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Original Article

Assessment of Knowledge, Attitude, and Practices of Personal Protective Equipment among Health Care Providers in Tamil Nadu, South India

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ABSTRACT

Introduction: Personal protective equipment provides considerable protection from hospital-acquired infections. Ample knowledge with a positive attitude and best practices of personal protective equipment by healthcare workers is indispensable to get protection themselves and to serve humanity. The study aimed to assess the knowledge, attitude, and practice (KAP) regarding personal protective equipment (PPE) among healthcare workers along with possible determinant factors.

Methods: An observational cross-sectional study was conducted from August - September 2022 among 386 healthcare workers in Tamil Nadu, South India. The structured self-administered questionnaire was used for data collection. The study comprised questions evaluating a socio-demographic profile, knowledge, attitude, and practice of personal protective equipment. Descriptive statistics (percentage, frequency, mean) and inferential statistics (Chi-square test) were used for the data analysis.

Results: The overall knowledge of the participants was satisfactory (73.3%). Physicians had a good knowledge level against non-physicians ($p<0.05$). It was observed that the 30 and more years of experience group has less knowledge ($p<0.05$). A positive attitude toward PPE was noted in 58.3% of the participants. Statistical significance in the attitude of participants with education, occupation, and experience was not observed ($p>0.05$). Good practice of PPE was followed by 66.8% of participants. Nurses (91.7%) showed good practice of PPE than physicians and laboratory technicians and was found to be statistically significant ($p<0.05$).

Conclusion: The findings demonstrated that most healthcare workers had an overall good knowledge, positive attitude, and good practice regarding PPE however they need periodical training and auditing.

Keywords: Attitude, health care workers, knowledge, personal protective equipment, practice.

Introduction

The first case of COVID-19 outbreak was reported from Hubei province in central China on 29 December 2019.[1,2] Since then the infection spread rapidly all across the world and the World Health Organization (WHO) on March 11, 2020, declared it a COVID-19 pandemic.[3] As COVID-19 is highly infectious and is transmitted from one person to another through close contact and respiratory droplets along with airborne transmission makes healthcare workers (HCWs) vulnerable to contracting the disease.[4-7]

A large proportion of HCWs tested positive and some have succumbed to COVID-19 around the world.[7] According to WHO estimates, around 14% of those affected are HCWs.[8] Hence securing the HCWs is compelling to the healthcare system which was already been burdened by the pandemic.[3] But the well-being of HCWs was foremost for the betterment of society.[8] WHO and the Center for Disease Control and Prevention (CDC) updated infection prevention guidelines by the end of January 2020.[9,10] Strict and flawless usage of personal protective equipment (PPE) by health care professionals not only helps in drastically reducing infection rates among front-line HCWs but also the society can be served better.[9] Compliance with infection prevention control practices, periodic education, and monitoring are the crucial components of risk management training in healthcare settings.[11,12] Requisite knowledge, positive attitude, and correct practices influence the accurate use of PPE.[9] Lacunae in any of the parameters may produce a negative impact on the health care system.[11,12] Studies during previous pandemics in the past also disclose the same.[13-16] However, there is a vast information gap in this area as there is no single study done in South India among HCWs. The present study was a multicentric study among various HCWs in Tamil Nadu, South India with the following objectives to assess the knowledge level, attitude, and practice of PPE, and to identify the gap between knowledge, attitude, and practice of PPE. Adequate knowledge and strict adherence to appropriate PPE usage can bring down hospital-acquired infection (HAI) rates.

Methods

A cross-sectional study was carried out from August -September 2022 among the healthcare workers of three tertiary care teaching hospitals in Tamil Nadu, South India. To ensure optimum coverage, data were collected using both offline and online methods. The structured questionnaire was adopted from an earlier study.[17] Data were collected through face-to-face interviews from tertiary care hospitals in Chennai. The questionnaires were incorporated into Google Forms in the web-based approach. The required sample size was calculated as 384, anticipating a population proportion of 50%, a confidence interval of 95%, and a relative precision of 10% (of 50%), since there were no previous studies in this area.[18] HCWs including doctors, nurses, pharmacists, and lab technicians, above 18 years of age, those who worked actively during the COVID-19 pandemic, and who consented were included in this study. Confidentiality was maintained. Incomplete forms were excluded from the study.

The study comprised questions evaluating the socioeconomics, knowledge, attitude, and practice of HCWs regarding PPE. Demographic characteristics included gender, age, marital status, household members, occupation, and job experience. Work-related factors encompassed the type of establishment and placement of the workplace of healthcare providers in the workplace, duty hours, place of living during that time, and transportation facilities towards the workplace.

Ten questions were incorporated in the knowledge section, each question had a 'Yes' or 'No' answer option. One mark was assigned for the correct response and zero for the wrong response. Total scoring ranged from 0 to 10. Scores of 0-2 were considered as very poor knowledge, 3-4 as poor knowledge, 5-6 as average knowledge, participants with scores of 7-8 had satisfactory knowledge, and 9-10 had excellent knowledge regarding PPE in preventing Covid 19.

The attitude section had 8 questions, and responses to each question were documented on a

5-point Likert scale as follows: strongly agree (5-point), agree (4-point), neutral (3-point), disagree (2-point), and strongly disagree (1-point). The total score ranged from 8 to 40. A score of 8 was considered as a very poor attitude, 9-16 had a poor attitude, 17-24 had an average attitude, 25-32 had a good attitude, and above 33 had a very good attitude towards PPE.

The practice section comprised 14 items, and each item comprised two responses: Yes (1-point) and No (0-point). Practice items total score ranged from 0 to 14. A score below 2 indicated very poor practice, a score of 3-5 poor practice, 6-8 was average practice, 9-11 was good practice, and 12 and above was very good practice towards standard precautions. Questionnaires also assessed the perception of HCWs regarding barriers in infection control practice.

The study was approved by the Institutional Research Committee and Institutional Ethical Committee (SP No 2/July/22) of Tagore Medical College and Hospital, Chennai, Tamilnadu. Written and electronic Informed consent was obtained during the face-to-face interview and web-based questionnaires respectively from all the participants involved in the study. The nature, purpose, and objective of the study were clearly stated along with the declaration of confidentiality and anonymity.

All categorical variables were expressed as frequencies and percentages. The association between different responses was analyzed using the Chi-square test of independence. R studio version 4.2.2 was used for statistical analysis.

Results

A total of 386 participants participated in the study. Female preponderance was observed with 240 (62.2%) female respondents in the study. The mean age group and standard deviation of the participants was 34.75 ± 11.15. The majority of people were in the age group of 21-30 constituted 198 (51.3%), followed by 89 (23.1%) participants in the 31-40 years of age group. Based on occupation, the participants were stratified as physicians, nurses, pharmacists, lab technicians, and housekeeping staff. The majority of the participants were doctors and accounted for 292 (75.5 %) of the total participants, followed by 60 (15.5%) nurses and the rest 34 (9%) constituted lab technicians, pharmacists, and housekeeping staff. There were 250 (64.8%) graduates. The median experience of the participants was 5 years. A total of 254 (65.8%) participants surveyed had experienced between 0-10 years, and the rest 62 (16.1%), 45 (11.7%) and 25 (6.5%) had 11-20 years, 21-30 years and 31-40 years of experience respectively. Out of the total 387 participants, 167 (43.3%) of them were posted in the wards. The work area included the emergency department, Intensive Care Units (ICUs), and laboratories. The socio-demographic and work-related profile of the participants is given in (Table 1).

Table 1: The socio-demographic profile and work-related characteristics of participants

Variables		No. of participants (n=386)
Age group	20 and below	1 (0.3%)
	21-30 years	198 (51.3%)
	31-40 years	89 (23.1%)
	41-50 years	39 (10.1%)
	51-60 years	55 (14.2%)
	61 and above	4 (1%)
Sex	Male	146 (37.8%)
	Female	240 (62.2%)
Marital Status	Married	217 (56.2%)
	Unmarried	128 (33.2%)
	Single	40 (10.3%)
	Separated	1 (0.3%)

Education	Diploma	23 (5.9%)
	Graduate	250 (64.8%)
	Masters	106 (27.5%)
	PhD	7 (1.8%)
Occupation	Physician	292 (75.6%)
	Nurses	60 (15.5%)
	Pharmacist	5 (1.4%)
	Laboratory Technicians	20 (5.2%)
	Housekeeping staff	9 (2.3%)
Work Experience	0-10 years	254 (65.8%)
	11-20 years	62 (16.1%)
	21-30 years	45 (11.7%)
	31-40 years	25 (6.4%)
Work Place	Emergency Department	74 (19.2%)
	ICU	22 (5.7%)
	Wards	167 (43.3%)
	Laboratory	123 (31.9%)

Of 386 participants, 283 (73.3%) had very excellent knowledge. Of 292 physicians 212 (72.6%) and among 60 nurses 51 (85%) had excellent knowledge of PPE. The knowledge level when compared with education, participants with doctoral degrees had excellent knowledge 7 (100%), followed by postgraduate degree holders 86 (81.1%). A good knowledge level was noticed among participants within 10 years of experience 198(78%). All the respondents had very good knowledge about the necessity, 5 moments, and steps of hand hygiene. In the present study, the results indicated that an overwhelming majority of 368 (95.5%) of them were aware of the correct procedure for donning and doffing personal protective equipment (PPE). The knowledge level of usage of N95 or equivalent masks was 67.4% (260). A discordant response was noticed in the questionnaire about N95 masks. Table 2 shows the comparison of knowledge level with occupation, education, and experience.

Table 2: Comparison of knowledge level with occupation, education, and experience (n=386)

	Knowledge				**p-value**
	Average	**Satisfactory**	**Excellent**	**Total**	
Occupation					
Physician	3(1%)	77(26.4%)	212(72.6%)	292(100%)	
Nurses	1(1.7%)	8(13.3%)	51(85%)	60(100%)	
Pharmacists	0(0%)	3(60%)	2(40%)	5(100%)	0.025
Lab Technician	0(0%)	6(30%)	14(70%)	20(100%)	
Housekeeping	1(11.1%)	4(44.4%)	4(44.4%)	9(100%)	
Education					
UG	5(2%)	73(29.2%)	172(68.8%)	250(100%)	
PG	0(0%)	20(18.9%)	86(81.1%)	106(100%)	0.118
Diploma	0(0%)	5(21.7%)	18(78.3%)	23(100%)	
PhD	0(0%)	0(0%)	7(100%)	7(100%)	
Experience					
0 to 10 years	5(2%)	51(20%)	198(78%)	254(100%)	
11 to 20 years	0(0%)	15(24.2%)	47(75.8%)	62(100%)	0.002
21 to 30 years	0(0%)	21(46.7%)	24(53.3%)	45(100%)	
31 to 40 years	0(0%)	11(44%)	14(56%)	25(100%)	

On analysis of knowledge with occupation, physicians had a higher knowledge level than the other group of participants ($p<0.05$). As far as the experience is concerned, with 30 years and more experience group showed less knowledge which was statistically significant ($p<0.05$). On comparative analysis, knowledge level does not have much difference between the education of the participants ($p>0.05$) (table 2).

A comparison of attitude with occupation, experience, and education is shown in Table 3. The overall attitude of participants was very good with 225 (58.3%) participants showing a positive attitude. Positive attitude towards PPE was shown more by doctors (60.3%) and pharmacists (80%). Unlike knowledge level, a very good attitude was observed the most among undergraduates (62%) and participants holding diplomas (65.2%). A very good attitude response was observed among participants (28) with 21-30 years of work experience (62.2%). Only 185 (47.9%) of the participants agreed that wearing PPE would protect them from COVID-19. Even though only 92 (23.8%) respondents were satisfied with the quality of PPE they got, 163 (42%) partakers felt protected by wearing PPE. Additionally, 69 (17.9%) participants reported difficulty using PPE to treat covid 19 patients.

Table 3: Comparison of Attitude level with occupation, education, and experience (n=386)

	Attitude				p-value
	Average	**Good**	**Very Good**	**Total**	
Occupation					
Physician	6(2.1%)	110(37.7%)	176(60.3%)	292(100%)	
Nurses	1(1.7%)	27(45%)	32(53.3%)	60(100%)	
Pharmacists	0(0%)	1(20%)	4(80%)	5(100%)	0.228
Lab Technician	2(10%)	9(45%)	9(45%)	20(100%)	
Housekeeping	1(11.1%)	4(44.4%)	4(44.4%)	9(100%)	
Education					
UG	5(2%)	90(36%)	155(62%)	250(100%)	
PG	4(3.7%)	50(47.2%)	52(49.1%)	106(100%)	0.287
Diploma	1(4.3%)	7(30.4%)	15(65.2%)	23(100%)	
PhD	0(0%)	4(57.1%)	3(42.9%)	7(100%)	
Experience					
0 to 10 years	8(3.2%)	94(37%)	152(59.8%)	254(100%)	
11 to 20 years	0(0%)	31(50%)	31(50%)	62(100%)	0.336
21 to 30 years	2(4.4%)	15(33.3%)	28(62.2%)	45(100%)	
31 to 40 years	0(0)	11(44%)	14(56%)	25(100%)	

In the comparison of attitude with occupation, experience, and education, there was no statistical significance in the attitude of participants ($p>0.05$) (Table 3).

Out of the total 386 participants, 258 (66.8%) participants reported following good practice of PPE. Very good practice was noticed more among 55 nurse respondents (91.7%), followed by 64% of physicians (187). As noted in the knowledge level of participants, the doctoral degree holders (100%), postgraduate degree holders (77.4%), and diploma holders (95.7%) showed very good practice of PPE. Among 62 participants with an experience of 11-20 years, 51 (82.3%) showed very good practice, while only 9 (36%) out of 25 respondents with experience of 31-40 years showed very good practice. 331 (85.8%) of the participants used PPE regularly. As observed with a satisfactory knowledge level regarding hand hygiene 100% of the participants strictly followed the hand hygiene before and after donning and doffing respectively. Only 247 (64%) of the respondents did a fit test for N95. 139 (36%) of the HCWs were not using N95 or equivalent masks

while seeing patients. The comparison of practice with occupation, experience, and education is shown in Table 4.

Table 4: Comparison of Practice level with occupation, education, and experience(n=386)

	Practice						p-value
	Very Poor	Poor	Average	Good	Very Good	Total	
Occupation							
Physician	3(1%)	8(2.8%)	32(11%)	62(21.2%)	187(64%)	292(100%)	
Nurses	0(0%)	1(1.7%)	3(5%)	1(1.7%)	55(91.7%)	60(100%)	
Pharmacists	0(0%)	0(0%)	1(20%)	2(40%)	2(40%)	5(100%)	**0.019**
Lab Technician	0(0%)	1(5%)	4(20%)	4(20%)	11(55%)	20(100%)	
Housekeeping	0(0%)	0(0%)	2(22.2%)	4(44.4%)	3(33.3%)	9(100%)	
Education							
UG	3(1.2%)	9(3.6%)	37(14.8%)	54(21.6%)	147(58.8%)	250(100%)	
PG	0(0%)	1(0.9%)	5(4.7%)	18(17%)	82(77.4%)	106(100%)	**0.005**
Diploma	0(0%)	0(0%)	0(0%)	1(4.3%)	22(95.7%)	23(100%)	
PhD	0(0%)	0(0%)	0(0%)	0(0%)	7(100%)	7(100%)	
Experience							
0 to 10 years	3(1.2%)	10(3.9%)	27(10.6%)	41(16.2%)	173(68.1%)	254(100%)	
11 to 20 years	0(0%)	0(0%)	3(4.8%)	8(12.9%)	51(82.3%)	62(100%)	**0.001**
21 to 30 years	0(0%)	0(0%)	5(11.1%)	15(33.3%)	25(55.6%)	45(100%)	
31 to 40 years	0(0%)	0(0%)	7(28%)	9(36%)	9(36%)	25(100%)	

Good practice of PPE was most observed in 55 (91.7%) nurses followed by physicians and laboratory technicians and the difference was found to be statistically significant ($p<0.05$) (Table 4). In comparison of practice with experience, participants with 30 and more years of experience showed poor practice (Table 4) and was statistically significant ($p<0.05$). When the practice was compared with education, the undergraduates showed very poor practice compared to others ($p<0.05$) (Table 4).

Discussion

Successful management of COVID-19 became possible because of the pivotal role of healthcare workers as front-liners despite many underlying risks involved. The appropriate infection prevention practices with adequate competency enabled adequate protection.[17,19] The current study was undertaken to assess the knowledge, attitude, and practice towards PPE among HCWs during this pandemic period. To the best of our knowledge, this was the first-ever multicentric study that entirely assessed the knowledge, attitude, and practice regarding PPE among HCWs towards COVID-19 in Tamil Nadu, South India.

Young adults with an average age of 30 ± 5 years participated in the study. Females (62%) outnumbered males. In the present study, 69.8 % of the HCWs had between 0-10 years of experience and only 1.4% had experience above 30 years. Older people were at risk and more vulnerable to COVID-19 infection.[20] Hence, they were less involved as front-line workers during the pandemic. The reason for young adults outnumbering old age is also a proven statement.

All the participants were educated, with the highest degree being a doctoral and the lowest being a diploma (5.9%). Most of the participants were physicians (75.6%) with 15 years of experience. The predominant work area was the COVID ward and emergency department. This could be the reason for commendable responses to the technical questions that were asked during the data collection.

Overall, the results of the study showed that 73.3% of the participants had very good knowledge of PPE. The knowledge of PPE was statistically significant ($p<0.05$) with occupation i.e.; physicians had a good knowledge level compared with non-physicians. The housekeeping staff and pharmacist were less aware of the components of PPE and the usage of N95 or equivalent masks. The educational parameter can be a reason for this knowledge level. This was different from earlier studies from Bangladesh, China, Iran, Pakistan, and Turkey.[17,21-24] In another study from Nepal, the nurses had better knowledge of PPE.[25] HCWs with 30 and more years of experience had less knowledge of others which was statistically significant ($p<0.05$). The findings were similar to the study from Nepal.[25] This can be because they might not have played a pivotal role as front-line workers because of risk factors and also may not have been updated with precautionary steps regarding PPE and lack of digital naivety. The necessity was also less because a pandemic hasn't happened in the recent past. The present scenario necessitated training of all HCWs on the PPE irrespective of age and experience and sequentially foreseeing such an infectious emergency so that the health system can be fully equipped.

Unlike previous studies from Bangladesh, the participants had remarkable knowledge regarding the proper donning and doffing steps.[17] The study was conducted after the first wave of the pandemic and the HCWs had adequate training in infection control practices with an emphasis on donning and doffing steps.

The present study observed that 58.3% of the participants had a positive attitude toward PPE in COVID-19 management. Although the difference was noticed among HCWs, it was not statistically significant ($p>0.05$). The study was different from having a statistically significant positive attitude in previous studies.[17] The present study was undertaken in the latter stages of the second wave can be a reason for the differences. Participants found it difficult to use PPE for long hours and were not satisfied with the quality of the PPE supplied. Previous studies also underline these facts.[17]

Like knowledge level, participants with 30 years and more experience group also showed poor practice and were statistically significant ($p<0.05$). Despite participants having good knowledge of PPE, very good practice was followed by only 66.8% of the respondents. Good practice of PPE was most observed in nurses (91.7%) followed by physicians and laboratory technicians and was found to be statistically significant ($p<0.05$). Education was also an important factor in influencing good practices. Diploma holders and undergraduates showed statistically significant poor practices ($p<0.05$). Many of the respondents have not got or attended any training on PPE can be a reason for this difference. Earlier studies also highlight the significance of training on the flawless use of PPE.[26,27] HCWs should be updated on infection control practices. Open -WHO is an online platform providing training courses regarding correct practices of hand hygiene and the use of PPE for HCWs.

Working hours and workplace also influence good practice. The long hospital shifts made some of the participants use minimal PPE which is not advisable. Further, the healthcare workers compromise on donning appropriate PPE because of the poor quality. As in previous studies, in the present study also the participants complained about minimized airflow, reduced dexterity, impaired visibility, and back pain in turn affecting compliance and thereby putting HCWs at risk of infection.[28, 29, 30]

Participants found it difficult to dispose of gloves each time they saw a patient because of inadequate supply.[25,31] Many of the respondents

sanitized and reused the gloves. Participants also found it difficult to use designated doffing rooms for doffing. This was another constraint for the HCWs, especially during the first and second wave peak of the COVID-19 pandemic. Previous studies also state the same scenario.[32,33,34,35]

In addition, as the study was conducted through a hybrid self-administered questionnaire, we could not observe the practice of PPE used by online participants and rather had to rely on self-reported assessment for that.[36]

Conclusions

The COVID-19 pandemic has given the healthcare system an alarming signal to brace itself for any infectious emergencies. Health systems around the world should take necessary steps with an emphasis on infection prevention practices. PPE should be procured in adequate quantity without compromising the quality. National state or regional level or in-house proper training to be given to all HCWs, to serve the communities better and to protect themselves. The current study is a distinctive one as it is multicentric and the first from Tamil Nadu, South India where knowledge, attitude, and approach of HCWs regarding the use of PPE were assessed.

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