of the virus that distinguish it from other members of the coronavirus family such as SARS-CoV and MERS-CoV are its Low Pathogenicity and High Transmissibility.[5] It is a highly infectious disease as the transmission is believed to occur through respiratory droplets (particles >5-10 μm in diameter) from coughing, sneezing and close contacts.[1] With this mode of transmission, healthcare workers are among the highest risk of being infected. The highly contagious SARS-CoV-2 virus is an additional hazard for the healthcare system, apart from the burden of extended work hours and physical and psychological stress.[6] According to the Indian Medical Association (IMA), 500 doctors have been infected with Covid-19 across Maharashtra.[7]

Protecting healthcare workers (HCWs) is crucial during Corona Virus Disease 2019 pandemic and requires wearing Personal Protective Equipment (PPE).[8] PPEs are the protective gears designed to safeguard the health of workers by minimizing the exposure to a biological agent.[9] It reduces the exposure of health-care workers to the respiratory pathogens during aerosol-generating procedures. Also, Case–control studies that focused on SARS suggest that PPE creates a barrier in the transmission, and thereby, plays an important role in limiting the epidemic spread of this virus. Therefore, it not only protects the health workers but also the people from infection.[10]

Appropriate use of PPE is the easiest way to prevent the contact from secretions and transfer of COVID-19 virus. This will not only protect the health-care workers but also prevent the nosocomial transmission of COVID-19 virus. Therefore, the objective of this study was to determine the use of PPEs among the doctors deployed in COVID-19 duty and the factors affecting it.

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2. Materials and Methods

2.1. Ethical clearance and informed consent

The ethical clearance was obtained from the Institutional Ethics Committee, Dr. D.Y. Patil Medical College, Pune, prior to the start of the study. Informed consent was obtained from the participants for their willingness to participate in the study. Participation in the study was voluntary and anonymity was maintained throughout the course of study.

2.2. Study design and data collection

This was a cross sectional, questionnaire-based study. The study was conducted between 30^{th} April 2020 to 30^{th} June 2020. The study population consisted of doctors including residents and interns who were engaged in the government and private practice in the state of Maharashtra. Assuming that 70% of the respondents would be using PPE appropriately, with an allowable error of 9%, at a confidence level of 95%, with a nonresponse rate of 20%, a sample size of 120 was estimated. The statistical package used was WinPepi. 146 health professionals responded the questionnaire however 24 were not considered due to incomplete information. So, the final sample considered for analysis was 122.

2.3. Research instrument

A self-designed, pre-validated questionnaire was used for the study. The questionnaire was divided into three sections. Section 1 comprised of professional details of the subjects. Section 2 evaluated the use of PPEs according to the guidelines given by The Indian Ministry of Health and Family Welfare on "The Rational Use of Personal Protective Equipment".[11] Section 3 evaluated the factors affecting the use of Personal Protective Equipment (PPE). The questionnaire was prepared in the form of an online form and was sent via WhatsApp and email to the health professionals including residents and interns at various healthcare institutions in the state of Maharashtra, India. It could not be handed over personally because of the city being under 'Lockdown' to prevent the spread of the virus.

2.4. Data analysis

The data was entered in Excel and analyzed using SPSS package version 19.0 (SPSS, Chicago, IL, USA) and Epi Info 7. It was summarized using percentages. Appropriate measures of association such as Odds Ratio (OR) and statistical tests such as Chi square were used. The significance level was set at <0.05.

3. Results

3.1. Professional information

The professional profile of the study participants is depicted in Table 1.

The study includes a total of 122 participants, out of which a 59.8% were practicing in Pune and 13.1% in Mumbai District. 77% of people were engaged in Private Hospitals/Institutes while 23% were employed in Government Hospitals. Percentage of participants working in OPD and IPD were 51.6% and 24.6% respectively.

3.2. Use of personal protective equipment

The criterion for determining the appropriate use of PPE was based on the guidelines given by the Indian Ministry of Health and Family Welfare on "The Rational Use of Personal Protective Equipment".[11] The use of Personal Protective Equipment among the subjects is depicted in the Figure 1.

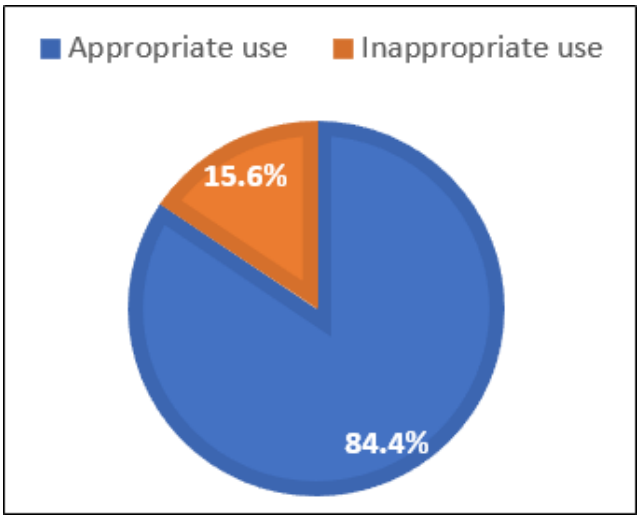

Fig. 1: The use of personal protective equipment (PPE). The percentage of appropriate use of PPE 84.4% and inappropriate use is 15.6%

84.4% of the participants were using PPE appropriately as per guidelines, with the highest being in the subjects working in Patient Department (IPD) and Emergency Department for attending the patients with Severe Acute Respiratory Disease.

3.3. Factors affecting the use of personal protective equipment

The factors assessed in this study are depicted in Table 2.

86.9% had awareness regarding the guidelines given by the Indian Ministry of Health and Family Welfare on "The Rational Use of Personal Protective Equipment". 78.7% of the participants were encouraged for appropriate use of PPE by their hospital management. 62.3% of the health professionals had received training regarding the usage of PPE, whereas 37.7% of the participants did not receive any training. 17.2% of the participants reported that PPE were rarely available in the hospital, while for 44.3% participants, PPEs were provided to them sometimes but not always. For 38.5% of the participants, PPEs were always available in the hospital. 65.6% participants were provided with PPE by the hospital, while others got their PPE either from the NGO or corporate companies or they had to arrange it by themselves (22.1%).

There was a statistically significant association of Appropriate use of PPE with awareness (p=0.026) training (p=0.025), and availability (p=0.001). (Table 3)

4. Discussion

Pandemics and re-emerging diseases put pressure on the health care system for the patient care and sample logistics, requiring increased supply of PPEs for health care workers. Safety is a very important component of every healthcare organization. They ought to provide quality health services to protect the health care professionals from health-related risks, particularly, exposure to the body fluids containing infectious agents has long been recognized as a potential threat to HCPs.

At least 96 doctors and 156 nurses have tested positive for COVID 19 across India as of April 22. As most of these infections were transmitted by the patients in a hospital environment, at least 826 medical workers who came in contact with the infected personnel had to be quarantined and at least 20 hospitals had to be fully or partially closed. Maharashtra accounted for close to 42% of these infected doctors. This speaks importance of forming certain guidelines, and making all health professionals aware of those should be the utmost priority.

Indian Ministry of Health and Family Welfare has devised guidelines on 'The Rational Use of Personal Protective Equipment.'[11]

Our study included 122 doctors including the residents and interns all over Maharashtra. Out of them, 23% were working in the Government set up, while a huge number, 77%, were in the private set up. Out of them 51.6% were working in the Outpatient Department (OPD) while 24.6% were working in the IPD, and only 10.7% doctors were posted in the Emergency department. (Table 1)

The current study showed that almost 86.9% doctors were aware of the guidelines about the appropriate use of PPE, and quite a few of them (84.4%) were using the PPEs appropriately as per the guidelines. This finding is more or less comparable with the findings from the health institutions of Bahir Dar (84%) and Debre Markos town (84.7%), respectively.[12,13] The possible explanation for the differences could be due to the difference in methodology, work experience, training, personal characteristics of the

Table 1: Professional profile of the participants

Profile		Count	Percentage (%)
Sector	Government Hospital	28	23
	Private Hospital/Institute	94	77
Hospital Setting	OPD	63	51.6
	IPD	30	24.6
	Emergency Department	13	10.7
	Laboratory	5	4.1
	At superficial level of investigation	11	9

Table 2: Factors affecting theuse of personal protective equipment

Factors		Count	Percentage (95%CI)*
Awareness about guidelines to use PPE	Yes	106	86.9(80-92)
	No	16	13.1(8-20)
Encouragement at hospital	Yes	96	78.7(70.8-85.2)
	No	26	21.3(14.8-29.2)
Training at hospital	Yes	76	62.3(53.5-70.6)
	No	46	37.7(29.4-46.5)
Availability at hospital	Sometimes	54	44.3(35.6-53.2)
	Rarely	21	17.2(11.3-24.7)
	Always	47	38.5(30.2-47.4)
Allocation of PPE	Hospital	80	65.6(56.8-73.6)
	NGO	1	0.8(0.04-3.98)
	Corporate Company	2	1.6(0.3-5.3)
	I arrange it myself	27	22.1(15.4-30.1)
	Hospital, I arrange it myself	8	6.6(3.1-12.1)
	Hospital, NGO	2	1.6(0.3-5.3)
	Hospital, I arrange it myself, NGO	1	0.8(0.04-3.98)
	Hospital, I arrange it myself, NGO, Corporate Company	1	0.8(0.04-3.98)

Table 3: Association of the use of personal protective equipment with the factors assessed in this study

Factors	Use of Personal Protective Equipment		P-value	Odds Ratio (95% CI)
	Appropriate Use No. (%)	Inappropriate Use No. (%)		
Awareness of guidelines				
Yes	93(87.7)	13(12.3)	P=0.026	4.29 (1.08-15.61)
No	10(62.5)	6(37.5)		
Encouragement at hospital				
Yes	86(89.6)	10(10.4)	P=0.007	4.6 (1.4-14.5)
No	17(65.4)	9(34.6)		
Training at hospital				
Yes	69(90.8)	7(9.2)	P=0.025	3.48 (1.13-11.32)
No	34(73.9)	12(26.1)		
Availability at hospital				
Rarely	12(57.1)	9(42.9)		Ref. cat
Sometimes	47(87.0)	7(13.0)	P=0.001	5.04 (1.3-19.2)
Always	44(93.6)	3(6.4)		11 (2.2-69.8)

study participants and most importantly the timing of survey.

Implementing a culture of safety can require changes in the organization's policies, procedures, actions and priorities of hospital management, and resources dedicated to safety with access to effective safety equipment. We tried to evaluate the factors associated for the inappropriate use of PPEs which are shown in Table 2. It was found that unavailability of the PPEs in the hospital, lack of encouragement for the use of PPEs by the hospital management, training provided to doctors regarding the proper use of PPEs were some of the important factors responsible for the inappropriate use. 44.3% and 17.2% of doctors mentioned that PPEs were sometimes and rarely available in the hospital respectively and so they had to arrange it on their own. This finding goes hand in hand with the study conducted by Jawad Ahmad in 2020 where he noticed that the unavailability of the PPEs was the most important factor responsible for not using PPEs by the health professionals.[14] Research published since 2007 on healthcare personnel and PPE shows that a number of individual factors continue to contribute to the poor compliance and other safety-related outcomes. Three sets of factors deserve mention. First, studies continue to show knowledge gaps and training deficiencies among the healthcare personnel with respect to the proper PPE usage, modes of transmission, and other infection control topics.[15] Precautions to be implemented by health care workers treating COVID-19 include using the PPE appropriately; this involves selecting proper PPE and being trained in how to put on, remove, and dispose it off.[16] In our study we found that although 78.7% of the participants were encouraged for the usage of PPEs in the hospital, only 62.3% were given proper training regarding its use. Table 2). Research by Bryce and colleagues (2008) found that even though healthcare personnel may use appropriate PPE, they often do so incorrectly or incompletely.[17]

Following the instances of doctors getting infected with COVID-19 due to a lack of adequate PPE, and a plea by Nagpur-based doctor JerrylmBanait, the Supreme Court directed the government to ensure an adequate supply of PPE to the healthcare workers on 8^{th} April 2020. But the situation seemed to have persisted with a lot of hospitals not providing PPEs to the health professionals. In our study we found that only 65.6% of the participants were provided with PPEs by their hospitals, rest of them were either arranging on their own (22.1%) or were given PPEs by NGOs or by a corporate company. (Table 2). We have also observed a very significant association of the use of PPEs with their availability in the hospital, awareness about the guidelines, encouragement by the hospital management and training provided to them in the hospital. (Table 3)

The level of knowledge, awareness, training and availability of PPEs in this study is unacceptably below standard to prevent the spread of infection and hence safety of health of workers.

Employees should feel uncomfortable when not wearing PPE during the appropriate situations, and hospital management should reinforce the importance of PPE and enforce policies so that noncompliance is a rare exception and not the rule. Each healthcare employer should assume the responsibility for taking an active role to encourage the use of PPEs by health care professionals, by providing them proper training and making those available to them as and when required. Healthcare facilities need to foster and promote a strong culture of safety.

5. Source of Funding

None.

6. Conflict of Interest

The authors declare that there is no conflict of interest.

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