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Feature Article

Knowledge of Handling the Personal Protective Equipment by Frontline Allied Health Professionals in COVID-19 Outbreak—A Web-Based Survey Study

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ABSTRACT

Ever since the coronavirus disease 2019 (COVID-19) has emerged, the number of affected individuals has been increasing exponentially. The frontline health workers are in constant risk because of the etiology and mode of transmission of the disease. Thus, the proper use of personal protective equipment (PPE) is very crucial during this pandemic. This study is to assess the knowledge regarding the handling of PPE among frontline allied health professionals who are directly in contact with patients with COVID-19. A standard questionnaire was prepared in Google Forms and circulated within the network of health-care workers via online platforms. A total of 143 frontline health workers participated in the questionnaire survey. It was found that only 44.1% of the total participants had previously undergone training regarding the handling of PPE. About 86.0% of participants gave correct response to the safety etiquette questions. For another knowledge-based question about using the N95 respirator in conjunction with a face shield, 86.7% of participants responded correctly. Only 67.8% of participants gave the right response to the question regarding the sequence of donning and doffing of PPE. The last question was regarding knowledge about the disposal of PPE, where 95.8% of participants responded correctly. Despite the safety precautions and procedures set forth by the Centers for Disease Control and Prevention for handling patients with COVID-19, the health-care workers are still prone to occupational hazards. The only barrier standing between the health-care workers and COVID-19 is the PPE. Thus, in-depth training and education should be imparted on the health-care workers in the present pandemic situation.

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Background

In December 2019, patients with lower respiratory tract infections started emerging in Wuhan City, Hubei province in China. The microbe responsible for this outbreak was found to be severe acute respiratory syndrome coronavirus-2 initially called as novel coronavirus. In February 2020, the WHO named the infection as coronavirus disease 2019 (COVID-19) (Cascella et al., 2020; Park, 2020). Since then, there has been an exponential rise in the number of cases because of its etiology and mode of transmission.

Based on the studies conducted until now, the main mode of transmission of this disease seems to be via droplet or direct contact, symptomatic people being the main cause of transmission. However, many studies suggested that the presymptomatic transmission and asymptomatic transmission also account for transmitting the virus, suggesting that isolation is the best way to stifle this epidemic (Cascella et al., 2020; World Health Organization, 2020a).

In the present scenario, frontline health-care professionals being at constant contact with patients with COVID-19 possess a substantial risk in their working environment. Personal protective equipment (PPE) is the only protective barrier for working staff and other patients from COVID-19 transmission (Cook, 2020; Holland et al., 2020). The PPE kits should be appropriately chosen according to each setting.

The use of the contact precaution PPE, that is, fluid-resistant surgical face mask, apron, and gloves are appropriate for
protection against direct contact infection when at least 2 m away from the patient. As for droplet precaution PPE, when handling patients in the close range, that is, less than 2 m, eye protection is added, depending on the risk estimation. During high-risk procedures such as airway management where respiratory aerosol are produced, airborne precaution PPE should be used by everyone involved during the procedure. The airborne precaution PPE kit includes the gloves, fluid-repellent long-sleeve gown, high filtering face piece such as N95 masks or a powered air-purifying respirator, and face shield. When appropriate and feasible, it is crucial that an infected person use a fluid-resistant face mask to reduce the risk of transmission via droplets (Cook, 2020; World Health Organization, 2020b).

Apart from using the appropriate PPE, the staff should always follow safety protocols set forth by the Centers for Disease Control and Prevention (CDC) regarding the personal hygiene, handling, and the dooming of used PPE kits. The staff should be well trained and should be made aware of the safety aspects and guidelines to reduce the cross-infection. Apart from all the precautions and safety protocols, the frontline health workers are at constant occupational risk despite the standard safety conventions.

### Aim

The main purpose of this study is to assess the knowledge regarding the handling of PPE among frontline allied health professionals who are directly in contact with patients with COVID-19.

### Material and methods

A web-based survey study was conducted from May 3, 2020 to May 8, 2020 during the pandemic lockdown COVID-19 among frontline health-care workers because they are directly associated with the diagnosis and treatment of patients with COVID-19. Hospital frontline health-care workers within India were included in this study. A standard questionnaire was prepared after the discussion with other experienced faculties. Owing to the pandemic lockdown, the institutional ethical board was not approachable; thus, telephonic approval was taken from the University Hospital—Charusat Healthcare and Research Foundation, Changa, Gujarat. Questionnaires were prepared in Google Forms and circulated through the social media platforms and e-mail of health-care workers and employers within India.

The study PROforma was categorized into three sections. The first section consisted of the title and objective of the study, instructions, and the declaration of anonymity. The willingness of participants was recorded in the first section with close-end questions, that is, yes—no response and forwarded to further sections if participants agreed to participate in the survey. Demographic data such as gender, age, education, department of employment, and location were included in the second section. The third section consisted of 5 questions among which 4 questions were purely knowledge based and 1 question was about the previous training experience of PPE before the COVID-19 outbreak (Table 1).

### Statistical Analysis

The collected data were analyzed by using descriptive statistics, that is, the mean and standard deviation (SD) of samples. The data analysis was performed by IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, NY) and presented in the form of frequency and percentage.

### Results

A total of 143 frontline health-care workers participated in the questionnaire survey, among which 66 (46.2%) were men and 77 (53.8%) were women (Figure 1). The mean age of the male participants was 29.14 years with an SD of 7.3 and that of female participants was 24.62 years with an SD of 4.03 (range 18–48 years).

The maximum participation of health-care workers for the survey study was from the Nursing Department (n = 54) followed by the Radiology Department (n = 51), Department of Operation Theater and Anesthesia Technology (n = 23), Medical Laboratory Department (n = 12), and Physiotherapy (n = 3) as shown in the bar graph in percentage (Figure 2).

The total of 67.1% (n = 96) of participants had a graduate degree followed by postgraduate participants 18.2% (n = 26) and diploma degree 14.7% (n = 21). The samples were collected from 20 states of India and of all participants, the majority of them were from the Gujarat state (28.67%) followed by other locations as shown in the graph in percentage (Figure 3).

As shown in Table 2, only 44.1% of the total participants had previously undergone training regarding the handling of PPE in the epidemic/pandemic disease outbreak. About 86.0% of participants gave a positive response against the question about the safety etiquette of touching and adjusting the face mask with the gloves after handling a patient. For another knowledge-based question about using the N95 respirator in conjunction with a face shield, 86.7% of participants responded positively. For another knowledge-based question regarding the donning and doffing of the PPE, 67.8% of participants gave the right response, whereas 25.2% gave the wrong response and 7% responded as maybe. The last question was regarding knowledge about the disposal of PPE, where 95.8% of participants responded positively (Table 2).

### Discussion

The outbreak of COVID-19 has caused fear among the world population and the government. The etiology and mode of transmission of this disease make the treatment of the patients more challenging for health-care workers. The use of PPE is the only barrier that minimizes the occupational risk of these workers. Thus, to assess the knowledge of handling the PPE among the health-care workers, a questionnaire was prepared with close-end questions to assess the knowledge of handling the PPE among frontline allied health professionals. The collected data were analyzed by using descriptive statistics, that is, mean and standard deviation (SD) of samples.

| Questions                                                                 | Response |
|---------------------------------------------------------------------------|----------|
| 1. Do you have any previous training experience in handling personal protective equipment before the Corona outbreak? | Yes, No  |
| 2. Can you touch your face or adjust personal protective equipment with gloves after or while handling the patient? | Yes, No, Maybe |
| 3. According to you, is it beneficial to use both the N95 respirators and a face shield that covers the forehead, extends below the chin, and wraps around the side of the face while handling patients with COVID-19? | Yes, No, Maybe |
| 4. Is the sequence of wearing and removing the personal protective equipment the same? | Yes, No, Maybe |
| 5. After handling the patient with COVID-19, do you dispose of your personal protective equipment kits according to standard guidelines? | Yes, No, Maybe |

PPE = personal protective equipment; COVID-19 = coronavirus disease 2019.
workers, a survey was conducted among frontline health-care professionals from different hospitals.

Taghrir et al. (2020) conducted a study on COVID-19 based on knowledge, preventive behaviors, and risk perception among Iranian medical students, on which they reported that only 43.3% had received any kind of education about COVID-19; however, there was no significant difference of response between those who had not attained any kind of education in his study. In the same study, 85.5% of the participants responded the use of PPE such as face mask can help prevent the transmission of COVID-19 and 79.2% of the study population knew the use of N95 respirators with face shield during aerosols producing procedures (Taghrir et al., 2020).

Kotian et al. (2020) also conducted a study on COVID-19 based on knowledge and understanding among medical imaging professionals, on which they reported that only 46.5% of participants have undergone training for the safe use of PPE (Kotian, Faujdar, & Kotian, 2020).

In the present study, the results were similar to the other studies; only 44.1% of participants had attended direct training from their health-care institute regarding the PPE handling and safety in epidemic/pandemic situation before involving in the

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**Figure 1.** Distribution according to gender.

![Chart showing distribution according to gender](image1)

**Figure 2.** Distribution according to the department.

![Chart showing distribution according to the department](image2)
treatment and diagnosis of patients with COVID-19. This increases the risk of getting exposed to viral infection as the safety protocols vary while handling the patients in a pandemic outbreak such as COVID-19. Although the health-care professionals did not have any training about the safe use of PPE in the COVID-19 outbreak, the majority of participants have responded correctly against the questions regarding the safety aspects, etiquettes, and knowledge about the PPE.

A study conducted by Modi et al. (2020) among the health-care students and professionals in the Mumbai metropolitan area showed 45.4% of responders knew the right sequence of donning and doffing of the PPE. The results were slightly higher in the present study; about 67.8% of the study population responded correctly. However, there is still the need for in-depth training and briefing of the health-care workers regarding the different safety aspects about the use of PPE such as using a right PPE kit for a different scenario, the sequence of donning and doffing of soiled PPE, standard etiquette while using PPE, and maintaining personal hygiene (Modi et al., 2020).

This study shows the awareness among the health-care workers regarding the use of PPE is good but lacks in-depth knowledge about handling and disposal of used PPE, which is crucial in a pandemic situation such as COVID-19.

Limitations of the Study

Because the survey was conducted within the author’s circle for a short duration and due to the busy schedule of health workers, a limited study sample was obtained. Furthermore, the reliability of the questionnaire was not tested. There may be potential bias in the response because of the participation of responders with good knowledge of PPE. Despite the limitations, this study was conducted during the mid-phase of COVID-19 lockdowns to review the knowledge of the health-care workers after their experience with patients with COVID-19.

Conclusion

Despite the safety precautions and procedures set forth by the CDC for handling patients with COVID-19, the health-care workers are still prone to occupational hazards. The only barrier standing between the health-care workers and COVID-19 is the PPE. This

| SN | Questions                                                                 | Response (n = 143)       |
|----|---------------------------------------------------------------------------|-------------------------|
| 1  | Do you have any previous training experience in handling personal protective equipment before the corona outbreak? | 63 (44.1%) 80 (55.9%)  |— |
| 2  | Can you touch your face or adjust personal protective equipment with gloves after or while handling the patient? | 8 (8.0%) 123 (86.0%) 12 (8.4%) |
| 3  | According to you, is it beneficial to use both the N95 respirators and a face shield that covers the forehead, extends below the chin, and wraps around the side of the face while handling patients with COVID-19? | 124 (86.7%) 10 (7.0%) 9 (6.3%) |
| 4  | Is the sequence of wearing and removing the personal protective equipment the same? | 36 (25.2%) 94 (67.8%) 10 (7.0%) |
| 5  | After handling the patient with COVID-19, do you dispose of your personal protective equipment kits according to standard guidelines? | 137 (95.8%) 3 (2.1%) 3 (2.1%) |

COVID-19 = coronavirus disease 2019.
The present study concludes that there are inadequate training and education among health-care workers that is why in-depth training of PPE is important to develop the essential skill and awareness among frontline health-care workers in the present pandemic situation.

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Approval for the study was taken from the University’s Hospital board telephonically as Institutional Ethical Committee was not approachable because of the pandemic lockdown.

CREDIT Statement: Santosh Ojha contributed Data curation, Formal analysis, Writing- Original draft preparation. Manna Deb-nath contributed Conceptualization, Methodology. Dolly Sharma contributed Supervision, Validation and critically reviewed the manuscript. Anupam Niraula contributed Data collection, Writing - Review & Editing. All the authors have contributed significantly, read the manuscript, and agree to its submission to Journal of Radiology Nursing.

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