Knowledge and practices on personal protective equipment among nurses working in selected tertiary level hospital during COVID-19 pandemic

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ARTICLE INFO	ABSTRACT
  *Corresponding Author Mst Arzina Khatun ✉mstarzinakhatun497@gmail.com	Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. The ability to limit the transmission of COVID-19 in the healthcare setting requires infection prevention and control measures, of which Personal Protective Equipment (PPE) is a fundamental element. The objective of the study was to assess the level of knowledge and practices on PPE among nurses during COVID-19 pandemic in tertiary level hospital. This cross-sectional study was conducted among 185 nurses working in M Abdur Rahim Medical College Hospital, Dinajpur from 1st January to 31st December, 2020. Purposive sampling was adopted and semi-structured questionnaire was used to collect data from the respondents. The mean age of nurses was 30.60 (±5.53) years where 167 (90.3%) were female. Most of the nurses 179 (96.8%) had no training on PPE use. In the hospital, 149 (80.5%) nurses always had easy access of PPE while 36 (19.5%) sometimes had easy access of PPE. The study found that 113 (61.1%) nurses had good knowledge on PPE while 72 (38.9%) had poor knowledge on PPE. Among the nurses, 146 (78.9%) worn gown properly, 134 (72.4%) worn mask properly, 174 (94.1%) worn gloves properly. However, 106 (57.3%) nurses worn surgical cap or hood properly, 111 (60.0%) worn shoe cover properly. Out of 185 nurses, 56.6% had good practice on PPE and 45.4% had poor practice on PPE. Level of knowledge was significantly associated with availability of PPE (p=0.004) and working department (p<0.001). Level of practice was significantly associated with work experience (p=0.008), availability of PPE (p<0.001), working department (p<0.001) and level of knowledge (p<0.001). The nurses caring for patients with COVID-19 had good level of knowledge and practice on PPE. Training sessions regarding the use of PPE, along with adequate supply of PPE, should be implemented to ensure maintenance of appropriate practices during the COVID-19 pandemic.

INTRODUCTION

In December 2019, a novel coronavirus (2019-nCoV; SARS-CoV-2), which is believed to have originated in Wuhan, the capital city of Hubei province, began spreading rapidly across China. The virus is transmitted mainly via respiratory droplets and/or contact, and human-to-human transmission and family clustering have been reported (Zhu et al., 2020) Reported illnesses have ranged from patients with little or no symptoms to patients being severely ill and dying (Guan et al., 2020). The main clinical manifestations include fever, cough, fatigue, and dyspnea. As compared to young and middle-aged patients with COVID-19, elder infected patients with chronic comorbidities have an increased risk of developing organ dysfunctions, including shock, acute respiratory distress syndrome (ARDS), acute cardiac injury, and acute kidney injury, resulting in a higher mortality rate (Wang et al., 2020).

The important ways to slow the spread are to wear a mask to protect oneself and others and stop the spread of COVID-19, stay at least 6 feet (about 2 arm lengths) from others and avoid crowds (CDC, 2020).

Health care professionals and patients are at high risk to be exposed to potentially infected substance that can lead to serious or even lethal infections. Nurses, in particular, are repeatedly exposed to various infections during the course of carrying out their nursing activities (Kosgeroglu et al.,

2004). Additional precautions are required by health care workers to protect themselves and prevent transmission in the healthcare setting. Precautions to be implemented by health care workers caring for patients with COVID-19 include using Personal Protective Equipment (PPE) appropriately; this involves selecting proper PPE and being trained in how to put on, remove, and dispose of it (WHO 2020).

PPE is a physical barrier worn by HCWs to prevent spreading of a pathogen from either a suspected or confirmed case or a pathologic specimen. It serves the dual role of preventing disease spread from patients to HCWs and vice versa. These physical barriers include goggles, face shields, fluid-resistant medical or surgical masks, particulate respirators (e.g., powered air-purifying and N95 respirators), gloves, disposable gowns, disposable coveralls, waterproof or heavy-duty aprons, waterproof boots, and hoods or head covers in conjunction with other infection and prevention control (IPC) methods (WHO, 2020).

There are risks to both staff and patients with respect to inappropriate use of PPE, namely cross-contamination and the spread of infection. The reasons of inappropriate use of PPE are lack of awareness about the importance of PPE, time constraints for donning/doffing the equipment and lack of realization about the importance of the technique for proper safe removal (Bovin, 2021). A Study observed that 90% of doffing processes were incorrect. The most common errors occurred in the aspect of the correct removal of gowns (65%) and contact with potentially contaminated surfaces (48%) (Phan et al., 2019). A study conducted in Bangladesh showed that 65.5% adhered principals of hand washing and only 76.4% of respondents maintained aseptic precautions for donning/doffing (Karim et al., 2020).

For this reason, lack of appropriate knowledge and deficits in the use of PPE are to be identified and analyzed in order to provide nurses with targeted training on the correct and indication-appropriate use of PPE. Therefore, the purpose of the study was to assess the level of knowledge and practices on PPE among nurses working in selected tertiary level hospital during COVID-19 pandemic.

MATERIALS AND METHODS

Study area and population

It was a cross sectional study. The study was conducted one year from 1st January 2020 to 31st December 2020. The study was conducted in M Abdur Rahim Medical College Hospital. This is a Government Medical College located in the town of Dinajpur. The 500-bed hospital has high technology and has started to provide more services. During COVID 19 pandemic situation it was dedicated as a COVID-19 hospital.

Nurses working in M Abdur Rahim Medical College Hospital were the study population. Nurses were selected on the basis of inclusion and exclusion criteria. In this study sample size was calculated by using following formula. $n=z^2pq/d^2$. Here p=0.26 {25.7% nurses had adequate knowledge about PPE (Alao et al., 2020)}. Purposive sampling technique was used in this study to select sample from study population.

Research instrument

A semi-structured interviewer-administered questionnaire was used to collect data. The questionnaire was pretested and necessary modifications were done and the questionnaire was finalized before collection of data. First part of the questionnaire contained questions regarding socio-demographic status which included age, sex, marital status, educational status, monthly family income, and religion. Second part contained job related information. Third part contained knowledge related questions. There were 18 knowledge related questions related to type of PPE, proper use and disposal of PPE. Answers were collected in three-point Likert scale such as 'no', 'do not know' and 'yes'. Fourth part contained practice related questions. There were 9 practice related questions related to donning, doffing and disposal of PPE. Answers were collected in three-point Likert scale. Practice of the respondents regarding use of PPE was assessed with the help of observational check list.

Data collection technique

Data was collected by face-to-face interview in Bangla. Observational check list was filled up

after observing the respondent during the data collection period.

Data analysis

The statistical analysis was conducted using SPSS (Statistical Package for Social Science) version 26 statistical software. Means and standard deviations for continuous variables and frequency distributions for categorical variables were used to describe the characteristics of the total sample. Age, and monthly family income were considered as categorical variables. The mean score of knowledge and practice related questions were determined. Further, knowledge and practice scores were categorized into good and poor score if it is equal to or above the mean and below the mean, respectively (Yazie et al., 2019; Alao et al., 2020). Associations of categorical data were assessed using Chi square test and Fisher's Exact test. Here, $p<0.05$ was considered significant and all p-values were two sided.

Ethical consideration

At the beginning, approval was obtained from the ethical committee of NIPSOM, under the Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. Before collection of data, written permission was taken from the Director of the hospital. Also written permission was taken from the respondents

RESULTS

This cross-sectional study was carried out among 185 nurses to assess the level of knowledge and practice on personal protective equipment among nurses working in selected tertiary level hospital during COVID-19 pandemic. Collected data were cleaned and analyzed with the help of SPSS (statistical package for social science) version 26.

Socio-demographic characteristics of the respondents show that 118 (63.8%) respondents were from 26-35 years age group where the mean age of respondents was 30.60 (±5.53) years and 167 (90.3%) respondents were female. Among the respondents, 137 (74.1%) were Diploma passed and 36 (19.5%) had BSc in nursing. Out of the 185 respondents, 148 (80.0%) had monthly income from 34,001 to 39000 Taka where the mean of the monthly income was 37020.30 (±6735.26) Taka (Table 1).

Most of the respondents 176 (95.1%) were senior staff nurse and the mean of the working experience was 4.04 ±3.87 years. Most of the respondents 181 (97.8%) had no training on COVID-19 and most of the respondents 179 (96.8%) had no training on PPE use. Among the respondents, 103 (55.7%) was working in COVID unit and 149 (80.5%) respondents always had easy access of PPE while 36 (19.5%) respondents sometimes had easy access of PPE (Table 2).

Table 1: Distribution of the respondents by socio-demographic characteristics (n-185)

Variables	Categories	Frequency	Percentage	Statistics
Age group (in years)	≤ 25	27	14.6	Mean ±SD 30.60 ±5.53
	26-35	118	63.8	
	>35	40	21.6	
Gender	Male	18	9.7	
	Female	167	90.3	
Educational status	Diploma in nursing	137	74.1	
	BSc in nursing	36	19.5	
	Master in nursing and public health	12	6.4	
Monthly family income (in Taka)	≤ 34,000	17	9.2	Mean ±SD 37020.30 (±6735.26)
	34,001 to 39,000	148	80	
	> 39,000	20	10.8	

Table 2: Distribution of respondents by job related information (n-185)

Variables	Categories	Frequency	Percentage	Statistics
Designation	Senior staff nurse	176	95.1	
	Staff nurse	9	4.9	
Working experience (in years)	< 1	38	20.5	
	1-4	107	57.8	Mean (±SD)
	>4	40	21.6	4.04 (±3.87)
Training on COVID-19	Received	4	2.2	
	Not received	181	97.8	
Training on PPE use	Present	6	3.2	
	Absent	179	96.8	
Easy access of PPE	Always	149	80.5	
	Sometimes	36	19.5	
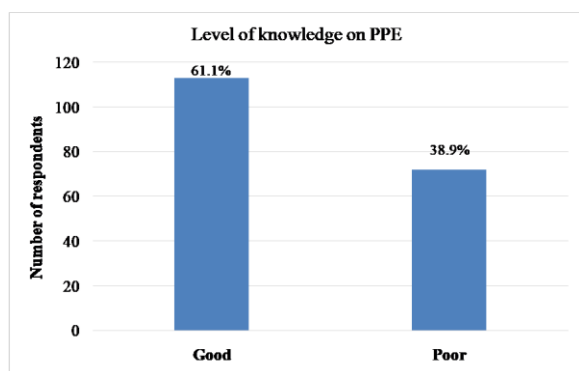
Figure 1: Distribution of the respondents by level of knowledge on PPE (n-185)

Out of the 185 respondents, 113 (61.1%) respondents had good knowledge on PPE while 72 (38.9%) respondents had poor knowledge on PPE (Figure 1).

Among the 185 nurses, 146 (78.9%) nurses worn gown properly, 134 (72.4%) worn mask properly, 174 (94.1%) worn gloves properly. However, 106 (57.3%) nurses worn surgical cap or hood properly, 111 (60.0%) worn shoe cover properly. Only 28 (15.1%) doffed PPE properly and 11 (5.9%) disposed used PPE anywhere (Table 3).
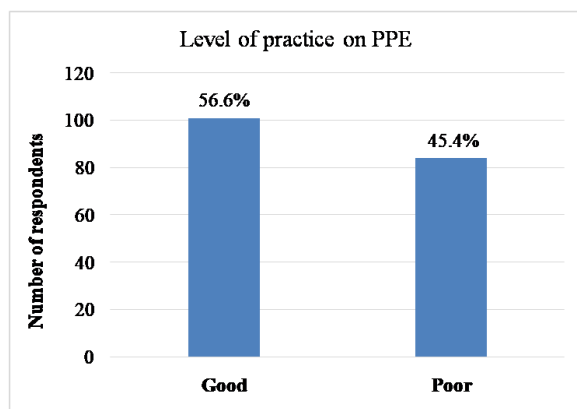
Table 3: Distribution of the respondents by observation of practice of PPE (n-185)

Observation of practice of PPE	Frequency (f)	Percentage (%)
Gown		
Not worn	23	12.4
Not properly worn	16	8.6
Properly worn	146	78.9
Mask		
Not properly worn	51	27.6
Properly worn	134	72.4
Gloves		
Not worn	2	1.1
Not properly worn	9	4.9
Properly worn	174	94.1
Eye protector		
Not worn	74	40.0
Not properly worn	16	8.6
Properly worn	95	51.4
Surgical cap or hood		
Not worn	55	29.7
Not properly worn	24	13.0

Properly worn	106	57.3
Shoe cover or rubber boot		
Not worn	39	21.1
Not properly worn	35	18.9
Properly worn	111	60.0
Maintenance hand hygiene		
Not properly maintained	162	87.6
Properly maintained	23	12.4
Doffing of PPF		
Not properly doffed	31	16.8
Somewhat properly doffed	126	68.1
Properly doffed	28	15.1
Dispose used PPE		
Anywhere	11	5.9
Not properly disposed	97	52.4
Properly disposed	77	41.6

Table 3: Association of level of knowledge on PPE with job related factors (n = 185)

Job related variables	Poor knowledge	Good knowledge	Test statistics
Experience (in years)			
<1	12 (31.6%)	26 (68.4%)	
1-4	47 (43.9%)	60 (56.1%)	p=0.279
>4	13 (32.5%)	27 (67.5%)	
Training on PPE			
Absent	69 (38.5%)	110 (61.5%)	p=0.679
Present	3 (50.0%)	3 (50.0%)	
Easy access of PPE			
Sometimes	22 (61.1%)	14 (38.9%)	**p=0.004**
Always	50 (33.6%)	99 (66.4%)	
Working department			
COVID-19 unit	28 (27.2%)	75 (72.8%)	**p<0.001**
Non COVID-19 unit	44 (53.7%)	38 (46.3%)	

Figure 2: Distribution of the respondents by level of practice on PPE (n-185)

Out of the 185 respondents, 101 (56.6%) respondents had good practice on PPE while 84 (45.4%) respondents had poor practice on PPE.

Respondent's working experience (p=0.279) and training on PPE (p=0.679) were not associated with knowledge of the respondents regarding PPE (obtained by Pearson's Chi-square test and Fisher Exact test respectively). Respondents (66.4%) who had always easy access of PPE more good knowledge than others (38.9%) who sometimes had easy access of PPE (p=0.004).Respondents (72.8%) working in COVID-19 unit had significantly more good knowledge than respondents (46.3%) working in non-COVID-19 unit (p<0.001) (Table 3). Respondents (76.3%) who had working experience < 1 year had

significantly more good practice than respondents (50.5%) who had working experience 1-4 years and respondents (45.0%) who had working experience >4 year (p=0.008).Respondents (61.1%) who had always easy access of PPE more good practice than others (27.8%) who sometimes had easy access of PPE (p<0.001). Respondents (77.7%) working in COVID-19 unit had significantly more good practice than respondents (25.6%) working in non-COVID-19 unit (p<0.001) (Table 4).

Table 5: Association of level of knowledge and level of practice on PPE (n = 185)

Level of knowledge	Level of practice		Test statistics
	Poor practice	Good practice	
Poor	49 (68.1%)	23 (31.9%)	χ^2=24.396
Good	35 (31.0%)	78 (69.0%)	**p<0.001**

Respondents who had good knowledge had significantly more good practice (69.0%) than respondents who had poor knowledge (31.9%) (p<0.001) (obtained by Chi square test) (Table 5).

DISCUSSION

This cross-sectional study was carried out among 185 nurses to assess the level of knowledge and practice on personal protective equipment among nurses in M Abdur Rahim Medical College Hospital during COVID-19 pandemic. The present study found that 61.1% respondents had good knowledge on PPE while 56.6% respondents had good practice on PPE. Knowledge was associated with easy access of PPE and working department while practice was associated with work experience, easy access of PPE and working department**.** Respondents who had good knowledge had significantly more good practice than respondents who had poor knowledge.

The result of the present study showed that majority of the nurses were from 26-35 years age group where the mean age of respondents was 30.60 ±5.53 years. Similar observation was reported in other studies. The mean age of respondents of the study of Alao et al. (2020) was 32.99 years while the mean age of respondents of the study of Hossain et al. (2021) was 28.9±5.2 years. As evidence started to accumulate that older people are particularly vulnerable to COVID-19-related mortality, young HCWs came to the forefront of the front-liners. As this study was conducted among the front-liners, the proportion younger nurses were high.

Most of the respondents of the present study were female which was similar with other studies (Alao et al., 2020; Elhadi et al., 2021; Neuwirth et al., 2020). In Bangladesh, percentages of female nurses recruitment are more compared to male. This might be the reason of more female providers in the current study.

Only 2.2% of the nurses had training on COVID-19 (97.8%). Saha et al. (2020) conducted a study to identify the nurses' knowledge and practices regarding prevention and control of COVID-19 infection where they found that only 8.7% took training on COVID-19.

The ability to limit the transmission of COVID-19 in the healthcare setting requires infection prevention and control measures, of which PPE is a fundamental element. This is essential to limit the transmission of the virus to health professionals to protect both the patients they care for and the wider community (Gordon et al., 2020). Nurses training on PPE is important as this can properly guard them against workplace hazards. Understanding how to wear PPE, what their PPE will help protect against, and how to care for their PPE is essential for their safety. However, only 3.2% nurses had training on use of PPE.

The availability of PPE and their consistent, proper use by healthcare providers and public health professionals is a crucial factor in combating any infectious disease in a crisis

(Sharma et al., 2020). In M Abdur Rahim Medical College Hospital, 80.5% respondents always had easy access of PPE while 19.5% respondents sometimes had easy access of PPE.

Most of the nurses had knowledge on types of PPE that should be used while providing direct care to COVID19 patient, while aerosol-generating procedures performed on COVID-19 patients and pre-donning instruction. However, 38.9% nurses did not know that health worker should be eaten, well hydrated and has used the rest room before donning. Again, 61.1% respondents did not know the correct sequences of putting on PPE (Gown, Mask, Respirator, Goggles or face shield and finally Gloves). PPE provides a physical barrier to the transmission of infectious particles present in bodily fluids. It also protects patients from transmission via the contaminated hands or clothing of healthcare staff (Brown et al., 2019).

The meta-analysis of Tabatabaeizadeh (2021) suggests that there is association between face mask use and reduction of COVID-19. However, 10.8% nurses did not know that they should inspect the mask for tears or holes, 29.7% did not know that white side should be inside of the mask.

Among the 185 nurses, 35.7% respondents did not know the correct sequences of putting off PPE (Gloves, Gown, Goggles or face shield and finally Mask/ respirator). Majority of the nurses had knowledge on correct methods of safely removal of gloves, gown. The study of Alao et al. (2020) reported that only 6.6% respondents had correct knowledge on donning of PPE while 40.0% knew the correct knowledge on doffing of PPE. The dissimilarity of results might be due to the study place and study population. The study of Alao et al. (2020) was conducted in Nigeria and they included all category of health workers.

The current study found that 61.1% nurses had good knowledge on PPE while 38.9% nurses had poor knowledge on PPE. Different studies reported different results regarding this issue. Study of Hossain et al. (2021) found that 99.5% health workers of Bangladesh had good knowledge while the study of Saha et al. (2020) found that 73.6% nurses had good knowledge on PPE. The study of Alao et al. (2020) reported that 25.0% health workers in Nigeria had knowledge on PPE. The

dissimilarity of results might be due to the study place and study population.

While observing the practice of nurses, it was found that 27.6% did not wear mask properly. Wearing the mask under the nose, could hamper the preventive effect of mask. Neuwirth, et al. (2020) also found that many health workers were not wearing masks properly.

Healthcare professionals' hands are the typical leading vehicle for transmitting healthcare-associated pathogens from patient to patient and patient to healthcare professionals and within the healthcare environment (Verbeek et al., 2020). Hand hygiene is a crucial measure for preventing the spread of pathogens and reducing healthcare-associated infections (Mehta et al., 2014). Unfortunately, hand hygiene was properly maintained by only 12.4% nurses.

Only 15.1% nurses doffed PPE properly. Study of Karim et al. (2020) reported that 76.4% Bangladeshi healthcare workers maintained aseptic precautions for donning/doffing. The dissimilarity of finding might be due to the study methodology. The study of Karim et al. (2020) was an online survey where respondents' responses were not verified. So, there were chances of biasness. But, the present study collect practice related data by observation where the actual fact is visible.

Majority of the nurses (56.6%) of the present study had good practice on PPE 45.4% had poor practice. This finding was consistent with other studies. The study of Hossain et al. (2021) reported that 51.7% health workers had good practice while the study of Saha et al. (2020) reported that 73.2% health workers had good practice.

Several factors found to be associated with the level of knowledge and practice of nurses on PPE. Nurses working in COVID-19 unit had significantly more good knowledge than nurses working in non-COVID-19 unit (p<0.001). The availability of PPE was also a factor of having good knowledge of the nurses (p=0.004).

Results showed that nurses who had working experience < 1 year had significantly more good practice than others (p=0.008).Nurses working in

COVID-19 unit had significantly more good practice than nurses working in non-COVID-19 unit (p<0.001). This might be due to the fear of getting infected from COVID-19 unit patients. This result was consistent with the result of Neuwirth et al. (2020) where found that adherence to PPE was more in COVID-19 unit than others. The availability of PPE was also a factor of having good practice of the nurses (p=0.004). If nurses are well equipped, they can practice properly.

Nurses who had good knowledge had significantly more good practice than nurses who had poor knowledge (p<0.001). There is a link between knowledge and practice. It is essential to have adequate knowledge to do adequate practice (Ramachadran, 1976).

CONCLUSION

Majority of the nurses had good knowledge and practice on PPE. Level of knowledge was significantly associated with availability of PPE and working department. Level of practice was significantly associated with work experience, availability of PPE and working department. Respondents who had good knowledge had significantly more good practice than respondents who had poor knowledge. Training sessions regarding the use of PPE, along with more provision of PPE, should be carried out to control and prevent COVID-19 infection.

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