

**KAPB STUDY ON USE OF PERSONAL PROTECTIVE EQUIPMENT BY HEALTH  
CARE PERSONNEL IN A COVID-19 FACILITY****Sujata Banerjee<sup>1\*</sup>, Aniruddha Malgaonkar<sup>2</sup> and Sundaram Kartikeyan<sup>3</sup>**<sup>1</sup>Junior Resident-1, Department of Community Medicine, Rajiv Gandhi Medical College, Kalwa, Thane-400605, Maharashtra, India.<sup>2</sup>Assistant Professor, Department of Community Medicine, Rajiv Gandhi Medical College, Kalwa, Thane-400605, Maharashtra, India.<sup>3</sup>Professor and Head, Department of Community Medicine, Rajiv Gandhi Medical College, Kalwa, Thane-400605, Maharashtra, India.**\*Corresponding Author: Dr. Sujata Banerjee**

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**ABSTRACT**

This cross-sectional descriptive study was conducted on medical, paramedical and housekeeping staff, of either sex, in a designated COVID-19 facility in Maharashtra state. After explaining the purpose of the study to participants, their informed consent was obtained. A pre-tested and pre-validated questionnaire was used for interviewing the participants, at their convenience. The gender differences in age were not significant for medical ( $Z=1.878$ ;  $p=0.060$ ), paramedical ( $Z=1.705$ ;  $p=0.089$ ) and housekeeping personnel ( $Z=0.537$ ;  $p=0.589$ ). The gender differences in duration of COVID-19 duty were not significant for medical ( $Z=0.695$ ;  $p=0.490$ ), paramedical ( $Z=1.215$ ;  $p=0.222$ ) and housekeeping personnel ( $Z=1.699$ ;  $p=0.089$ ). Significant gender difference ( $Z=2.031$ ;  $p=0.042$ ) was seen between paramedical staff who had used personal protective equipment before COVID-19 pandemic, but these gender differences were not significant amongst medical and housekeeping staff. This study has revealed gaps in the existing knowledge, attitude, practice and behaviour of health care personnel in relation to use of personal protective equipment and has drawn attention to missed opportunities for their training and re-training. Health care facilities ought to prepare for future pandemics by establishing norms and periodically auditing the use of personal protective equipment by health care personnel.

**KEYWORDS:** Coronavirus, COVID-19, Health care personnel, KAPB, PPE.**INTRODUCTION**

Personal protective equipment (PPE) provides a physical barrier and offers protection by preventing microorganisms from contaminating hands, eyes, clothing, hair and shoes.<sup>[1]</sup> PPE should be used by all health care personnel (HCP), supporting staffs, laboratory staffs, and family care-givers in situations where there is a likelihood of contact with the patient's blood, body fluids, secretions or excretions.<sup>[2]</sup> PPE comprises protective gowns, apron, gloves, face masks/filtering face pieces (FFP2), goggles/visors, boots/shoe cover, hair cover, as indicated.<sup>[2]</sup>

The Ministry of Health and Family Welfare, Government of India has issued guidelines that emphasize correct selection and use of PPE based on the risk of infection to an individual.<sup>[3]</sup> COVID-19-related measures for personnel protection can be considered at three levels, depending on the nature and extent of contact with patients – (i) *Low-risk situations*: Personnel working in health desks, temperature recording stations, general outpatient departments and pre-examination triage

should wear disposable surgical caps and masks, uniforms, and latex gloves. (ii) *Moderate-risk situations*: HCPs in the fever clinic, isolation wards who are not attending to patients or suspects, sanitary staff and those performing non-respiratory specimen examination and imaging should use disposable surgical caps, protective masks (N95 respirator), disposable protective medical uniforms, latex gloves, and goggles. (iii) *High-risk situations*: HCPs who carry out procedures that are likely to expose them to the respiratory secretions of the patient, such as tracheal intubation, fiber-optic bronchoscopy, endoscopy, or those performing surgeries or autopsies of patients suspected or confirmed to be COVID-19 positive, should use full complement of PPE.<sup>[3]</sup>

Duty rotations and psychological interventions can help in dealing with increased work pressure, high risk of infection, inadequate protection, isolation, and exhaustion that can adversely affect their well-being and hence the quality of care provided.<sup>[4,5]</sup>

The purpose of PPE is to safeguard HCPs from infection during the course of their work.<sup>[6]</sup> Non-availability or shortage of PPE, erroneous donning and doffing processes,<sup>[7-9]</sup> and contact with potentially contaminated surfaces<sup>[8]</sup> have been reported. The high levels of violations of the donning-doffing protocol for PPE could be ascribed to the intricacy of the protocols and the necessity for training and retraining.<sup>[10]</sup>

While HCPs having poor knowledge of use of PPE can complicate the containment of infectious diseases, the HCPs themselves are at risk of contracting infections and they also function as hosts to rapidly transmit the disease within a short period.<sup>[10,11]</sup> COVID-19 infections among HCP, acquired during patient care, have been documented.<sup>[12]</sup> Pre-symptomatic or asymptomatic carriers among the HCP could have contributed to additional transmissions.<sup>[13]</sup>

Many doctors feel that they have inadequate knowledge and practical skills in infection prevention and control (IPC) and use of PPE,<sup>[14]</sup> implying an unmet need for teaching undergraduate medical students about its significance.<sup>[15]</sup> The need for greater stress on IPC in the medical curriculum was voiced by about 50% of medical students,<sup>[16]</sup> while 92.5% of medical students made procedural errors when removing PPE during training.<sup>[17]</sup> Practical PPE skills are not formally assessed during undergraduate medical education<sup>[17]</sup> and are frequently learnt from junior residents through a “hidden curriculum” during clinical placements.<sup>[18]</sup> The SARS outbreak in Hong Kong revealed flaws in medical students’ PPE skills, which triggered changes in undergraduate IPC education.<sup>[19]</sup> Unlike nursing staff, junior doctors receive less peer support for use of PPE and are more likely to accidentally transmit pathogens within a health care facility because they commonly move between different wards.<sup>[20]</sup>

For the above-mentioned reasons, it is essential that the existing knowledge, attitude, practice and behaviour (KAPB) of HCP, as well as shortcomings in the use of

PPE are identified and analyzed in various categories of HCP in order to provide them with targeted training on the correct and indication-appropriate use of PPE.

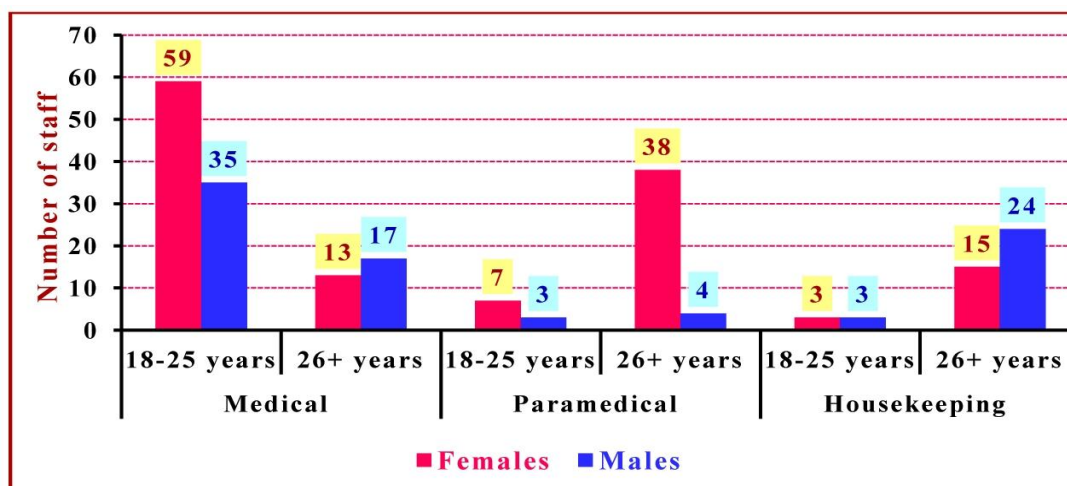
## MATERIALS AND METHODS

This cross-sectional descriptive study was conducted on medical, paramedical and housekeeping staff, of either sex, in a designated COVID-19 facility in Maharashtra state, Western India during August-September 2020. After explaining the purpose of the study, the prospective participants were assured that confidentiality and anonymity would be maintained and their informed consent was obtained. A pre-tested and pre-validated questionnaire was used for interviewing the participants, at their convenience. The data were entered in Microsoft Excel spreadsheet (Microsoft Corporation, Redmond, WA, USA) and analyzed using SPSS statistical software Windows Version 25.0 (IBM Corporation, Armonk, NY, USA). Percentage distribution was computed for discrete data. Standard error of difference between sample proportions was calculated to determine the statistical significance at  $p < 0.05$ .

## RESULTS AND DISCUSSION

**Participants:** The participants comprised – (i) 124 medical staff (females: 72; 58.06% and males: 52; 41.92%); (ii) 52 paramedical staff (females: 45; 86.54% and males: 7; 13.46%); and (iii) 45 housekeeping staff (females: 18; 40.00% and males: 27; 60.00%).

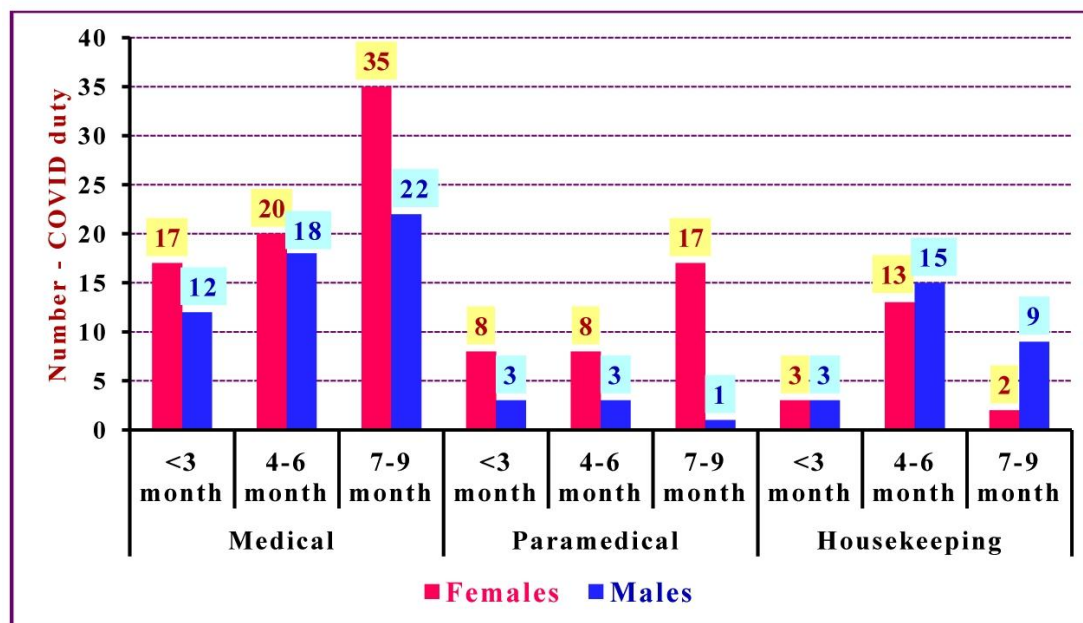
**Age distribution:** Among medical staff, 81.94% females and 67.31% males were aged between 18 and 25 years, without exhibiting significant gender difference ( $Z=1.878$ ;  $p=0.060$ ); while among paramedical staff, the age of 84.44% females and 57.14% males was above 26 years, without exhibiting significant gender difference ( $Z=1.705$ ;  $p=0.089$ ). Among housekeeping staff, the age of 83.33% females and 88.89% males was above 26 years, without exhibiting significant gender difference ( $Z=0.537$ ;  $p=0.589$ ). The age distribution of respondents is graphically depicted in Fig 1.



**Fig. 1: Age distribution of respondents.**

**Duration of duty in COVID facility:** Among medical personnel who were working in the COVID-19 facility since 7-9 months, 48.61% and 42.31% were females and males, respectively. The gender difference in duration of COVID-19 duty was also not significant ( $Z=0.695$ ;  $p=0.490$ ). Among the paramedical personnel who were working in the COVID-19 facility since 7-9 months, 37.78% and 14.29% were females and males,

respectively, without significant gender difference in duration of COVID-19 duty ( $Z=1.215$ ;  $p=0.222$ ). Among the housekeeping personnel who were working in the COVID-19 facility since 7-9 months, 11.11% and 33.33% were females and males, respectively, without significant gender difference in duration of COVID-19 duty. ( $Z=1.699$ ;  $p=0.089$ ). The distribution of duration of COVID-19 duty is graphically depicted in Fig 2.

**Fig. 2: Distribution of duration of COVID duty of respondents.****Table 1: PPE status before COVID-19 pandemic.**

Staff category and gender	Seen PPE	Actually used PPE
Female medical staff (n=72)	51 (70.83%)	14 (19.44%)
Male medical staff (n=52)	34 (65.38%)	09 (17.31%)
Female paramedical staff (n=45)	38 (84.44%)	25 (55.55%)
Male paramedical staff (n=07)	03 (42.86%)	01 (14.29%)
Female housekeeping staff (n=18)	08 (44.44%)	03 (16.67%)
Male housekeeping staff (n=27)	07 (25.93%)	01 (03.70%)

The status of PPE use before COVID-19 pandemic is depicted in Table 1. Significant gender difference ( $Z=2.031$ ;  $p=0.042$ ) was seen among female and male paramedical staff who had used PPE before COVID-19 pandemic. But the gender differences were not significant among female and male medical and housekeeping staff.

**Table 2: Gender differences in PPE training and its outcome.**

[A] Medical staff	Females (n=72)	Males (n=52)	Z value	'p' value
Has been trained in PPE use	54 (75.00%)	50 (96.15%)	3.160	0.0015 *
Correctly explains donning	50 (69.44%)	36 (69.23%)	0.025	0.976
Correctly explains doffing	43 (59.72%)	35 (67.31%)	0.862	0.389
Correctly explains decontamination	43 (59.72%)	32 (61.54%)	0.204	0.841
Removal rules are mandatory	71 (98.61%)	50 (96.15%)	0.878	0.378
[B] Paramedical staff	Females (n=45)	Males (n=07)	Z value	'p' value
Has been trained in PPE use	43 (95.56%)	06 (85.71%)	1.038	0.298
Correctly explains donning	43 (95.56%)	06 (85.71%)	1.038	0.298
Correctly explains doffing	43 (95.56%)	05 (71.49%)	2.228	0.025 *
Correctly explains decontamination	43 (95.56%)	06 (85.71%)	1.038	0.298

Removal rules are mandatory	44 (97.78%)	06 (85.71%)	1.543	0.123
[C] Housekeeping staff	Females (n=18)	Males (n=27)	Z value	'p' value
Has been trained in PPE use	17 (94.44%)	19 (70.37%)	1.977	0.047 *
Correctly explains donning	13 (72.22%)	23 (85.19%)	1.065	0.284
Correctly explains doffing	13 (72.22%)	24 (88.89%)	1.432	0.152
Correctly explains decontamination	12 (66.67%)	16 (51.85%)	0.502	0.617
Removal rules are mandatory	14 (77.78%)	24 (88.89%)	1.007	0.312

Z=Relative deviate; \*Significant

**Perceptions about PPE:** Both female and male medical personnel were self-confident about their knowledge of PPE use; were convinced about adequate protection offered by the supplied PPE and 72.22% females and 96.15% males were willing to use the provided PPE, exhibiting significant gender difference ( $Z=3.442$ ;  $p=0.0005$ ). 44 (97.78%) females and 05 (71.43%) males were self-confident about their knowledge of PPE use, with significant gender difference ( $Z=2.781$ ;  $p=0.005$ ). A higher percentage of females were convinced about adequate protection offered by the supplied PPE and expressed their willingness to use the provided PPE, without significant gender difference. 44 (97.78%) female and 22 (81.48%) male personnel were self-confident about their knowledge of PPE use, without significant gender difference ( $Z=0.304$ ;  $p=0.764$ ). A higher percentage of females were convinced about

adequate protection offered by the supplied PPE and expressed their willingness to use the provided PPE, without significant gender difference. A Nigerian study<sup>[10]</sup> reported that 60% of the HCPs believed that the supplied PPE was of reasonable quality. The paramedical personnel were more knowledgeable about donning, doffing and decontamination of PPE (Table 2) as compared their medical and housekeeping counterparts, probably because paramedical personnel are routinely exposed to using PPE during their clinical duty. Similar results have been reported by other authors.<sup>[10,21,22]</sup> Gender differences in PPE training and its outcome and problems faced by medical, paramedical and housekeeping staff during PPE use are depicted in Table 2 and Table 3, respectively.

**Table 3: Gender differences in problems faced during PPE use.**

[A] Medical staff	Females (n=72)	Males (n=52)	Z value	'p' value
Skin problems	20 (27.78%)	06 (11.54%)	2.192	0.028 *
Suffocation	13 (18.06%)	12 (23.08%)	0.687	0.490
Sweating	11 (15.28%)	15 (28.85%)	1.831	0.067
Dehydration	16 (22.22%)	15 (28.85%)	0.840	0.401
Inconvenience - menses	05 (06.94%)	...	...	...
[B] Paramedical staff	Females (n=45)	Males (n=07)	Z value	'p' value
Skin problems	25 (55.55%)	01 (14.29%)	2.031	0.042 *
Suffocation	12 (26.67%)	02 (28.57%)	0.105	0.912
Sweating	07 (15.56%)	03 (42.86%)	1.705	0.089
Dehydration	07 (15.56%)	03 (42.86%)	1.705	0.089
Inconvenience - menses	04 (08.89%)	...	...	...
[C] Housekeeping staff	Females (n=18)	Males (n=27)	Z value	'p' value
Skin problems	07 (38.88%)	02 (07.41%)	2.586	0.009 *
Suffocation	06 (33.33%)	06 (22.22%)	0.825	0.406
Sweating	04 (22.22%)	05 (18.52%)	0.304	0.764
Dehydration	03 (16.67%)	05 (18.52%)	0.159	0.872
Inconvenience - menses	05 (27.78%)	...	...	...

Z=Relative deviate; \*Significant

**Limitations:** The results of this study cannot be generalized since the study was conducted at only one COVID facility. Further, it was not possible to verify the responses to the questionnaire.

## CONCLUSION

This study has ascertained gaps in KAPB of HCP in relation to use of PPE and has drawn attention to missed opportunities for their training and re-training. Though all newly recruited HCP are exposed to orientation training in most institutions, the focus of this training may not target gaps in previously acquired KAPB and inappropriate habits developed in earlier years. There is



an obvious need for training in the correct and indication-appropriate use of PPE to protect HCP from infection by transmissible pathogens. Health care facilities ought to prepare for future pandemics by establishing a regular PPE audit for HCP.

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