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KNOWLEDGE AND UTILIZATION OF PERSONAL PROTECTIVE EQUIPMENT AMONG HEALTHCARE PROFESSIONALS IN PUNJAB, PAKISTAN

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Abstract

Objective: *Given the severe consequences associated with this disease, the present study aimed to assess the knowledge, attitudes, and practices regarding the availability and use of personal protective equipment (PPE) among healthcare workers and medical students.*

Methods: *A cross-sectional study was conducted using a non-probability convenience sampling technique. Data were collected through a self-administered online questionnaire completed by participants in direct contact with COVID-19 patients, including doctors, medical students, nurses, and paramedical staff. The study was carried out in various medical colleges and hospitals across Lahore over a one-week period (26/05/2021 – 04/06/2021). Data analysis was performed using SPSS Version 22, and findings were compared against guidelines from the World Health Organization (WHO). Ethical approval for the study was obtained from the Ethics Review Committee of the Specialized Healthcare and Medical Education Department, Lahore.*

Results: *A total of 604 responses were analyzed, with a mean participant age of 31 ± 9.3 years; 323 (53.5%) were male. The majority of responses were from doctors (68.4%). Only 244 (40.5%) participants reported prior exposure to PPE. Nearly all respondents were unaware of the WHO guidelines for PPE use and its conservation strategies during times of shortage. The combination of inadequate knowledge and limited proficiency in PPE use placed additional strain on already scarce PPE resources. As WHO recommendations for PPE use during the pandemic evolved with emerging evidence, the rapid depletion of PPE supplies prompted global measures to implement conservation strategies.*

Conclusion: *PPE is a critical component for ensuring the safety of healthcare workers and should be used in accordance with established guidelines. This study highlights a significant gap in awareness and proper use of PPE, underscoring the need for targeted educational interventions.*

INTRODUCTION

The COVID-19 pandemic has underscored the critical importance of personal protective equipment (PPE) in safeguarding healthcare professionals against infection and ensuring continuity of essential medical services. In Pakistan, the pandemic exposed significant vulnerabilities in the healthcare system, notably due to inconsistent guidelines and widespread shortages of PPE, particularly burdening low- and middle-income regions like Punjab (Haq et al., 2023). Inadequate education on the correct donning and doffing of PPE posed further risks, compromising healthcare workers' safety (Haq et al., 2023). Within this context, exploring the current levels of knowledge and utilization of PPE among healthcare professionals in Punjab is timely and essential.

Studies from Pakistan have revealed variation in PPE-related knowledge and practice across different healthcare settings. A study in Peshawar reported that although healthcare professionals generally displayed good knowledge and attitudes toward PPE, notable gaps remained—particularly in practical usage (Adeel et al., 2025). In Lahore, an assessment of nurses at a tertiary care hospital found that two-thirds demonstrated good knowledge of PPE, yet inconsistencies persisted in actual use, with only one-third acknowledging routine PPE use as significantly reducing infection risk (Hussain et al., 2024). Meanwhile, research in Karachi demonstrated that approximately 70% of healthcare professionals had very good knowledge of standard precautions—but nurses lagged behind doctors in their comprehension (Dhedhi et al., 2021). These regional findings illustrate both strengths and deficiencies in PPE-related practices, underscoring the need to map knowledge and behavior across Punjab.

Despite the growing body of research within Pakistan, systematic investigation of PPE knowledge and utilization among healthcare professionals across Punjab remains limited. Given the province's sizable and diverse healthcare workforce—including doctors, nurses, medical students, and paramedics—understanding their awareness, attitudes, and behaviors is vital for developing targeted training and resource-allocation strategies. Therefore, the present study aims to assess the levels of knowledge and utilization of PPE among healthcare professionals and medical students in Punjab, Pakistan, to inform evidence-based interventions that strengthen infection control practices.

1. Materials and Methods

This cross-sectional study was conducted between May and June 2021 using a non-probability convenience sampling technique. Ethical approval was obtained from the Institutional Review Board of the Specialized Healthcare and Medical Education Department, Lahore. No personal identifiers were collected from participants to maintain confidentiality.

A self-administered online questionnaire was distributed to healthcare workers (HCWs) directly involved in the care of COVID-19 patients. Eligible participants included on-call physicians (emergency physicians, internists, hospitalists, infectious disease specialists, surgeons, etc.), nurses, patient care or nursing attendants, laboratory technicians, and medical students.

Data analysis was performed using SPSS Version 22. Demographic characteristics were summarized using descriptive statistics, with continuous variables presented as mean and standard deviation, and categorical variables reported as frequencies and percentages. Associations between variables were assessed using the Chi-square test, with a p-value of <0.05 considered statistically significant.

Operational Definitions

- **COVID-19:** Coronavirus disease 2019, an infectious illness caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (15).
- **Probable Case:** An individual who tests positive using a validated SARS-CoV-2 nucleic acid test or in whom the virus is identified through electron microscopy (16).
- **Suspected Case:** A person presenting with high fever (>38°C), cough, or difficulty breathing, with a history of contact with a confirmed or suspected COVID-19 case, and/or travel to an area affected by the COVID-19 pandemic (16).
- **Personal Protective Equipment (PPE):** Specialized gear designed to protect healthcare personnel from exposure to infectious agents, including gloves, face masks, protective eyewear, face shields, N95 respirators, and protective clothing (e.g., reusable or disposable gowns).

- **Healthcare Workers (HCWs):** Employees of a healthcare facility or emergency medical system who interact closely with patients. For the purpose of this study, HCWs were categorized into doctors (postgraduate house officers, trainees, residents, and consultants), nurses, technicians, and ancillary staff.
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2. Results

Table 1: Basic Demographics of Sample (n = 604)

Characteristic	N (%) or Mean ± SD
Age (years)	31 ± 9.3
Gender	
Male	323 (53.5%)
Female	275 (45.5%)
Prefer not to say	6 (1.0%)
Profession	
Doctors	413 (68.4%)
Students	141 (23.3%)
Nurses & Paramedics	50 (8.3%)
Department	
Medicine & Allied	252 (42.5%)
Medical College	141 (23.8%)
Surgery & Allied	103 (17.4%)
Emergency Medicine	28 (4.7%)
Other	69 (11.7%)
Hospital Type	
Private	372 (61.6%)
Public	232 (38.4%)

The study included a total of 604 participants with a mean age of 31 ± 9.3 years. More than half of the respondents were male (53.5%), followed by females (45.5%), and a small proportion preferred not to disclose their gender (1.0%). The majority of participants were doctors (68.4%), with medical students comprising 23.3% and nurses or paramedics making up 8.3%. In terms of departmental affiliation, the largest group worked in Medicine and Allied specialties (42.5%), followed by those from medical colleges (23.8%), Surgery and Allied (17.4%), Emergency Medicine (4.7%), and other departments (11.7%). Most respondents were employed in private hospitals (61.6%), while 38.4% worked in public sector facilities.

Table 2. Knowledge and Utilization of PPE among Healthcare Professionals

No.	Question	Total (N=604)	Doctor n=413 (68.4%)	Nurses & Paramedics n=50 (8.3%)	Medical Students n=141 (23.3%)	Private n=372 (61.6%)	Public n=232 (38.4%)
1	Have you ever used PPE before this Covid-19 pandemic? [people who said yes are reported]	244 (40.5%)	175 (42.5%)	37 (74.0%)	32 (22.7%)	197 (53.1%)	47 (20.3%)

2	Have you ever heard of PPE before this Covid-19 pandemic? [people who said yes are reported]	363 (60.1%)	255 (61.7%)	43 (86.0%)	65 (46.1%)	247 (66.4%)	116 (50.0%)
3	Does your institute/hospital have an awareness and training session on PPE?	384 (63.6%)	282 (68.3%)	39 (78.0%)	63 (44.7%)	277 (74.5%)	107 (46.1%)
4a	Where did you get the information on PPE use? a. Internet	300 (49.7%)	175 (42.4%)	17 (34.0%)	108 (76.6%)	148 (39.8%)	152 (65.5%)
4b	Where did you get the information on PPE use? b. Respected Institute	287 (47.5%)	225 (54.5%)	33 (66.0%)	29 (20.6%)	215 (57.8%)	72 (31.0%)
4c	Where did you get the information on PPE use? c. Other	17 (2.8%)	13 (3.1%)	0 (0.0%)	4 (2.8%)	9 (2.4%)	8 (3.4%)
5	Would you like to have a formal teaching session on PPE?	470 (77.9%)	311 (75.5%)	39 (78.0%)	120 (85.1%)	280 (75.5%)	190 (81.9%)
6	Do you think that you can still get infected with COVID-19 despite wearing PPE?	475 (78.6%)	331 (80.1%)	34 (68.0%)	110 (78.0%)	296 (79.6%)	179 (77.2%)
7	Is your hospital adequately supplying the health care workers with PPE?	398 (65.9%)	281 (68.0%)	42 (84.0%)	75 (53.2%)	279 (75.0%)	119 (51.3%)
8	Are you satisfied with the supply	346 (57.3%)	244 (59.1%)	40 (80.0%)	62 (44.0%)	251 (67.5%)	95 (40.9%)

	of PPE at your hospital?						
9	Do you think your colleagues are adhering to the PPE protocols?	392 (64.9%)	246 (59.6%)	40 (80.0%)	106 (75.2%)	255 (68.5%)	137 (59.1%)
10	Are you aware of the PPE conservation strategy by the CDC?	275 (45.4%)	193 (46.7%)	37 (74.0%)	45 (31.9%)	196 (52.7%)	79 (34.1%)
11	Do you think N95 respirators are compulsory to wear while providing direct care to all COVID-19 patients? [No]	81 (13.4%)	61 (14.8%)	6 (12.0%)	14 (9.9%)	46 (12.4%)	35 (15.1%)
12	Is N95 respirator necessary while performing aerosol-generating procedures on COVID-19 patients? [Yes]	596 (98.7%)	408 (98.8%)	50 (100.0%)	138 (97.9%)	368 (98.9%)	228 (98.3%)
13	Do you think it is necessary to change PPE while visiting COVID-19 diagnosed patients when visibly contaminated? [Yes]	540 (89.4%)	372 (90.1%)	49 (98.0%)	119 (84.4%)	338 (90.0%)	202 (87.1%)
14	Do you think cloth face covering can be used as an alternative to face masks as a part of PPE? [No]	503 (83.3%)	364 (88.1%)	35 (70.0%)	104 (73.8%)	311 (83.6%)	192 (82.8%)
15	Which type of gown do you think should be	120 (19.9%)	72 (17.4%)	6 (12.0%)	42 (29.8%)	70 (18.8%)	50 (21.6%)

	preferred during this pandemic? [Reusable]						
16a	Do you think it is compulsory to wear PPE in the following cases? a. Covid-19 [Yes]	597 (98.8%)	410 (99.3%)	49 (98.0%)	138 (97.9%)	366 (98.4%)	231 (99.6%)
16b	Do you think it is compulsory to wear PPE in the following cases? b. Tuberculosis [Yes]	421 (69.7%)	281 (68.0%)	35 (70.0%)	105 (74.5%)	284 (76.3%)	137 (59.1%)
16c	Do you think it is compulsory to wear PPE in the following cases? c. AIDS [No]	427 (70.7%)	301 (72.9%)	28 (56.0%)	98 (69.5%)	262 (70.4%)	165 (71.1%)
16d	Do you think it is compulsory to wear PPE in the following cases? d. H1N1 Pneumonia [Yes]	457 (75.7%)	320 (77.5%)	38 (76.0%)	99 (70.2%)	289 (77.7%)	168 (72.4%)
17a	Do you think health care practitioner should wear PPE for the following? a. Suspected COVID-19 Cases [No]	18 (3.0%)	9 (2.2%)	3 (6.0%)	6 (4.3%)	5 (1.3%)	13 (5.6%)
17b	Do you think health care practitioner should wear PPE for the following? b. Confirmed COVID 19 cases [Yes]	602 (99.7%)	413 (100.0%)	49 (98.0%)	140 (99.3%)	371 (99.7%)	231 (99.6%)
17c	Do you think health care practitioner should wear PPE for the following?	53 (8.8%)	21 (5.1%)	5 (10.0%)	27 (19.1%)	21 (5.6%)	32 (13.8%)

	c. Emergency triage area [No]						
18a	Which components of PPE can be reused in multiple confirmed cases of COVID 19: a. N95 Respirator [Yes]	483 (80.0%)	342 (82.8%)	41 (82.0%)	100 (70.9%)	309 (83.1%)	174 (75.0%)
18b	Which components of PPE can be reused in multiple confirmed cases of COVID 19: b. Surgical mask [Yes]	136 (22.5%)	95 (23.0%)	12 (24.0%)	29 (20.6%)	92 (24.7%)	44 (19.0%)
18c	Which components of PPE can be reused in multiple confirmed cases of COVID 19: c. Gloves [No]	530 (87.7%)	376 (91.0%)	36 (72.0%)	118 (83.7%)	327 (87.9%)	203 (87.5%)
18d	Which components of PPE can be reused in multiple confirmed cases of COVID 19: d. Goggles [Yes]	485 (80.3%)	340 (82.3%)	38 (76.0%)	107 (75.9%)	307 (82.5%)	178 (76.7%)
18e	Which components of PPE can be reused in multiple confirmed cases of COVID 19: e. Gown [Yes]	217 (35.9%)	125 (30.3%)	20 (40.0%)	72 (51.1%)	132 (35.5%)	85 (36.6%)

Table 2 presents the responses from 604 healthcare professionals and medical students regarding their awareness, attitudes, and practices related to Personal Protective Equipment (PPE) before and during the COVID-19 pandemic. The table breaks down responses by profession (doctors, nurses & paramedics, medical students) and hospital setting (private vs. public). Key findings show that only 40.5% had prior PPE use experience, while 60.1% had heard of PPE before COVID-19. Awareness and training sessions were more prevalent in private institutions (74.5%) than public ones (46.1%). The internet and respected institutes were the main sources of PPE information. While most respondents expressed interest in formal PPE training, gaps remain in satisfaction with PPE supply and awareness of CDC conservation strategies, with public sector respondents showing lower figures across several indicators. The findings reveal that only 13.4% correctly identified that N95 respirators are not compulsory for all COVID-19 direct care, while almost all (98.7%) recognized their necessity during aerosol-generating procedures. A large majority (89.4%) agreed on changing PPE when visibly contaminated, and 83.3% rejected cloth masks as substitutes. Awareness about preferring reusable gowns was notably low (19.9%). PPE was overwhelmingly deemed necessary for COVID-19 and other infectious diseases, but awareness was lower for tuberculosis (69.7%) and AIDS (70.7%). Knowledge of WHO guidance against PPE use for suspected COVID-19 cases and in emergency triage areas was minimal (3.0% and 8.8%, respectively). While most participants recognized that N95 respirators (80.0%) and goggles (80.3%) can be reused, fewer identified surgical masks (22.5%) and gowns (35.9%) as reusable, indicating persistent gaps in understanding PPE conservation and rational use.

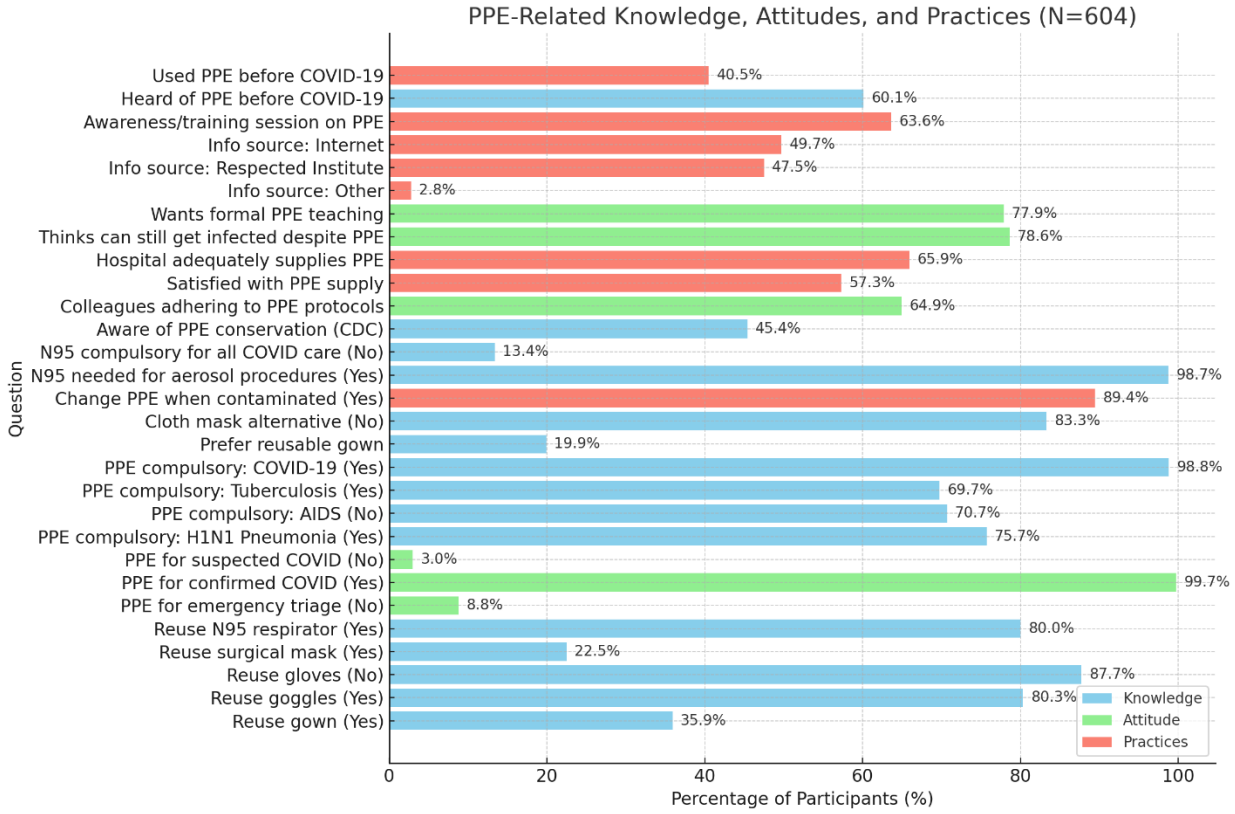

Figure 1: PRE-Knowledge, Attitude and Practices among Healthcare Professionals

3. Discussion

The mixed picture observed in this study—high endorsement of PPE for confirmed COVID-19 and aerosol-generating procedures (AGPs) but notable gaps in conservation knowledge and reuse—aligns with multi-country KAP studies showing that healthcare workers (HCWs) generally uphold core risk-reducing behaviors while struggling with nuanced, evolving guidance. Surveys from Pakistan, Egypt, and Qatar have similarly reported good overall awareness alongside uneven adherence and resource-driven variability, mirroring the lower satisfaction with supply and reduced awareness of conservation strategies in public facilities seen in our data (El-Sokkary et al., 2021; Alah et al., 2022; Yusuf et al., 2023). Consistent with our findings, expert guidance emphasizes that N95 respirators are specifically warranted for AGPs rather than all direct care, a distinction many respondents missed—an uncertainty also noted in clinical practice where AGP lists and requirements differ across institutions (Klompas, 2021; Society for Healthcare Epidemiology of America [SHEA], 2020).

The finding that most participants rejected cloth masks as a PPE substitute aligns with randomized trial evidence showing inferior protection of cloth masks compared with medical masks or respirators in healthcare settings (MacIntyre et al., 2015) and population-based studies demonstrating a clear protective gradient favoring respirators over surgical and cloth masks (Andrejko et al., 2022). Low preference for reusable gowns and uncertainty about gown reuse mirror early-pandemic global confusion; however, laboratory and economic analyses indicate that reusable gowns can provide robust barrier protection and greater supply resilience (McQuerry, 2020/2021), and conservation frameworks, including extended use and reuse under defined conditions, are well established (Centers for Disease Control and Prevention [CDC], 2024). Finally, the finding that many respondents relied on internet sources rather than institutional training echoes observations from implementation studies showing that structured institutional programs, such as on-site audits and coaching, significantly improve correct PPE use—supporting the recommendation for expanded formal training, especially in public facilities (Shehab et al., 2021).

4. Conclusion

Based on the findings, the study concludes that while healthcare professionals demonstrated strong awareness of PPE use for high-risk situations such as aerosol-generating procedures and confirmed COVID-19 cases, significant knowledge gaps remain regarding PPE conservation strategies, appropriate reuse, and its application in non-COVID infectious diseases. Satisfaction with PPE supply and formal training opportunities was notably lower in public sector facilities, underscoring the need for targeted capacity-building initiatives, consistent supply chains, and evidence-based institutional training programs to ensure optimal and rational PPE use across all healthcare settings.

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