Original Article

Assessment of Knowledge, Attitudes, and Practices Regarding Infection Control Measures Among Doctors and Paramedical Staff in a Tertiary Care Teaching Hospital

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Abstract

Background: Healthcare-associated infections (HAIs) are the major cause of significant patient morbidity, mortality, and prolonged duration of hospital stay. Application of effective Infection prevention and control (IPC) measures are essential to reduce the transmission of infections. The knowledge and good practices of doctors and paramedical staff is critical for successful implementation of IPC protocols. This study aimed to determine the assessment of knowledge, attitudes, and practices (KAP) regarding infection control measures. **Material and Methods:** This cross-sectional questionnaire-based survey was conducted among doctors, nursing officers, health care staff, students, and administrative staff working in a tertiary care teaching hospital. Data were collected using a self-administered questionnaire comprising demographic details and questions related to knowledge, attitudes, and practices regarding infection prevention and control. The data was analysed by application of statistical methods using SPSS version 26. **Results:** A total of 200 participants were included in the study. Awareness of the IPC protocols was observed in 90% of respondents, while 60% had received a formal IPC training. Knowledge regarding key IPC measures was high in the participants, with 87.5% identifying hand hygiene and 81.5% identifying appropriate PPE use. Positive attitudes towards infection control were observed with 95%, agreeing that IPC measures reduce healthcare-associated infections. And 93% believing that training programs improve infection control practices. Major barriers identified were heavy workload (60%), insufficient staffing (48%), lack of training (45%), and inadequate PPE supply (35%). **Conclusion:** The study demonstrated that good knowledge and positive attitudes regarding infection prevention and control among healthcare workers. However, appears to be some gaps remaining in regular training participation, regular PPE use, and adherence to certain infection control protocols. Addressing barriers such as workload, shortage of staff, and inadequate training through continuous education may sstrengthen infection control compliance.

Keywords: Infection prevention and control, Healthcare-associated infections, Knowledge, Attitude, Practice, Healthcare workers.

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Introduction

Healthcare-associated infections (HAIs) are infections acquired 48 hours or more after hospital admission or within 48 hours of discharge or procedure.[1] They are one of the causes of increased morbidity, mortality, and prolonged hospital stay. About 63.5% of cases of HAIs are with antibiotic-resistant organisms. This has given rise to an increase in global mortality rates to about 5 million deaths due to antimicrobial resistance in 2019.[2] Balasubramanian et al. have reported that approximately 136 million healthcare-associated antibiotic-resistant infections occur every year across the world.[2] WHO has estimated that millions of patients are affected by HAIs annually, and they are the most common cause of increased health care costs.[3] The burden is particularly increasing in developing countries because of a lack of resources, limited infrastructure, and poor adherence to infection prevention practices, which has caused increased transmission of nosocomial infections.[4] Infection prevention and control (IPC) protocol is an evidence-based guideline that is designed to prevent the spread of infection among patients, healthcare workers, and visitors of healthcare facilities. The IPC practice includes procedures such as hygiene, use of personal protective equipment (PPE), safe injection practices, biomedical waste management, and sterilization of equipment.[5] Studies have shown that effective implementation of these protocols has substantially reduced transmission of nosocomial infections.[4] Healthcare workers, including doctors and paramedical staff, play a crucial role in the implementation of these protocols; the assessment of their knowledge regarding infection control and adherence to recommended practice is critical for the effectiveness of IPC programs.[6,7] Although clear guidelines are framed to be practiced, their compliance remains an important aspect to be considered. In many places, there may be sub optimal

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implementation of these protocols. Previous studies in this field have highlighted this issue, where they found gaps in knowledge, inadequate hand hygiene, irregular use of PPE, and substandard adherence to precautions among health care workers.[8,9] Knowledge, Attitudes, and Practice (KAP) is a common tool utilized to evaluate the implementation and practice of infection control among health care workers. Adequate knowledge is the first criterion for effective implementation of established protocols. However, several impediments exist for practice, which can be because of workload, resource limitations, training, and organizational barriers.[9,10] Hence, there is a need for regular evaluation of KAP among healthcare workers, which is crucial to detect the gaps and plan interventions to better align with the infection control guidelines. Healthcare-associated infections are especially prevalent in tertiary care teaching hospitals, where there is a greater number of patients, and complicated procedures are commonly undertaken. The risk of infectious disease transmission is increased in such places because of increased patient contacts and invasive procedures.[11,12] Studies from different areas have shown different levels of knowledge and compliance with infection control measures in healthcare workers.[13,14] Therefore, it becomes important to determine the proper awareness and compliance of infection control measures among doctors and paramedical staff, from time to time, for a safer healthcare environment. With this background, we in the current study aimed to determine the knowledge, attitude, and practice of doctors and paramedical staff about infection control measures in a tertiary care teaching hospital. The results of this study can help in preparing effective training and policy implementation programs.

Materials and Methods

This cross-sectional questionnaire-based survey was conducted among doctors and paramedical staff working in a tertiary care teaching hospital. Institutional Ethical approval was obtained for the study. The study included doctors, nurses, paramedical staff, and students employed in various departments of the hospital participation wa voluntary. Confidentiality and anonymity of the respondents were maintained throughout the study.

A pre-structured, validated Google-based questionnaire form was circulated among the participants. The responses were collected and analyzed. The proforma of the questionnaire consisted of 30 items divided into four sections:

Sociodemographic and Professional Characteristics

- Age
- Gender
- Professional designation
- Years of experience

Knowledge Assessment

- Knowledge of WHO Infection Prevention and Control (IPC) guidelines
- Formal training received in infection control
- If infection control measures are recommended, be aware of them.
- The purpose of personal protective equipment (PPE).
- WHO hygiene promotion is essential in health care facilities
- Hand hygiene products to be used in normal clinical situations:

Practice Assessment

- Attendance at infection control training programs
- Compliance with hand hygiene protocols
- Use of standard precautions during patient care
- Appropriate use of PPE
- Availability of PPE and sanitation supplies
- Biomedical waste segregation and disposal practices
- Adherence to isolation precautions
- Vaccination status of healthcare workers

Attitude and Perception Assessment

- Perceived effectiveness of infection control measures
- Opinion regarding the role of hand hygiene audits
- Perceived benefits of training programs
- Need for additional infection control training
- Perceived barriers to effective infection control practices
- Suggestions for improvement of infection control management

Study Variables: The primary outcome variables were knowledge, attitude, and practice scores related to infection control measures. Secondary variables included awareness of WHO IPC guidelines, training status, perceived effectiveness of infection control measures, and barriers affecting implementation of infection control practices.

Statistical Analysis: Data obtained from the completed questionnaires were analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0. Categorical variables were expressed as frequencies and percentages. Continuous variables were summarized using mean and standard deviation wherever applicable.

Results

A total of 200 healthcare personnel participated in the study. They participants comprised of doctors, nursing officers, community health officers, technicians, students, and administrative staff. The demographic profile of the participants is given in Table 1. The age group that obtained the maximum response was the 25–35 years age group (73%), indicating that young people were participating. Interestingly, female responses were more numerous 56%, compared to 43% of males, although 1% did not respond to gender. Doctors represented the largest group of participants (40%). This was followed by nursing officers (35%), community health officers (15%), technicians (5%), students (3%), and administrative staff or others (2%). More than half of the respondents (53%) had 1–5 years of professional experience, whereas 17% had 6–10 years of experience, and 15% each had less than one year and more than ten years of experience.

Knowledge regarding infection prevention and control among the participants is depicted in [Table 2]. The awareness of WHO IPC guidelines was affirmative in 90%, and 60% received formal IPC training. Hand hygiene, was the most frequently identified measure (87.5%). This was followed by PPE use (81.5%), biomedical waste management (79%), and sterilization. The knowledge regarding disinfection of instruments was present

among 75% participants, isolation precautions (71%), environmental cleaning (68%), and vaccination of healthcare workers (65%). The primary purpose of personal protective equipment was the prevention of the spread of infection, correctly identified by 98% of participants. Further, 96% correctly recognized the WHO recommendations regarding the timing of hand hygiene. Regarding preferred hand hygiene products when hands are not visibly soiled, 80% correctly selected alcohol-based hand rubs, while 15% preferred soap and water, and 5% were unaware of the recommended practice.

Table 1: Demographic and Professional Characteristics of Respondents (N=200)

Characteristic	Category	Frequency (n)	Percentage (%)
Age	Below 25 years	20	10
	25-35 years	146	73
	36-45 years	24	12
	> 45 years	10	5
Gender	Male	86	43
	Female	112	56
	Not specified / other	2	1
Professional Designation	Doctor	80	40
	Nursing Officer	70	35
	Community Health Officer (CHO/MLHP)	30	15
	Technician	10	5
	Student	6	3
	Administrative staff / Other	4	2
Years of Experience	Less than 1 year	30	15
	1-5 years	106	53
	6-10 years	34	17
	More than 10 years	30	15

Table 2: Knowledge Regarding Infection Prevention and Control (IPC)

Knowledge Variable	Correct/Positive Response	Frequency (n)	Percentage (%)
Aware of WHO IPC guidelines	Yes	180	90
Received formal training in IPC	Yes	120	60
Knowledge of routinely recommended IPC measures (multiple responses)	Hand hygiene	175	87.5
	PPE use	163	81.5
	BMW management	158	79
	Sterilization/disinfection of instruments	150	75
	Isolation precautions	142	71
	Environmental cleaning	136	68
	Vaccination of healthcare workers	130	65
Purpose of PPE (to prevent the spread of infection)	Correct	196	98
WHO recommendation for hand hygiene timing (all of the above)	Correct	192	96
Preferred hand hygiene product when hands are not visibly soiled	Alcohol-based hand rub	160	80
	Soap and water	30	15
	Plain water / Do not know	10	5

Table 3: Attitude Towards Infection Control Measures

Attitude Statement	Response	Frequency (n)	Percentage (%)
Infection control measures reduce HAIs	Strongly agree / Agree	190	95
	Neutral / Disagree	10	5
Regular hand hygiene audits improve staff compliance	Strongly agree / Agree	184	92
	Neutral / Disagree	16	8
Training programs improve infection control practices	Strongly agree / Agree	186	93
	Neutral / Disagree	14	7
Perceived effectiveness of current IPC measures in the hospital	Very effective	54	27
	Effective	90	45
	Moderately effective	46	23
	Poor / Very poor	10	5
Overall rating of IPC management (scale I-5)	5 (Excellent)	50	25
	4 (Good)	84	42
	3 (Average)	46	23
	2 (Below average)	14	7
	1 (Poor)	6	3
Observed reduction in HAIs due to IPC practices	Yes	136	68
	No / Not sure	64	32
Need for additional IPC training programs	Yes	180	90

Attitude towards infection control measures is given in [Table 3]. Participants demonstrated positive attitudes towards infection control practices. The majority (95%) agreed or strongly agreed that infection control measures reduce healthcare-associated infections (HAIs). Similarly, 92% believed that regular hand hygiene audits improve staff compliance, and 93% agreed that training programs enhance infection control practices. When asked about the effectiveness of current IPC measures in the hospital, 27% rated them as very effective, 45% as effective, and 23% as moderately effective, while only 5% considered them poor or very poor. The overall rating of IPC management was favorable, with 25% assigning an excellent score and 42% rating it as good. Furthermore, 68% of respondents reported observing a reduction in healthcare-associated infections attributable to IPC practices. Notably, 90% expressed the need for additional IPC training programs.

Self-Reported Infection Control Practices in the study are given in [Table 4]. Overall, there was an adequate level of self-reported adherence with infection control measures. But only 50% participants of the IPC training programme had attended them routinely. Approximately 40% of them attended them occasionally, 35% of them rarely attended and 10% had never attended such programs. Most 83% said that IPC policies were made visible or communicated in their departments. Overall compliance with hand hygiene was good; 73% always performing hand hygiene before and after patient contact and 18% occasionally. Likewise, 80% indicated that they ALWAYS used standard precautions when managing patients.

Use of PPE during clinical procedures was consistently reported by 60% of participants, often by 25% and inconsistently by 15%. 70% of respondents reported providing adequate amounts of PPE.70% of respondents reported providing adequate amounts of sanitation supplies. 77% of participants reported consistently disposing of biomedical waste as per proper disposal guidelines and 83% reported disposing of waste in the right color-coded containers consistently. Regarding isolation precautions for infectious patients, 68% of respondents said they always followed isolation precautions, while 25% followed them often or sometimes. Vaccination coverage was encouraging, with 82% reporting completion of recommended vaccinations, including Hepatitis B, COVID-19, and Influenza vaccines.

Table 4: Self-Reported Practices Regarding Infection Control

Practice Variable	Response	Frequency (n)	Percentage (%)
Frequency of attending IPC training programs	Regularly	30	15
	Occasionally	80	40
	Rarely	70	35
	Never	20	10
IPC policies were displayed/communicated clearly in the department	Yes	166	83
	Sometimes / NO	34	17
Follow hand hygiene before/after patient contact	Always	146	73
	Often	36	18
	Sometimes / Rarely	18	9
Use standard precautions while handling patients	Always	160	80
	Often	26	13
	Sometimes / Rarely	14	7
Use appropriate PPE during clinical procedures	Always	120	60
	Often	50	25
	Sometimes / Rarely / Never	30	15
The hospital provides adequate PPE and sanitation supplies	Yes	140	70
	NO / Sometimes	60	30
Biomedical waste disposal procedures are properly followed	Yes	154	77
	NO / Sometimes	46	23
Biomedical waste is separated into the correct color-coded bins	Always	166	83
	Sometimes / Rarely	34	17
Isolation precautions are followed for infectious patients	Always	136	68
	Often / Sometimes	50	25
	Rarely / Never	14	
Completed recommended vaccinations (Hepatitis B, COVID-19, Influenza)	Yes	164	82
	Partially / NO	36	18

The existence of Barriers to Effective Infection Control Practices and implementation is given in [Table 5]. The first important factor was the workload, which was a frequent barrier 60% of respondents. This was followed by inadequate staffing 48% and lack of proper training 45%.

The miscellaneous factors acting as barriers were inadequate PPE supply (35%), poor compliance among staff (32%), lack of awareness (27%), and limited institutional support or funding (15%). A small proportion (8%) cited other barriers such as inadequate audits and a lack of corrective or accountability mechanisms.

Table 5: Major Barriers to Effective Infection Control Practices (Multiple responses)

Barrier	Frequency (n)	Percentage (%)
Heavy workload	120	60
Insufficient staff	96	48
Lack of training	90	45
Inadequate PPE supply	70	35
Poor compliance among staff	64	32
Lack of awareness	54	27
Limited institutional support/funds	30	15
Other (lack of audits, no punitive actions)	16	8

Suggestions for improving infection control management were the question kept for participants' response in this study. The common suggestion given by participants was hands-on training programs, 48%. This was followed by ensuring an adequate supply of PPE, sanitizers, and color-coded waste bins (n=84). Increasing staffing levels and reducing workload were recommended by 36% respondents. Other suggestions included stricter monitoring, periodic audits, and feedback 24%, motivational measures such as awards and recognition 12%, improved biomedical waste collection and transportation systems 10%, and display of simple information, education, and communication (IEC) materials and checklists in clinical areas 8%.

Table 6: Key Suggestions Provided by Respondents to Improve IPC Management

Suggestion	Frequency Mentioned (n)
Regular hands-on training and awareness programs	96
Adequate supply of PPE, sanitizers, and color-coded bins	84
Increase staff and reduce workload	72
Strict monitoring, audits, and feedback	48
Motivational measures (awards, recognition) rather than only punishment	24
Improved biomedical waste collection and transportation	20
Display simple IEC materials and checklists	16

Discussion

Health care workers plays a key role in infection prevention and control. The awareness of health care workers to various protocols of IPC is important in the successful implementation of the program. The current study was designed to assess the awareness and implementation of IPC measures among doctors and paramedical staff in our tertiary care teaching hospital. A Google-based questionnaire was used for assessment. The majority of respondents were young healthcare professionals aged 25–35 years (73%), with most of them having about 1 – 5 years of experience. Similar demographic patterns have been shown by other studies in the field, where the majority of health care workers are young adults forming a substantial workforce in the health care system.[10,11] Assessment of awareness of IPC guidelines received a response of 90%, indicating a high level of awareness. About 60% of them reported having received formal training in infection prevention and control. Our findings are in agreement with Ganczak et al,[15] who found a good level of awareness of infection control principles among healthcare personnel; however, they found deficiencies in formal training. It is similar to this study because only 60% have received formal training. Desta et al,[16] have reported that although healthcare workers had adequate knowledge of IPC, the training remained at inadequate levels in many institutions. Therefore, a structured professional continuous education for IPC with updated guidelines is the need of the hour for effective control of HAIs. The results for knowledge of specific IPC measures, including hand hygiene, were positively recognized by 87.5% of respondents, and PPE use was identified by 81.5% of participants. We found that almost all participants 98% correctly identified the purpose of PPE, and WHO-recommended hand hygiene 96%. Our findings align with the other studies that have found improved awareness of hand hygiene and PPE protocols following effective initiatives during the COVID-19 pandemic. [17,18] but gaps were found to exist as far as vaccination, isolation practice, and environmental cleaning, which required broader knowledge enhancement.

The results of this study showed that the majority of participants reported that IPC measures are effective in reducing HAIs (95%), and over 90% indicated that hand hygiene audits and training are effective in increasing compliance. Stein et al,[19] reported similar results, with positive attitudes toward infection control being strongly correlated with adherence to preventive measures. A positive attitude is important among healthcare workers, as it allows acceptance and implementation of institutional infection control policies. There were notable gaps in self-reported practices, despite high knowledge and positive attitudes. The results showed that 73% of respondents always wash their hands before and after patient contact. About 15% regularly participated in IPC training programs. Few previous studies have reported similar discrepancies between knowledge and behaviour.[6,20] When knowledge is not translated into consistent practice, it indicates impediments in the workplace culture or institutions. In addition, only 60% of participants said that they always wore proper PPE equipment when performing procedures, suggesting there is room for improvement in adherence to PPE protocols. The overall practice of biomedical waste management was acceptable, with 77% disposing of waste properly and 83% always separating waste into colour-coded bins. Results are similar to the studies conducted with tertiary care hospitals biomedical waste generating units in India following the national regulations on biomedical waste management.[21] All the HCWs were vaccinated with 82 % indicating the enhanced awareness of occupational health and safety. The following three barriers to the effective

implementation of infection control, with 60%, 48% and 45% respectively, emerged as the most important; these include heavy workload, inadequate staffing and lack of training. A significant number of the respondents believed on the need of regular hands-on training for staffs. This also includes an adequate supply of PPE, increased staff, and an increased healthcare monitoring system. The WHO and CDC guidelines suggest ongoing education, access to resources, and regular audits to maintain effective infection control programs. [3,22] Lastly, our study indicated that healthcare workers possessed good knowledge and favorable attitudes toward infection prevention and control measures. But strengthening of the practices by imparting regular training programs with adequate allocation of resources and staff will improve infection control standards in hospitals.

Conclusion

The results of this study found that doctors and paramedical staff possessed adequate knowledge and attitudes regarding infection prevention and control measures. The awareness of WHO guidelines and hygiene practices, and the importance of personal protective equipment, was found to be high among the respondents. The gaps noted in this study were particularly related to training programs, consistent PPE utilization, and adherence to certain infection control practices. Several impediments to implementation were identified, which include heavy workload, insufficient staffing, and a lack of proper training. Strengthening the IPC by continuous education and hands-on training is the need of the hour, apart from improving institutional support, and conducting regular audits can identify gaps in implementation and practice in the future.

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Conflicts of interest

There are no conflicts of interest.

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