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Infection Control Practices, Vaccination Status and Past Episodes among Medical Professionals in Punjab, India

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ABSTRACT

Background: Infection prevention and control practices in health care are extremely important for health workers to safeguard individual and public health. The current study (July 2023 to September 2023) was planned to understand the infection control practices, vaccination status and past infectious disease episodes among medical professionals in Punjab, India. **Methods:** Information on demography, infection control practices, infectious disease episodes, vaccination status and needle stick injury episodes was recorded using a structured questionnaire. Descriptive analyses were conducted, and univariable logistic regression was employed to understand the factors associated with hand hygiene, PPE use and infectious disease episodes. **Findings:** Of the 256 participants, 81% were female, 99% belonged to the 20–30 year age group, and 47% were 3rd year medical students. The reported hand hygiene score was 100% in 19 participants, 87.5% in 73 and 75% in 125 participants. The reported PPE use score was 100% in 188 participants, 91.7% in 38 and 87.5% in 12 participants. The odds of having a ≥90% PPE use score (%) were 0.42 (95% CI 0.18, 0.96; p-value = 0.048) in males as compared to female counterparts. The odds of experiencing an infectious disease episode were 0.38 (95% CI 0.17, 0.84; p-value = 0.019) in those having a ≥90% PPE use score (%) as compared to those having a score of <90%.**Conclusion:** Overall, the current study provides valuable information on infection control practices, vaccination status and past episodes among medical professionals and will aid in reducing occupational health hazards in healthcare workers in Punjab, India.

Key-words: Infection Control Practices, Medical Professionals,. Vaccination status, Punjab, India

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Introduction

Infection prevention and control (IPC) practices in health care are extremely important for health workers to safeguard individual and public health. As per the World Health Organization, IPC is a practical, evidence-based approach to preventing patients and health workers from being harmed by avoidable infections [1]. IPC includes practices such as hand hygiene, personal protective equipment (PPE) use, injection safety, surgical site infections, antimicrobial stewardship and emergency health care [1]. IPC practices play an important role in reducing the risk of hospital-acquired infections, thereby protecting patients, employees, health sciences students, volunteers, and visitors.

Healthcare-associated infections (HAI) are responsible for a significant health impact globally. In developing countries, ~10% of patients acquire at least one HAI, further resulting in 10% mortality [2]. Several studies report a substantial economic burden associated with HAI in India [3]. For example, it has been reported that the chances of being infected with the coronavirus infectious disease 2019 (COVID-19) are ten times higher in healthcare workers (HCWs) as compared to the general population [4].

Previous studies indicate that ≥ 95% intervention compliance is necessary to decrease central line-associated bloodstream infections [5]. HCWs are at a high risk of exposure to infectious agents, which could also be a source of transmission to patients [6]. Inappropriate hygiene and sanitary practices, PPE use and lack of trained staff are important barriers to IPC practices in India [7].

The current study was planned to understand the ICPs, vaccination status and past infectious disease episodes among medical professionals in Punjab, India.

Methods

Study area: Punjab is a border state located (Latitude of 30°4′N and Longitude 75° 5′ E) in North India. The state has a human population of 27,743,338, consisting of 14,639,465 males and 1,31,03,873 females [8]. The density of health workers per 100, 000 human populations include 111.5 allopathic doctors, 18.7 Ayurvedic doctors, 3.0 homoeopathic doctors, 4.5 dental practitioners, and 64.8 nurses and midwives [9]. Many infectious diseases, such as tuberculosis and hepatitis A and E viruses, are endemic in the state [10, 11].

Sample size estimation: Assuming that 80% (95% CI 75% - 85%) of the medical students would have knowledge about infection control practices [12], a sample size of 246 was required with 5% precision and 95% level of confidence [13].

Study design: The study was conducted as a cross-sectional study from July 2023 to September 2023. The study was conducted using a multi-stage sampling design. The target population consisted of medical professionals (students and doctors), and the study population consisted of medical professionals in a medical institute in Punjab, India.

Questionnaire design: The questionnaire consisted of three sections: demographics, infection control practices and vaccination status. In the demographics section, information related to age, gender, educational qualifications and workplace was collected. In the infection control practices section, information on hand hygiene and personal protective equipment use in different settings was collected. Information on vaccination status, work experience, past sickness and needle stick injury episodes was collected in the vaccination status section. Information on the source of information for infection control practices and hand hygiene teaching was also collected. Overall, there were 38 questions in the questionnaire. The IPC questions were developed based on the WHO guidelines on hand hygiene in health care [14].

Participant enrolment: The participants were provided with a participant information statement explaining the objectives of the study. The medical students and doctors who consented to participate were enrolled in the study. The questionnaire was developed in the English language as an online Google Form, and the responses were recorded.

Data handling: The collected questionnaire data were entered into an Excel spreadsheet (Microsoft Office Excel 2013). The data records were examined, duplicates and those lacking primary information were deleted. Frequency, range and logic checks were conducted before formal analysis.

A new variable, 'Infection control practices score,' was generated: each correct answer on hand hygiene and PPE use was awarded a score of one, and an incorrect answer was awarded a score of zero. The scores for all the individual records were summed up, and the per cent score was estimated by dividing the obtained score by the total infection control practices score.

Outcome variables: Infection control practices (Hand hygiene and PPE use) were used as outcome variables to understand their association with demographic variables. For regression analysis, the hand hygiene and PPE use score was converted into a binary variable (having a score ≤ 80% and ≥ 81%; ≥81.0%, a compliance cut-off value recommended by the WHO Hand Hygiene Self-Assessment Framework 2010). 'Past episode of infectious disease illness' was used as a binary outcome variable to understand its association with infection control (Hand hygiene and PPE use) practices.

Explanatory variables: Demographic variables (gender, schooling and education) were used as explanatory variables. The variable 'Highest level of education in medical science' was converted into three categories viz. MBBS student (3rd and 4th year), MBBS intern and completed MBBS or a higher degree. As more than 98% participants were in the 20-30 year age group category, age-specific analysis was not explored. Infection control practices (Hand hygiene and PPE use) were used as an explanatory variable for the 'past episode of infectious disease illness' outcome variable.

Statistical analyses: Descriptive univariate and bivariate analyses were conducted. Bivariate analyses were conducted amongst (a) demography and hand hygiene score, (b) demography and PPE use practices score, (c) infectious disease episodes reported and hand hygiene practices score, and (d) infectious disease episodes reported and PPE use practices score. Univariable logistic regression was conducted to assess the association of (a) demography and hand hygiene practices score, (b) demography and PPE use practices score. Univariable logistic regression was conducted to assess the association of infectious disease illness episodes reported with hand hygiene practices and PPE use practices score. All the analyses were conducted in the R statistical program unless indicated otherwise (R statistical package version 3.4.0, R Development Core Team (2015), http://www.r-project.org).

Results

Descriptive analysis: Overall, 262 responses were recorded, and 256 were retained for further analysis. Of the 256 participants, 81% were female, 99% belonged to the 20-30 year age group, and 47% were 3rd year medical students. The participants had a median experience of 3.5 years (Range 0.25 – 30) and attended 53 cases (Range 2 – 500) per week.

Hand Hygiene associated practices: Of the 256 participants, 29% correctly performed hand washing for 40 – 60 seconds, 23% correctly performed hand rubbing for 20 – 30 seconds, and 98% wore gloves before and after any direct patient contact and between patients.

PPE use associated practices: Of 256 participants, 99% wore gloves when touching blood, body fluids, secretions, excretions, mucous membranes and non-intact skin; 90% wore a surgical or procedure mask and eye protection (eye visor, goggles) or a face shield to protect mucous membranes of the eye, nose and mouth during activities that are likely to generate splashes or sprays of blood, body fluids, secretions and excretions; 98% covered nose and mouth when coughing/sneezing with tissue/mask, and disposed of used tissue and masks.

Vaccination status and history of infectious disease: Of the 256 participants, 77% were vaccinated with hepatitis B, 73% with flu, 94% with MMR, 83% with varicella, 92% with Tdap, and 63% with meningococcal vaccine.

1. ***History of infectious disease, work experience and past episodes*****:** There were 14% of the participants who had been confirmed, and 11% suspected to be infected with an infectious disease during the course of their work in the hospital. Fifty-six per cent recapped used needles, and 71% of participants reported needle stick injuries and splashes.

   On average, the participants reported handling/assisting a median of one (range 0 – 100) HIV positive, one (range 0 – 130) hepatitis B, one (range 0 – 70) hepatitis C and two (range 0 – 450) tuberculosis clinical cases in the last three months. Most of the participants did not take sick leave (mean =2.6; range 0 -60) during the last six months.

2. ***Hand hygiene score and demography:*** Of the 256 participants, 19 had 100%, 73 had 87.5%, and 125 had 75% hand hygiene score. Eighty-six (178/207) per cent of female and 79.6 % (39/49) male participants had ≥75% hand hygiene score.

3. ***PPE use and demography:*** Of the 256 participants, 188 had 100%, 38 had 91.7%, and 12 had 87.5% PPE use score (Supplementary Table IX). Ninety-eight (203/207) per cent of female and 89.8 (44/49) % of male participants had ≥75% PPE use score.
4. ***Infection control practices and reported disease episodes:*** Of the participants who reported infectious disease episodes, 37.5 % (24/64) had a ≥ 87.5% hand hygiene score as compared to 35.42 (68/192) % in those where an infectious disease episode was not reported. Of the participants who reported infectious disease episodes, 81 % (51/63) had a ≥ 87.5% PPE use score as compared to 90.7 (175/193) % in those where an infectious disease episode was not reported.

5. ***Univariable logistic regression analysis:*** No significant associations of the hand hygiene score (%) were recorded with demographic variables, gender, schooling and highest education received (Table I). The odds of having a ≥90% PPE use score (%) were 0.417 (95% CI 0.181, 0.96; p-value = 0.048) in males as compared to female counterparts (Table II). The odds of experiencing an infectious disease episode was 0.381 (95% CI 0.17, 0.84; p = 0.019) in those having a ≥90% PPE use score (%) as compare to those having a score of <90% [Table III].

Table-1: Univariable logistic regression analysis demonstrating the influence of explanatory variables on the hand hygiene score (%) outcome variable.

Variable	Categories	Hand hygiene score (%)		Estimate	Odds Ratio	(95% CI)	p-value
		<90%	≥90%				
Gender	Male	46	3	-0.2503	0.779	(0.218, 2.785)	0.69
	Female	191	16	Reference			
Schooling	Rural	24	1	-1.2809	0.278	(0.027, 2.881)	0.49
	Urban	193	15	-0.6575	0.518	(0.138, 1.944)	
	Both	20	3	Reference			
Education	MBBS or higher	38	1	-0.7612	0.467	(0.05, 4.328)	0.18
	MBBS student	128	14	0.6634	1.941	(0.616, 6.122)	
	MBBS Intern	71	4	Reference			

Table-2: Univariable logistic regression analysis demonstrating the influence of explanatory variables on the PPE use score (%) outcome variable.

Variable	Categories	PPE Use score (%)		Estimate	Odds Ratio	(95% CI)	p-value
		<90%	≥90%				
Gender	Male	10	39	-0.8744	0.417	(0.181,0.96)	0.048
	Female	20	187	Reference			
Schooling	Rural	1	24	1.8971	6.667	(0.716,62.113)	0.15
	Urban	24	184	0.7559	2.13	(0.724,6.26)	
	Both	5	18	Reference			
Education	MBBS or higher	9	30	-0.7885	0.455	(0.164,1.26)	0.06
	MBBS student	12	130	0.3902	1.477	(0.592,3.683)	
	MBBS Intern	9	66	Reference			

Table -3: Univariable logistic regression results for infectious disease episodes based on hand hygiene and PPE use practices.

Variable	Categories	Infectious disease episode		Estimate	Odds Ratio	(95% CI)	p-value
Hand hygiene score	<90%	179	58	Reference	1.424	(0.518,3.917)	0.50
	≥90%	13	6	0.3538			
PPE use practices score	<90%	17	13	Reference			0.019
	≥90%	175	51	-0.9647	0.381	(0.174,0.837)	

Discussion

The current study was planned to understand infection control practices, vaccination status, and past infectious disease episodes among medical professionals in Punjab, India. Overall, the information was collected from 256 medical professionals, and associated risk factors were investigated. Hand hygiene is one of the most important infection control practices. The compliance rate varies in different settings. For example, Musu *et al.* reported a 3% to 100% compliance rate with the best hygiene practices in different intensive care units (ICUs) [17]. In the current study, only 36% (n=92) had a hand hygiene score ≥81.0%, a compliance cut-off value recommended by the WHO Hand Hygiene Self-Assessment Framework 2010. An average compliance rate of 78% has been reported in HCWs in an accredited tertiary care hospital in India [16]. Previous studies reported a 50% compliance rate nationwide across hospitals in the United States of America [17, 18] that improved substantially during the COVID-19 pandemic [19]. Low compliance in the current study indicates that hand hygiene practices should be improved among medical professionals in the study settings.

Of the 256 participants, 73% (n=188) had a PPE use score of 100%, and 93% (n=238) had ≥87.5%, indicating high compliance among participants. In Qatar, 53% HCWs were reported to be fully compliant with PPE use while attending suspected or confirmed COVID-19 cases, and 76.3% were fully compliant during aerosol-generating procedures [20]. In Germany, a high PPE use adherence was reported for COVID-19 wards, especially in those experienced with respiratory tract infections, compared to non-COVID-19 wards [21]. On the other hand, many studies have reported suboptimal PPE use compliance among HCWs [22, 23, 24]. High PPE use compliance in the current study might be associated with awareness during the COVID-19 pandemic. The risk of experiencing an infectious disease episode was lower (OR= 0.381; 95% CI 0.17, 0.84; p-value = 0.019) in those having a ≥90% PPE use score (%) as compared to those having a score of <90%. This is expected as effective PPE is one of the most important infection prevention and control measures used to prevent communicable diseases in healthcare settings.

Vaccination of HCWs is extremely important to prevent nosocomial infections, although vaccination coverage varies across regions, nationally and internationally [25]. In Pune (India), a 93.2% hepatitis B virus vaccination rate has been reported in HCWs, although only 56.3% were completely vaccinated [26]. In seven regions of Turkey, a vaccination rate of 57.8% for dT (in the last 10 years), 33.2% for varicella, 44.5% for MMR, and 13.5% for influenza has been reported among HCWs [27]. In the current study, 77% were vaccinated with hepatitis B, 73% with flu, 94% with MMR, 83% with varicella, 92% with Tdap, and 63% with meningococcal vaccine. Therefore, comparable vaccination among HCWs was observed in Punjab, except a high MMR vaccination rate. Needle stick injuries constitute a serious occupational risk to HCWs. In the current study, over 16% of the participants experienced needle sticks or injuries from other sharp instruments during the last 3 months. An incidence of 8.4% of needle stick injuries has been reported among HCWs in Saudi Arabia [28]. In Ethiopia, an institution-based study reported 29.5% (95% CI: 24.2–35.5%) prevalence of NSIs and being a nurse, non-use of safety boxes to disposal of sharp materials, recapping of needles and feeling sleepy at work were important factors associated with NSIs [29]. A 25% prevalence of NSIs has been reported among student nurses in Uttarakhand, India [30]. Similar to other studies, the results indicate that NSIs are an important health hazard among medical professionals in Punjab, India. Overall, the current study provides valuable self-reported information on infection control practices, vaccination status and past episodes among medical professionals and will aid in the reduction of occupational health hazards in HCWs in Punjab, India. There is a scope to improve hand hygiene and PPE use practices among medical professionals in Punjab, India.

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Ethics Approval: The current study was approved by the Institutional Ethics Committee, Sri Guru Ram Das Institute of Medical Science and Research, Sri Amritsar, Punjab (Approval No. Patho 751/18).

Supplementary Material

Supplementary Table –I: Demographic characteristics of 256 participants enrolled in the current study.

Variables	Category	No.	%
Age (in years)	20-30	253	98.8
	31-40	1	0.4
	>60	2	0. 8
Gender	Male	207	80.8
	Female	49	19.1
The highest level of education in medical science was completed	M.S	11	4.3
	MBBS	24	9.4
	MBBS (3rd year)	120	46.9
	MBBS (4th year)	22	8.6
	MBBS Intern	75	29.3
	Ph.D.	4	1.6
Schooling (1^{st} to 12^{th})	Both	23	8.9
	Rural	25	9.8
	Urban	208	81.2
Year of Graduation (if degree completed)	1981	1	5.9
	2013	1	5.9
	2018	1	5.9
	2020	2	11.8
	2023	12	70.6
	Total	**17**	**100.0**
	Missing Values	239	93.4
Workplace	Rural	22	16.3
	Urban	104	77.0
	Both	9	6.7
	Total	**135**	**100.0**
	Missing Values	121	47.3
Primary type of medical work	Family practitioner	9	10.1
	Hospitalist	49	55.1
	Infectious disease physician	5	5.6
	Pulmonologist	1	1.1
	Surgeon	25	28.1
	Total	**89**	**100.0**
	Missing Values	167	65.2
Other (please specify)	General	1	11.1
	Internist	1	11.1
	Medical volunteer	1	11.1
	Nurse	1	11.1
	Nursing	2	22.2
	Oral surgeon	1	11.1
	Student	1	11.1
	Teacher	1	11.1
	Total	**9**	**100.0**
	Missing Values	247	96.5

Supplementary Table- II: Hand hygiene associated practices of 256 participants enrolled in the current study.

Variable Name	Category	No.	%
Hand washing time	0-20 seconds	55	21.5
	20-40 seconds	100	39.1
	40-60 seconds	75	29.3
	60-80 seconds	26	10.2
Hand rubbing time	0-10 seconds	48	18.7
	10-20seconds	121	47.3
	20-30 seconds	59	23.1
	30-40 seconds	28	10.9
Do you perform hand washing?			
Before and after any direct patient contact and between patients, whether or not gloves are worn	No	8	3.1
	Yes	248	96.9
Immediately after the gloves are removed	No	12	4.7
	Yes	244	95.3
Before handling an invasive device	No	7	2.7
	Yes	249	97.3
After touching blood, body fluids, secretions, excretions, non-intact skin, and contaminated items, even if gloves are worn	No	12	4.7
	Yes	244	95.3
During patient care, when moving from a contaminated to a clean body site of the patient	No	19	7.4
	Yes	237	92.6
After contact with inanimate objects in the immediate vicinity of the patient	No	18	7.0
	Yes	238	92.9

Supplementary Table-III: PPE use associated practices of 256 participants enrolled in the current study.

Variable Name		Category	No.	%
Gloves	Do you wear gloves when touching blood, body fluids, secretions, excretions, mucous membranes, non-intact skin?	No	2	0.8
		Yes	254	99.2
	Do you change gloves between tasks and procedures on the same patient after contact with potentially infectious material?	No	27	10.5
		Yes	229	89.4
	Do you remove gloves after use before touching non-contaminated items and surfaces and before going to another patient?	No	5	1.9
		Yes	251	98.1
	Do you perform hand hygiene immediately after the removal of gloves?	No	5	1.9
		Yes	251	98.1
Facial protection (eyes, nose and mouth)	Do you wear a surgical or procedure mask and eye protection (eye visor, goggles) or a face shield to protect mucous membranes of the eye, nose and mouth during activities that are likely to generate splashes or sprays of blood, body fluids, secretions and excretions?	No	24	9.4
		Yes	232	90.6
	Do you wear a gown to protect skin and prevent soiling of clothing during activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions?	No	18	7.0
		Yes	238	92.9
	Do you remove soiled gowns as soon as possible and perform hand hygiene?	No	12	4.7
		Yes	244	95.3
Respiratory hygiene and cough etiquette	Do you cover your nose and mouth when coughing/sneezing with a tissue/mask, and dispose of used tissues and masks?	No	4	1.6
		Yes	252	98.4
	Do you perform hand hygiene after contact with respiratory secretions?	No	6	2.3
		Yes	250	97.7
	Do you recommend that acute febrile respiratory patients at least one meter (3 feet) away from others in common waiting areas if possible?	No	17	6.6
		Yes	239	93.6
Waste management	Do you treat waste contaminated with blood, body fluids, secretions and excretions as clinical waste in accordance with local regulations?	No	9	3.5
		Yes	247	96.5
Patient care equipment	Do you clean, disinfect and reprocess reusable equipment appropriately before use with another patient?	No	5	1.9
		Yes	251	98.0

Supplementary Table - IV: Deterrent to PPE use associated practices of 256 participants enrolled in the current study.

Variable Name	Category	No.	%
Time constraints	A little	81	31.6
	Extremely	5	1.9
	Moderately	100	39.1
	Not at all	58	22.7
	Very	12	4.7
Cost of PPE kits	A little	75	29.3
	Extremely	8	3.1
	Moderately	99	38.7
	Not at all	53	20.7
	Very	21	8.2
Heavy workload	A little	73	28.5
	Extremely	11	4.3
	Moderately	83	32.4
	Not at all	49	19.1
	Very	40	15.6
Negative patient perceptions about a doctor wearing PPE	A little	73	28.5
	Extremely	7	2.7
	Moderately	74	28.9
	Not at all	83	32.4
	Very	19	7.4
Non-availability of PPE kits	A little	70	27.3
	Extremely	11	4.3
	Moderately	75	29.3
	Not at all	64	25.0
	Very	36	14.1

Supplementary Table –V: Vaccination status of 256 participants enrolled in the current study.

Variable Name	Category	No.	%
Hepatitis B	No	57	22.3
	Yes	199	77.7
Flu (Influenza)	No	68	26.6
	Yes	188	73.4
MMR (Measles, Mumps and Rubella)	No	15	5.9
	Yes	241	94.1
Varicella (Chickenpox)	No	43	16.8
	Yes	213	83.2
Tdap (Tetanus, Diphtheria, Pertussis)	No	20	7.8
	Yes	236	92.2
Meningococcal	No	93	36.3
	Yes	163	63. 7

Supplementary Table –VI: History of infectious disease and needle stick injuries of 256 participants enrolled in the current study.

Variable Name	Category	No.	%
Past Episodes			
Have you ever been infected with an infectious disease during the course of your work in hospital?	No	192	75.1
	Yes, confirmed	36	14.1
	Yes, suspected	28	10.8
Needle stick and injuries from other sharp instruments			
Have you experienced needle stick or injury from other sharp instruments during last 3 months?	No	214	83.6
	Yes	42	16.4
Do you recap used needles?	No	113	44.1
	Yes	143	55.9
Do you report needle stick injuries and splashes?	No	74	28.9
	Yes	182	71.1
Source of information			
What is your MOST IMPORTANT source of information about infection control practices ?	Colleagues	39	15.2
	Government bulletins/ information leaflets	29	11.3
	Medical Journals or text books	129	50.4
	Medical websites	47	18.4
	Other	12	4.7
Hand hygiene teaching			
How have you been educated on hand hygiene?	Both formal and informal teaching	171	66.8
	Formal teaching	75	29.3
	Informal teaching	7	2.7
	Non-teaching	3	1.2

Supplementary Table –VII: Infectious disease cases handled and past episodes of 256 participants enrolled in the current study.

Variable Name	Mean ± SD	Min	Median	Max	No. used	No. Missing
Number of clinical cases handled/assisted in last 3 months						
HIV subjects	2.86 ±7.99	0	1	100	244	12
Hepatitis B	3.77 ±10.55	0	1	130	246	10
Hepatitis C	3.18±8.61	0	1	70	245	11
Tuberculosis	8.00 ±31.50	0	2	450	238	18
Flu	8.89±26.82	0	3	300	235	21
Past episodes						
Number of off days due to sickness during last 6 months	2.592±6.30	0	0	60	248	8
Number of episodes of an infectious disease	0.62±1.69	0	0	19	243	13

Supplementary Table -VIII: Hand hygiene score (%) in different demography categories.

Variables		Hand Hygiene Score (%)						
		25	**37.5**	**50**	**62.5**	**75**	**87.5**	**100**
Age (in years)	20 - 30	0	1	7	28	125	73	19
	31 - 40	1	0	0	0	0	0	0
	41 - 60	0	0	0	0	0	0	0
	>60	0	1	0	1	0	0	0
Gender	Male	0	0	7	22	102	60	16
	Female	1	2	0	7	23	13	3
The highest level of education in medical science was completed	MBBS	1	1	2	3	10	6	1
	MBBS (3rd yr)	0	0	2	9	66	33	10
	MBBS (4th yr)	0	1	0	3	7	7	4
	MBBS Intern	0	0	2	12	34	23	4
	MS	0	0	1	2	6	2	0
	Ph.D	0	0	0	0	2	2	0
Schooling (1st to 12th)	Rural	0	0	1	3	15	5	1
	Urban	1	2	5	19	103	63	15
	Both	0	0	1	7	7	5	3

Supplementary Table – IX: PPE use score (%) in different demography categories.

		PPE use score (%)						
Variables		**50**	**58.33**	**66.66**	**75**	**83.3**	**91.66**	**100**
Age (in years)	20 - 30	1	1	5	9	11	38	187
	31 - 40	0	1	0	0	0	0	0
	41 - 60	0	0	0	0	0	0	0
	>60	0	0	0	0	1	0	1
Gender	Female	1	0	3	9	7	36	151
	Male	0	2	2	0	5	2	37
Highest level of education in medical science completed	MBBS	0	1	0	1	0	3	18
	MBBS (3rd yr)	1	1	2	3	4	17	92
	MBBS (4th yr)	0	0	1	0	0	0	21
	MBBS Intern	0	0	2	2	5	16	50
	MS	0	0	0	3	2	1	5
	Ph.D	0	0	0	0	1	1	2
Schooling (1st to 12th)	Rural	0	0	0	1	0	5	19
	Urban	1	2	4	8	8	28	156
	Both	0	0	1	0	4	5	13
	Total	1	2	5	9	12	38	188

Supplementary Table –X: Infectious disease episodes reported in different hand hygiene and PPE use score (%) categories.]

Variable		Hand hygiene score (%)						
		25	**37.5**	**50**	**62.5**	**75**	**87.5**	**100**
Infectious disease episode reported	Yes	1	0	1	8	30	18	6
	No	0	2	6	21	95	55	13
	Total	1	2	7	29	125	73	19
PPE Use score (%)								
		50	**58.33**	**66.66**	**75**	**87.5**	**91.66**	**100**
Infectious disease episode reported	Yes	0	2	1	1	8	7	44
	No	1	0	4	8	4	31	144
	Total	1	2	5	9	12	38	188

References

1. WHO, Infection prevention and control. Geneva, Switzerland, 2024. Available from: https://www.who.int/health-topics/infection-prevention-and-control#tab=tab_1.
2. WHO, Report on the endemic burden of healthcare-associated infection worldwide. Geneva, Switzerland, 2011. Available from: http://apps.who.int/iris/bitstream/10665/80135/1/9789241501507_eng.pdf.
3. Ghosh P, Valia R. Economic burden of hospital acquired infections in India: A systematic review of published evidence. Value Health. 2018; 21: S88. doi: https://doi.org/10.1016/j.jval.2018.07.661.
4. Dzinamarira T, Nkambule SJ, Hlongwa M, Mhango M, Iradukunda PG, Chitungo I, et al. Risk Factors for COVID-19 infection among healthcare workers. A First Report from a living systematic review and meta-Analysis. Saf Health Work. 2022; 13(3): 263-268. https://doi.org/10.1016/j.shaw.2022.04.001.
5. Furuya EY, Dick AW, Herzig CT, Pogorzelska-Maziarz M, Larson EL, Stone PW. Central line-associated bloodstream infection reduction and bundle compliance in intensive care units: A National study. Infect Control Hosp Epidemiol. 2016; 37(7):805-10. doi: 10.1017/ice.2016.67.
6. MC Vos, Healthcare workers as a source of transmission, in: GML Bearman, M Stevens, MB Edmond, RP Wenzel (Eds.), A Guide to infection control in the hospital, International Society for Infectious Diseases, Chapter 11. 2014, pp. 57-67. https://www.dspsv.ro/ uploads/ epidemiologie/ 5thEd_ Guide Infection Control_forWEB.pdf
7. Murhekar MV, Kumar CPG. Health-care-associated infection surveillance in India. Lancet Glob Health. 2022; 10 (9): e1222 - e1223.
8. Census of India. 2011. Ministry of Home Affairs, Government of India. Available from: https:// censusindia.gov.in/ census.website
9. Anand S, Fan V. The health workforce in India. Human resources for health observer series no. 16. WHO, Switzerland. 2016, pp.1-104.
10. Kumar A, Singh AK, Upadhyay V, Pandey J. Epidemiology of multi-drug-resistant tuberculosis in Northern India. Biomed Biotechnol Res J. 2018; 2:112-21.

11. Arora D, Jindal N, Shukla RK, Bansal R. Water borne hepatitis A and hepatitis E in. malwa region of Punjab, India. J Clin Diagn Res. 2013;7(10):2163–2166. doi:10.7860/JCDR/2013/5966.3459.
12. Kamate S, Gautam N, Sharma S. Knowledge, attitude and practices regarding infection control measures among health care professional students in a tertiary care centre in India. Int J Infect Dis. 2020; 101:280-281. doi: 10.1016/ j.ijid. 2020. 09.734.
13. Dhand NK, Khatkar MS. Statulator: An online statistical calculator. Sample Size Calculator for Estimating a Single Proportion. Available from: http://statulator.com/SampleSize/ss1P.html (Cited 2017 December 1).
14. WHO, WHO Guidelines on Hand Hygiene in Health Care. World Health Organization, Geneva, Switzerland. 2009, pp. 1-262.
15. Musu M, Lai A, Mereu NM, Galletta M, Campagna M, Tidore M, et al. Assessing hand hygiene compliance among healthcare workers in six Intensive Care Units. J Prev Med Hyg. 2017; 58(3): E231-E237.
16. Chavali S, Menon V, Shukla U. Hand hygiene compliance among healthcare workers in an accredited tertiary care hospital. Indian J Crit Care Med. 2014 ; 18 (10):689-93. doi: 10.4103/0972-5229.
17. Knepper BC, Miller AM, Young HL. Impact of an automated hand hygiene monitoring system combined with a performance improvement intervention on hospital-acquired infections. Infect Control Hosp Epidemiol. 2020; 41(8):931-937. doi:10.1017/ice.2020.
18. Gould DJ, Moralejo D, Drey N, Chudleigh JH, Taljaard M. Interventions to improve hand hygiene compliance in patient care. Cochrane Database Syst Rev. 2017; 9(9):CD005186. doi:10.1002/14651858.
19. Makhni S, Umscheid CA, Soo J, Chu V, Bartlett A, Landon E, et al. Hand Hygiene Compliance Rate during the COVID-19 Pandemic. JAMA Intern Med. 2021;181(7):1006–1008. doi:10.1001/ jamainternmed.2021.1429.
20. Abed-Alah MTT, Abdeen S, Selim N, Tayar E, Bougmiza I. Occupational prevention of COVID-19 among healthcare workers in primary healthcare settings: Compliance and perceived effectiveness of personal protective equipment. J Patient Saf. 2022; 18(8):747–755. Available from: https://doi.org/10.1097/PTS.0000000000001004.
21. Neuwirth MM, Mattner F, Otchwemah R. Adherence to personal protective equipment use among healthcare workers caring for confirmed COVID-19 and alleged non-COVID-19 patients. Antimicrob Resist Infect Control. 2020; 9:199. Available from:https://doi.org/10.1186/s13756-020-00864-w.
22. Allen S, Cronin S. Improving staff compliance with isolation precautions through use of an educational intervention and behavioural contract. Dimens Crit Care Nurs. 2012; 31(5): 290-293. doi:10. l097/ DCC.0b013e31826199e8.
23. Jain M, Dogra V, Mishra B, Thakur A, Loomba PS. Factors limiting the usage of personal protective equipment in a tertiary-care hospital. Can J Infect Control. 2013; 28(2): 105-110.
24. Larkin J, Lee D, Kruedelback G, Maxwell T, Burroughs R, Emery C, et al. Target-improving personal protective equipment (PPE) compliance: A three-year study. Am J Infect Control. 2017; 45(6): S62. doi: 10.1016/j.ajic.2017.04.100.
25. Haviari S, Benet T, Saadatian-Elahi M, Andre P, Loulergue P, Vanhems P. Vaccination of healthcare workers: A review. Hum Vaccin Immunother. 2015; 11(11):2522-2537. doi:10.1080/ 21645515. 2015.1082014.

26. Manrai M, Harikrishnan P, Sahu R, Shergill SPS. Protected or not? Hepatitis B vaccination status among healthcare workers and the level of protection post-vaccination. Med J Armed Forces India. 2023. Available from: https://doi.org/10.1016/j.mjafi.2023.01.013.
27. Oygar PD, Buyukcam A, Sahbudak-Bal Z, Dalgic N, Bozdemir SE, Karbuz A, et al. Evaluation of vaccination status of health care workers for recommended vaccines and their acceptance of SARS-CoV-2 vaccines. Hum vaccin Immunother. 2022 ;18(5):2044707.
28. Alfulayw K H, Al-Otaibi ST, Alqahtani H A. Factors associated with needlestick injuries among healthcare workers: implications for prevention. BMC Health Serv Res. 2021; 21(1): 1074. Available from: https://doi.org/10.1186/s12913-021-07110-y.
29. Berhan Z, Malede A, Gizeyatu A, Sisay T, Lingerew M, Kloos H, et al. Prevalence and associated factors of needle stick and sharps injuries among healthcare workers in northwestern Ethiopia. PLoS ONE. 2021;16(9): e0252039. Available from: https://doi.org/10.1371/journal.pone.0252039.
30. Mishra R, Sharma SK, Gupta PK, Gupta P, Kalyani CV. Occupational health cognizance: Needle stick injuries among student nurses. Int J Afr Nurs Sci. 2021;15: 100370. Available from: https://doi.org/10.1016/j.ijans.2021.100370.