



Original Article



Knowledge, Attitude, and Practice of Infection Control Measures among Medical Students and Residents of a Private Medical College in Lahore, Pakistan: A Comparative Cross-sectional study

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ABSTRACT

Healthcare workers, especially medical students, are constantly exposed to pathogens in hospitals, which significantly increases the risk of them being infected. Infection control measures are pivotal in safeguarding them from these infections and reducing any risk of transmissibility. **Objective:** To assess the knowledge, attitude, and practice of Infection Control Measures among medical students and residents of a private medical college in Lahore. **Methods:** This was a cross-sectional study conducted from April to June 2023 at CMH Lahore Medical College, using a purposive sampling technique that included residents and medical students from the third to the final year, regardless of age or other demographic factors. A pretested structured questionnaire was used. Data were analyzed using SPSS 23.0. **Results:** In this study, the total number of responses collected was 378. Out of these responses, 95% possessed good knowledge. 55.8% of participants showed a positive attitude towards infectious control measures. 91.5% of participants said that they followed good practices in infection control. On comparison between House officers, PGs, and undergraduates, significant p-values were obtained in terms of Knowledge, Practice, and Attitude, indicating that the participants in all three categories are well-informed regarding infection control measures and putting them into practice. **Conclusions:** This study highlighted the extent to which medical students and residents effectively implement infection control measures in their work environment. Furthermore, it underscores their level of receptiveness to these practices, shedding light on both strengths and areas for improvement.

INTRODUCTION

Infection Prevention and Control (IPC) is necessary for ensuring the safety of both patients and Healthcare Workers (HCWs). The Knowledge, Attitude, and Practices (KAP) of health care workers play a crucial role in reducing the risk of infections. However, the gap between knowledge and actual practices highlights the need for regular training to enhance compliance and effectiveness [1]. Needle-Stick Injuries (NSIs) account for around 37.6% of hepatitis B, 39% of hepatitis C, and 4.4% of HIV/acquired immunodeficiency syndrome cases among healthcare workers globally, with HIV being ranked second in disease-

related deaths in Africa, fourth globally, and fifth among infectious diseases [2, 3]. Medical students, who are future doctors, face a high risk of getting Hepatitis B (HBV) because of their clinical duties. Studies show that, on average, 44.5% of healthcare workers worldwide experience needle-stick injuries in a year, increasing their risk of infections [4]. Dental care workers are at higher risk of exposure to infection, which can result from inadequate HBV vaccination and a lack of adherence to universal precautions, which point out that all blood and blood-contaminated fluids have the potential for infection [5].



Poor hygiene practices with clinical attire and equipment can cause healthcare-associated infections. Clinical coats may harbor harmful pathogens, so it's recommended to own at least two and wash them regularly, especially when soiled. Avoiding short sleeves, watches, and accessories can help reduce transmission [6]. Infections also pose economic burdens and can lead to significant mental or emotional stress if not managed properly [7]. Due to their frequent exposure to healthcare settings and direct patient interactions, medical students place a greater emphasis on personal hygiene. Sound knowledge, training, and work experience in infection control are required to lessen the high risks associated with infection transmission [8]. Good knowledge and a positive attitude toward disease prevention, especially after education, are associated with better preventive practices, leading to improved outcomes [9]. Risk reduction measures include using PPE, following standard precautions, using safety equipment properly, and ensuring efficient needle disposal. Handwashing with soap can lower the risk of acute respiratory infections by 16% to 23% [10]. Infection control has been a key part of CMH Lahore Medical College's curriculum for third and fourth-year students over the past four years. This study aimed to assess the knowledge of medical students and residents on infection control and to evaluate the effectiveness of undergraduate teaching in helping them apply these measures during their residency. While numerous international studies have examined the knowledge, attitudes, and practices of healthcare workers regarding infection control, there is limited research available in Pakistan, especially in Lahore, on how well medical trainees understand and follow these protocols. Most existing studies focus on nurses or experienced doctors, creating a gap in knowledge about how medical students and residents, who are still in training, adhere to infection control guidelines. Filling this gap is essential because insufficient awareness or failure to follow infection control practices can lead to higher rates of hospital-acquired infections, antibiotic resistance, and increased health risks for patients.

Infection control is essential in preventing hospital-acquired infections, yet healthcare trainees often face challenges in translating knowledge into consistent practice, increasing infection risks. In Pakistan, particularly in Lahore, limited evidence exists on comparative assessment of infection control knowledge, attitude, and practices among medical students and residents, as most studies focus on nurses or senior clinicians. This study aimed to identify shortcomings in current training, recognize obstacles to adherence, and suggest practical improvements to strengthen infection control education for future healthcare professionals.

METHODS

This was a comparative, cross-sectional study conducted at CMH, Lahore Medical College, from April to June 2023 after obtaining ethical approval from the College Ethical Review Committee. The target population included house officers and medical students studying in their 3rd year, 4th year, and final year of CMH Lahore Medical College. Ethical approval was obtained from the College Ethical Review Committee (IRB No: 746/ERC/CMH/LMC). The study included residents and medical students enrolled in the specified academic years who provided informed consent. The inclusion criteria were: (a) medical students from the 3rd to final year and (b) residents from any postgraduate training year at CMH Lahore Medical College. Exclusion criteria were: (a) students from preclinical years (1st and 2nd year), (b) individuals enrolled in nonmedical programs, and (c) those who declined to participate. The research employed a purposive sampling technique, ensuring participants met the defined criteria before completing the questionnaire. The calculated sample size is 378, based on a 95% confidence level, a 6% margin of error, and a population proportion (p) of 0.563, utilizing the formula provided below:

$$n = \frac{z^2 \times \hat{p} (1-\hat{p})}{\epsilon^2}$$

Data collection was conducted using a structured questionnaire adapted from a previously published article, ensuring its validity, with permission obtained from the original authors [11]. The questionnaire comprised three sections assessing the knowledge of medical students and residents regarding infection control measures, attitude towards infection control, and the practice of infection control measures among residents. It included closed-ended and Likert-scale questions (1 = Strongly Disagree to 5 = Strongly Agree) for attitude assessment, while knowledge and practice were evaluated through Yes/No questions. Content validity was further reviewed by the Pathology Department at CMH Lahore Medical College. A pilot study involving 10 students (excluded from the main study) was conducted to ensure clarity and feasibility. Reliability, assessed using Cronbach's alpha, yielded a coefficient of 0.698, indicating acceptable internal consistency. Knowledge scores were classified as low (0–50%), moderate (51–75%), and high (>75%) based on the percentage of correct responses. Attitude and practice scores were analyzed using mean scores, with higher means reflecting a more positive attitude or better adherence to infection control practices. Statistical analysis was conducted using SPSS version 23.0 to evaluate differences in Knowledge, Attitude, and Practice (KAP) of infection control measures among two groups: undergraduate medical students (3rd to final year) and postgraduate residents from any year of training. Descriptive statistics (means and standard deviations)

were used to summarize continuous variables, while frequencies and percentages were reported for categorical variables. The Analysis of Variance (ANOVA) test was chosen to compare mean KAP scores across multiple independent groups, as it is appropriate for assessing differences between more than two groups. Given a significant ANOVA result, Tukey's Honest Significant Difference (HSD) test was used as a post hoc analysis to identify specific pairwise differences while controlling for Type I error. A significance level of 0.05 was applied for all analyses. Each participant was explained the aim of the study and written informed consent was sought. The study maintained the privacy of responses.

RESULTS

In this study, the total number of responses collected was 378. Out of these, 35.4% were males and 64.6% were females. Among the Graduates, 34.4% were House Officers, and 17.9% were postgraduate residents, whereas among the Undergraduates, 36.8% of responses were from MBBS and 10.9% from BDS.

Table 1: Demographic Characteristics of Study Participants (n=378)

Variables	Frequency (%)
Gender	
Male	134 (35.4%)
Female	244 (64.6%)
Major (For Graduates)	
House Officer	130 (34.4%)
PG	68 (17.9%)
Total	198 (52.3%)
Major (For Undergraduates)	
MBBS	139 (36.8%)
BDS	41 (10.9%)
Total	180 (47.7%)

In terms of knowledge, 95% of responses received showed that the participants possessed good knowledge, indicated by a score >10. On the side of attitude, 55.8% of participants showed a positive attitude towards infectious control measures highlighted by a score between 31-50. Regarding practice, 91.5% of participants said that they followed good practices in infection control, indicated by a score >10.

Table 2: Frequency and Percentage Distribution of Study Variables (n=378)

Variables	Frequency (%)
Knowledge	
5-10 (Moderate)	19 (5.0%)
>10 (Good)	359 (95.0%)
Total	378 (100.0%)
Attitude	
10-30 (negative)	167 (44.2%)
31-50 (Positive)	211 (55.8%)

Total	378 (100.0%)
Practice	
<5 (weak)	2 (0.5%)
5-10 (Moderate)	30 (7.9%)
>10 (good)	346 (91.5%)
Total	378 (100.0%)

On comparison between House officers, PGs, and undergraduates, significant p-values were obtained in terms of Knowledge, Practice, and Attitude at 0.004, <0.001, and 0.033, respectively, thus indicating that the participants in all three categories are well-informed regarding infection control measures and putting them into practice.

Table 3: Comparison between House officers, PGs, and undergraduates regarding Knowledge, Attitude, and Practice-ANOVA

Variables	House Officers	Pgs	Undergraduates	p-value
Knowledge	13.5 ± 1.64	13.61 ± 1.4	12.02 ± 1.53	0.004
Attitude	31.23 ± 4.3	31.65 ± 5.6	32.7 ± 5.45	<0.001
Practice	14.23 ± 1.48	14.29 ± 2.06	13.37 ± 2.4	0.033

In comparison between MBBS, BDS, and Graduates, all participants showcased a positive attitude towards infection control measures, good knowledge regarding them, and applied them in practice. This is highlighted by the very significant p-values: 0.025 in Knowledge, <0.001 in Attitude, and 0.013 in Practice.

Table 4: Comparison between MBBS, BDS, and Graduates regarding Knowledge, Attitude, and Practice-ANOVA

Variables	MBBS	BDS	Graduates	p-value
Knowledge	13.1 ± 1.64	13.40 ± 1.52	13.6 ± 1.34	0.025
Attitude	32.66 ± 5.24	31.65 ± 5.6	30.85 ± 4.32	<0.001
Practice	13.4 ± 2.5	14.31 ± 1.2	14.52 ± 1.27	0.013

DISCUSSION

The study highlighted infection control measures among medical and dental students at various stages of their education. The analysis of attitudes toward infection control measures revealed a predominantly positive outlook, with only a minority holding negative views. A study conducted among healthcare students in Zambia assessed that while most students demonstrated awareness of common healthcare-associated infections and expressed positive attitudes toward reducing infection risks and valuing disinfection, their practical application during medical procedures was lacking [12]. This presented an alarming situation, as subpar practices regarding infection control could only promote a greater spread of infections and subsequently have an adverse impact on the well-being of patients and healthcare providers alike. Thus, the adequate practice of these control measures was deemed necessary. The "Practice to infection control measures" indicated a strong reported adherence to infection control among the respondents,

with a large majority reporting good practices. This aligned with a study that showed good knowledge and attitudes but highlighted a need for better implementation of IPC precautions and increased training for laboratory and healthcare workers [13]. Similarly, a survey conducted among Australian CT radiographers and radiology nurses showed a strong baseline knowledge of standard precautions. These results remained consistent with broader research indicating that healthcare workers generally possessed good knowledge, attitudes, and practices concerning infection prevention [14, 15]. Another inference that could be drawn from this comparison was that attitude toward infection control measures appeared almost universally positive, but the degree of implementation and practice of these measures differed from region to region. This presented another alarming picture in that subpar practices in certain regions might lead to greater disease outbreaks. This represented an avenue that required further research to develop a global gold standard and uncover the causes of these regional differences in practice. The comparison between House officers, PGs, and undergraduates in knowledge, practice, and attitude toward infection control measures depicted a significant difference. While awareness among clinical students in this study was high, it did not consistently translate to attitude and practice levels. Another study supported these findings, showing that participants with higher knowledge scores also had better infection control attitudes [16]. Differing levels of practice could adversely impact patient welfare and mortality if proper protocols were not adequately followed. Simultaneously, this connoted that differing levels of knowledge also impacted implementation, once again lending credibility to the need for developing appropriate policies and educational strategies to reinforce and properly teach these measures. The study found significant differences in infection control practices among House officers, PGs, and undergraduates. House officers, being more hands-on, may have exhibited different practices compared to PGs, who might have followed specialized practices based on their fields. Undergraduates, still in the learning phase, may have lacked extensive practical experience. This was supported by a quasi-experimental prospective study on medical undergraduates, which showed improved knowledge and practice scores after targeted training on infection control measures, emphasizing the effectiveness of customized training initiatives [17]. There were clear differences in infection control attitudes among House officers, PGs, and undergraduates, reflecting varied perspectives and motivations. Seetan *et al.*, supported these findings, noting good knowledge among medical students regarding isolation protocols, hand hygiene, and infection transmission via attire and equipment, along with gender-based and institutional differences in attitudes [18]. Similarly, an Egyptian study found that better education on

infection control led to fewer infection outbreaks among students, healthcare workers, and their patients [19]. Once again, the need for teaching infection control measures was highlighted and further emphasized the importance of customizing training methods and content according to medical specialties to better counter specific infections likely to arise within those fields. P-values were found significant when comparing MBBS and BDS students with graduates, revealing variations in knowledge levels, attitudes, and practices concerning infection control measures among these groups. The results suggested that a good level of knowledge was linked to better practices and a more cautious attitude. However, a study conducted on dental students in Sudan found low usage of Personal Protective Equipment despite good knowledge and positive attitudes toward infection control, with moderate compliance to guidelines [20]. Healthcare did not just encompass doctors but also dentists, as both disciplines dealt with the risk of infection and its adverse impact on patients. Thus, equal training and equipment must be provided across all healthcare sub-specialties to reduce the overall burden of disease and infection. Maintaining infection control remained a continuous effort and was crucial for ensuring high standards in healthcare. This study highlighted the need for targeted interventions to address the unique challenges faced by MBBS, BDS, and graduate students. Regular training on infection control should have been provided and integrated as a core component of ongoing medical education. As this was a single-center study, future research including multiple medical institutions could further investigate how educational interventions impact knowledge, attitudes, and practices over time among healthcare professionals. The sample size in this study was relatively restricted, and increasing it in future research may enhance the generalizability of the findings.

This study was conducted at a single institution with a relatively limited sample size, which may restrict generalizability to other settings. The use of self-reported questionnaires may also introduce response bias in assessing actual practices. Future research should include multi-center studies with larger and more diverse populations to improve external validity. Additionally, longitudinal and interventional studies are recommended to evaluate the long-term impact of targeted infection control training on improving real-world clinical practice.

CONCLUSIONS

The findings of this study demonstrated a high level of awareness and adherence to infection control measures among the participants. The results underscore the effectiveness of current educational and training programs in fostering a strong foundation of knowledge, positive attitudes, and good practices in infection control among healthcare professionals and students. However, the observed variations between groups suggest the need

for tailored interventions to address specific gaps and ensure uniform adherence across all levels of training and professional practice.

Authors' Contribution

Conceptualization: RF, MM, KHC

Methodology: RF, MM, IM, MMR

Formal analysis: MM, IM, MMR

Writing and Drafting: RF, MM, IM, MMR, KHC

Review and Editing: RF, MM, IM, MMR, KHC

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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