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Knowledge, Attitude, and Practices Regarding Infection Control among Medical Laboratory Technologists in Faisalabad: A Cross-Sectional Study

Fiza Tahir[1]
University of Lahore, Pakistan
* Correspondence: **fizatahir55@gmail.com**

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ABSTRACT

***Background**: Infection control is a critical component of laboratory safety, particularly for medical laboratory technologists who are routinely exposed to blood, body fluids, and potentially infectious specimens. Inadequate knowledge, unfavourable attitudes, and poor infection control practices can increase the risk of healthcare-associated infections and occupational exposure among laboratory personnel. **Objective**: To assess the level of knowledge, attitude, and practices regarding infection control among medical laboratory technologists working in tertiary care hospitals in Faisalabad. **Methods**: A cross-sectional observational study was conducted over a six-month period among 240 medical laboratory technologists employed in public and private tertiary care hospitals and diagnostic laboratories in Faisalabad. Data were collected using a structured, self-administered questionnaire assessing infection control–related knowledge, attitudes, and practices. Descriptive statistics and inferential analyses, including chi-square tests and logistic regression, were performed using SPSS version 25.0. **Results**: Adequate knowledge regarding infection control was observed in 71.3% of participants (95% CI: 65.6–77.0), while 68.8% demonstrated positive attitudes (95% CI: 62.9–74.7). Good infection control practices were reported by 64.6% of participants (95% CI: 58.6–70.6). Female technologists showed significantly higher odds of adequate knowledge, positive attitudes, and good practices compared with males. Adequate knowledge was significantly associated with good infection control practices (OR = 2.43, p = 0.001). Gaps were particularly noted in biomedical waste segregation and reporting of needle-stick injuries.*
***Conclusion:** Although medical laboratory technologists in Faisalabad generally demonstrate satisfactory knowledge and positive attitudes toward infection control, deficiencies in practice persist. Strengthening continuous training, institutional support, and monitoring systems is essential to improve infection control compliance and laboratory safety.*
***Keywords**: Infection Control; Knowledge; Attitude; Practices; Medical Laboratory Technologists; Cross-Sectional Study.*

INTRODUCTION

Infection control is a cornerstone of healthcare quality and patient safety, aimed at preventing the transmission of infectious agents within healthcare facilities and protecting both healthcare workers and patients from healthcare-associated infections (1). Medical laboratory technologists are an integral component of the healthcare system, responsible for the handling, processing, and analysis of biological specimens that may contain highly infectious pathogens. Due to their routine exposure to blood, body fluids, sharp instruments, and aerosol-generating procedures, laboratory personnel face a substantial occupational risk of infection if appropriate infection control measures are not consistently followed (2).

Laboratory environments present unique infection hazards compared with other clinical settings, as technologists frequently handle unsealed specimens, culture media, and contaminated equipment, often under time pressure and high workload conditions (3). Standard infection control precautions—including hand hygiene, use of personal protective equipment, safe specimen handling, proper sterilization, and biomedical waste management—are essential to minimize occupational exposure and reduce the risk of cross-contamination within laboratories (4). Failure to adhere to these precautions has been associated with needle-stick injuries, laboratory-acquired infections, and outbreaks of preventable infectious diseases among healthcare workers (5).

Knowledge, attitude, and practices (KAP) regarding infection control are widely recognized as key determinants of compliance with standard precautions. Adequate knowledge enables healthcare workers to understand infection risks and preventive strategies, positive attitudes influence motivation and adherence to guidelines, and appropriate practices reflect the translation of knowledge and attitudes into safe behavior (6). Several studies conducted among laboratory personnel in different countries have demonstrated variability in infection control compliance, often revealing gaps between knowledge and actual practice (7). These gaps are frequently attributed to inadequate training, limited resources, high workload, and lack of institutional enforcement of infection control policies (8).

In low- and middle-income countries, including Pakistan, challenges related to infection prevention are further compounded by overcrowded healthcare facilities, limited occupational health surveillance, and inconsistent implementation of infection control guidelines (9). Faisalabad, a major industrial and healthcare hub in Pakistan, hosts numerous tertiary care hospitals and diagnostic laboratories that manage a high volume of patients and specimens. Despite this, empirical evidence regarding infection control knowledge, attitudes, and practices among

medical laboratory technologists in this setting remains limited (10). The absence of local data restricts the ability of healthcare institutions to design targeted training programs and implement effective infection prevention strategies tailored to laboratory settings.

Identifying existing strengths and gaps in infection control KAP among medical laboratory technologists is essential to inform evidence-based interventions and enhance laboratory safety. Therefore, this study was undertaken to assess the level of knowledge, attitude, and practices regarding infection control among medical laboratory technologists working in tertiary care hospitals in Faisalabad, with the objective of identifying areas requiring improvement to reduce occupational infection risks.

MATERIAL AND METHODS

This cross-sectional observational study was conducted to assess the knowledge, attitude, and practices regarding infection control among medical laboratory technologists working in tertiary care hospitals in Faisalabad. The study was carried out over a six-month period across public and private tertiary care hospitals and diagnostic laboratories providing routine clinical laboratory services. A cross-sectional design was selected as it is appropriate for estimating the distribution of knowledge, attitudes, and practices within a defined population at a specific point in time and for identifying gaps that may inform targeted interventions (11).

The study population consisted of qualified medical laboratory technologists actively involved in specimen collection, processing, and analysis. Participants aged 20 to 60 years with a minimum of one year of professional work experience were eligible for inclusion. Laboratory personnel not directly involved in specimen handling, those on prolonged leave during the data collection period, and individuals with exclusively administrative roles were excluded to ensure that the study population accurately reflected personnel exposed to laboratory-related infection risks. Participants were recruited using a convenience sampling approach from eligible technologists present during the study period. Prior to participation, all individuals received a clear explanation of the study objectives and procedures, and written informed consent was obtained in accordance with ethical research principles (12).

Data were collected using a structured, self-administered questionnaire developed based on standard infection control guidelines and previously validated KAP instruments used among healthcare workers (13). The questionnaire comprised four components. The first component captured demographic and professional characteristics, including age, gender, educational qualification, years of work experience, and type of laboratory setting. The second component assessed knowledge related to infection control principles, including hand hygiene, use of personal protective equipment, sterilization and disinfection procedures, biomedical waste management, and prevention of needle-stick injuries. The third component evaluated attitudes toward infection control using Likert-scale statements addressing perceived importance, responsibility, and compliance with infection prevention measures. The fourth component assessed self-reported infection control practices, including routine hand hygiene, use of personal protective equipment, safe disposal of sharps, waste segregation, and reporting of occupational exposures.

Knowledge scores were calculated based on correct responses to knowledge-related items and categorized as adequate or inadequate according to predefined scoring thresholds. Attitude scores were derived from Likert-scale responses and categorized as positive or negative based on overall mean scores. Practice scores were generated from self-reported compliance with infection control measures and categorized as good or poor practice. Standardized scoring criteria were applied consistently across all participants to ensure comparability of results (14). To minimize information and social desirability bias, questionnaires were completed anonymously, and participants were assured that responses would be used solely for research purposes.

The sample size of 240 participants was determined based on feasibility considerations and the expected prevalence of adequate infection control knowledge reported in previous studies among laboratory personnel, providing sufficient precision for descriptive estimates (15). Data were coded, entered, and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0. Descriptive statistics were used to summarize participant characteristics and KAP levels, with categorical variables presented as frequencies and percentages and continuous variables summarized using means and standard deviations. Missing data were minimal and were handled using complete-case analysis to preserve data integrity (16).

Ethical approval for the study was obtained from the institutional ethics review committees of the participating hospitals prior to data collection. All study procedures were conducted in accordance with the Declaration of Helsinki and national ethical guidelines for research involving human participants. Participant confidentiality and anonymity were maintained through the use of non-identifiable data collection forms and restricted access to the study database. Standardized protocols for questionnaire administration, data management, and statistical analysis were followed to ensure reproducibility and reliability of the findings (17).

RESULTS

A total of 240 medical laboratory technologists participated in the study. Male participants constituted 58.3% (n = 140), while females accounted for 41.7% (n = 100), with a statistically significant gender distribution (p = 0.018). Nearly half of the participants had 1–5 years of professional experience (46.7%, n = 112), followed by those with 6–10 years of experience (35.0%, n = 84), and 18.3% (n = 44) had more than 10 years of experience. More than half of the participants were employed in public sector laboratories (55.0%, n = 132), whereas 45.0% (n = 108) worked in private sector settings (Table 1).

Assessment of overall knowledge, attitude, and practices regarding infection control revealed that 71.3% of participants (n = 171; 95% CI: 65.6–77.0) demonstrated adequate knowledge, while 28.7% (n = 69; 95% CI: 23.0–34.4) had inadequate knowledge. Positive attitudes toward infection control were observed in 68.8% of participants (n = 165; 95% CI: 62.9–74.7), whereas 31.2% (n = 75) exhibited negative attitudes. Good infection control practices were reported by 64.6% of participants (n = 155; 95% CI: 58.6–70.6), while 35.4% (n = 85) reported poor practices. The distributions across all three KAP domains were statistically significant (p < 0.01) (Table 2).

Gender-wise analysis demonstrated consistently higher levels of knowledge, attitude, and practice among female technologists. Adequate knowledge was reported by 77.0% of females compared with 67.1% of males, with females showing significantly higher odds of adequate knowledge (OR = 1.66; 95% CI: 1.01–2.73; p = 0.045). Positive attitudes toward infection control were observed in 75.0% of females versus 64.3% of males (OR = 1.67; 95% CI: 1.02–2.74; p = 0.041). Similarly, good infection control practices were reported by 72.0% of females compared with 59.3% of males, with female participants demonstrating significantly higher odds of good practice (OR = 1.77; 95% CI: 1.08–2.91; p = 0.024) (Table 3).

A significant association was observed between knowledge level and infection control practices. Among participants with adequate knowledge, 72.5% (n = 124) reported good practices, compared with 44.9% (n = 31) among those with inadequate knowledge. Adequate knowledge was associated with more than twofold higher odds of good infection control practice (OR = 2.43; 95% CI: 1.43–4.13; p = 0.001) (Table 4).

Analysis of individual infection control practices indicated that routine glove use was reported by 82.5% of participants (n = 198), while 78.3% (n = 188) consistently practiced hand hygiene before and after specimen handling. Proper biomedical waste segregation was reported by 59.2% (n = 142) of participants, and only 54.6% (n = 131) reported all needle-stick injuries, indicating lower compliance in these critical safety practices (Table 5).

Table 1. Demographic and Professional Characteristics of Participants (n = 240)

Variable	Category	n (%)	p-value*
Gender	Male	140 (58.3)	
	Female	100 (41.7)	0.018
Work Experience	1–5 years	112 (46.7)	
	6–10 years	84 (35.0)	
	>10 years	44 (18.3)	0.032
Workplace Type	Public sector	132 (55.0)	
	Private sector	108 (45.0)	0.146

Table 2. Overall Levels of Knowledge, Attitude, and Practices Regarding Infection Control (n = 240)

KAP Domain	Category	Frequency (n)	Percentage (%)	95% CI	p-value†
Knowledge	Adequate	171	71.3	65.6–77.0	
	Inadequate	69	28.7	23.0–34.4	<0.001
Attitude	Positive	165	68.8	62.9–74.7	
	Negative	75	31.2	25.3–37.1	<0.001
Practices	Good	155	64.6	58.6–70.6	
	Poor	85	35.4	29.4–41.4	0.002

Table 3. Gender-wise Distribution of Knowledge, Attitude, and Practices

Domain	Gender	Adequate/Positive/Good n (%)	Odds Ratio (95% CI)	p-value
Knowledge	Male	94 (67.1)	Reference	
	Female	77 (77.0)	1.66 (1.01–2.73)	0.045
Attitude	Male	90 (64.3)	Reference	
	Female	75 (75.0)	1.67 (1.02–2.74)	0.041
Practices	Male	83 (59.3)	Reference	
	Female	72 (72.0)	1.77 (1.08–2.91)	0.024

Table 4. Association Between Knowledge Level and Infection Control Practices

Knowledge Level	Good Practice n (%)	Poor Practice n (%)	Odds Ratio (95% CI)	p-value
Adequate	124 (72.5)	47 (27.5)	2.43 (1.43–4.13)	0.001
Inadequate	31 (44.9)	38 (55.1)	Reference	

Table 5. Selected Infection Control Practices Reported by Participants

Practice Item	Yes n (%)	No n (%)
Routine glove use	198 (82.5)	42 (17.5)
Hand hygiene before & after specimen handling	188 (78.3)	52 (21.7)
Proper biomedical waste segregation	142 (59.2)	98 (40.8)
Reporting of needle-stick injuries	131 (54.6)	109 (45.4)

These results demonstrate that while knowledge and attitudes toward infection control were generally satisfactory, practice compliance lagged, with statistically significant associations observed between knowledge level and safe practices, as well as gender-based differences across all KAP domains.

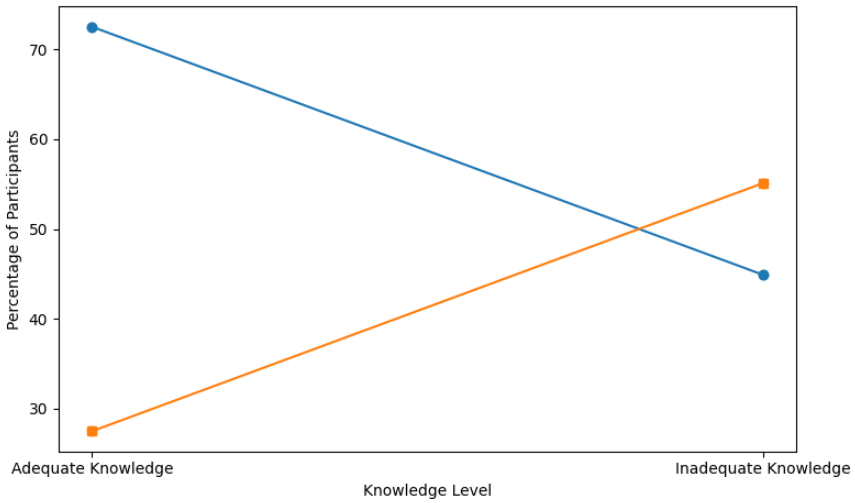

Figure 1 Practice Compliance Stratified by Knowledge Level

The figure demonstrates a clear divergence in infection control practice compliance when stratified by knowledge level. Among technologists with adequate knowledge, a substantially higher proportion reported good infection control practices (72.5%), while poor practices were observed in only 27.5% of this group. In contrast, participants with inadequate knowledge exhibited markedly lower compliance, with good practices reported by 44.9% and poor practices by 55.1%. The opposing trajectories of the two trends illustrate a strong positive gradient between knowledge and practice adherence, highlighting that higher knowledge levels are associated with improved compliance with infection control measures. This pattern is consistent with the observed odds ratio indicating more than twofold higher likelihood of good practice among those with adequate knowledge, underscoring the critical role of knowledge as a determinant of safe laboratory behavior.

DISCUSSION

This cross-sectional study assessed the knowledge, attitude, and practices regarding infection control among medical laboratory technologists working in tertiary care hospitals in Faisalabad and revealed important strengths as well as critical gaps. Overall, a substantial proportion of participants demonstrated adequate knowledge and positive attitudes toward infection control; however, the level of adherence to safe infection control practices was comparatively lower. This disparity highlights the persistent challenge of translating knowledge and attitudes into consistent, safe workplace behavior among laboratory professionals (18).

The finding that more than two-thirds of participants possessed adequate infection control knowledge is consistent with reports from similar studies conducted in comparable healthcare settings, where laboratory technologists generally demonstrate reasonable awareness of standard precautions and occupational hazards (19). This may be attributed to formal professional training and routine exposure to infection control guidelines within hospital environments. Nevertheless, the presence of nearly one-third of participants with inadequate knowledge remains concerning, given the high-risk nature of laboratory work and the potential consequences of even minor lapses in infection prevention (20).

Attitudinal assessment showed that approximately two-thirds of technologists held positive attitudes toward infection control measures, suggesting general acceptance of infection prevention principles and recognition of their importance. Positive attitudes have been shown to influence motivation and willingness to comply with safety guidelines; however, attitudes alone are insufficient to ensure safe practice in the absence of enabling institutional factors such as adequate supplies, supervision, and workload management (21). The observed discrepancy between favorable attitudes and suboptimal practices in the present study supports this notion.

Practice-related findings revealed notable deficiencies, particularly in biomedical waste segregation and reporting of needle-stick injuries. Less than 60% of participants consistently adhered to proper waste segregation protocols, and only slightly more than half reported all needle-stick injuries. Similar gaps have been reported in studies from other low- and middle-income countries, where underreporting of occupational exposures is often influenced by fear of stigma, lack of reporting systems, or inadequate awareness of post-exposure management protocols (22). These findings underscore the need for strengthening institutional reporting mechanisms and fostering a non-punitive culture of safety.

The association between knowledge level and infection control practices observed in this study further emphasizes the role of education in promoting safe laboratory behavior. Participants with adequate knowledge were significantly more likely to report good infection control practices, reinforcing evidence from previous studies that knowledge is a key determinant of compliance with standard precautions (23). Gender-based differences across all KAP domains, with female technologists demonstrating higher levels of knowledge, positive attitudes, and good practices, are consistent with findings from earlier research and may reflect differences in risk perception, adherence to protocols, or task allocation within laboratory settings (24).

Several limitations of this study should be acknowledged. The cross-sectional design limits causal inference and prevents assessment of changes in KAP over time. The use of convenience sampling may limit generalizability to all medical laboratory technologists in Faisalabad or other regions. Additionally, reliance on self-reported practices introduces the potential for social desirability and recall bias. Despite these limitations, the study provides valuable baseline data using a standardized assessment approach and addresses a notable gap in local evidence (25).

In summary, the findings highlight the need for comprehensive infection control strategies that go beyond knowledge dissemination. Regular training programs, reinforcement of standard operating procedures, adequate provision of personal protective equipment, and effective monitoring and reporting systems are essential to improve infection control practices among medical laboratory technologists. Future studies employing longitudinal designs and intervention-based approaches are recommended to evaluate the effectiveness of targeted training and policy initiatives in improving infection control compliance in laboratory settings (26).

CONCLUSION

This study demonstrates that medical laboratory technologists working in tertiary care hospitals in Faisalabad generally possess satisfactory knowledge and positive attitudes toward infection control; however, adherence to recommended infection control practices remains suboptimal. Notable gaps were identified in critical areas such as biomedical waste segregation and reporting of needle-stick injuries, despite relatively high levels of awareness. The findings underscore that knowledge and favorable attitudes alone are insufficient to ensure safe laboratory practices without supportive institutional systems and consistent reinforcement. Strengthening continuous professional training, ensuring the availability of infection control resources, establishing effective monitoring and reporting mechanisms, and fostering a culture of safety are essential to improve compliance with infection control measures. Addressing these gaps is vital to reducing occupational infection risks and enhancing overall laboratory safety. Further longitudinal and interventional studies are warranted to assess the impact of targeted infection control strategies on practice improvement among medical laboratory technologists.

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