

Original Article

Addressing Knowledge Gaps on Surgical Site Infections: A Multi-Center Study in District Hospitals of Khyber Pakhtunkhwa, Pakistan

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ABSTRACT

Background: Surgical site infections (SSIs) pose significant global health challenges, increasing mortality and healthcare costs. Effective prevention of SSIs is imperative for ensuring patient safety and maintaining high-quality surgical care standards.

Objective: To evaluate the knowledge levels of SSIs and associated wound infection risks among surgical staff in district hospitals throughout Khyber Pakhtunkhwa, Pakistan.

Methods: A comprehensive 20-item multiple-choice questionnaire was developed collaboratively with certified surgeons and based on extensive literature review. The survey assessed knowledge concerning SSIs and related risk factors among a diverse group of surgical staff, including consultants, specialists, residents, and medical interns, at various district hospitals.

Results: Out of 250 participants, the distribution by job role was as follows: 132 interns (52.8%), 50 resident doctors (20%), 20 surgical technologists (8%), 33 surgical technicians (13.2%), and 15 specialist doctors (6%). Overall, 113 participants (45.2%) correctly identified the definition of an SSI. Regarding knowledge levels, 50 participants (20%) demonstrated good knowledge, 166 (66.4%) had fair knowledge, and 34 (13.6%) showed poor knowledge about SSIs.

Conclusion: The study identifies critical gaps in the knowledge of surgical staff at district hospitals in Khyber Pakhtunkhwa concerning SSIs. These findings underline the necessity for targeted educational interventions to elevate knowledge levels, enhance patient safety, and advance infection control practices.

Keywords: Healthcare Education, Infection Control Practices, Khyber Pakhtunkhwa Hospitals, Patient Safety, Surgical Site Infections (SSIs).

INTRODUCTION

Surgical site infections (SSIs) are a significant healthcare issue that severely impacts patient safety, leading to increased morbidity, extended hospital stays, and substantial increases in treatment costs (1). Representing approximately 20% of all healthcare-associated infections globally, SSIs are among the most frequent postoperative complications (2). These infections are notably prevalent in low- and middle-income countries, where their incidence can be up to three times higher than in high-income environments. The World Health Organization has identified the prevention of SSIs as a key component of enhancing global healthcare quality and patient outcomes (3).

In Pakistan, particularly in the district hospitals of Khyber Pakhtunkhwa (KP), addressing SSIs is challenging due to limited resources and varying levels of staff training in infection control practices (4). These hospitals serve as critical healthcare providers to extensive and often rural populations, yet they face significant disparities in resource availability and the implementation of infection prevention protocols. Recent studies, such as those conducted by Ban et al. (2017) (5) and Javed et al. (2019) (6), have highlighted

a worrying deficiency in the knowledge base among healthcare providers regarding SSIs, thereby impeding the execution of effective prevention strategies (7).

In response to these challenges, a multi-center study was conducted across KP district hospitals to evaluate the current awareness and understanding of SSIs and associated risk factors among surgical staff, including interns, residents, specialist doctors, and consultants. This research employed a 20-item multiple-choice questionnaire, which was collaboratively developed by certified surgeons and based on the existing literature, to identify specific gaps in knowledge and practice. The objective of this study was to uncover these deficiencies to facilitate targeted educational interventions. Such initiatives are crucial for improving the knowledge base of surgical teams, thus enhancing patient safety and ensuring that local practices meet international healthcare standards.

METHODOLOGY

This cross-sectional study utilized a validated 20-item multiple-choice questionnaire, specifically crafted to gauge the knowledge surrounding surgical site infections (SSIs) and associated risk factors. The questionnaire's development involved a meticulous review of the relevant literature and collaboration with certified surgeons, ensuring comprehensive coverage of the crucial aspects of SSI knowledge necessary for effective prevention. Conducted over a five-month period from August to December 2023, the study encompassed 250 surgical staff members from district headquarters hospitals in Bannu and Miranshah, Khyber Pakhtunkhwa, Pakistan.

The participants, comprising surgical consultants, specialists, residents, medical interns, surgical technologists, and technicians, represented a wide spectrum of experience and expertise within the surgical departments. Their diverse backgrounds provided valuable insights into the prevailing knowledge levels regarding SSIs. Participants were tasked with completing the questionnaire, which evaluated their understanding of the definition, incidence, and prevention strategies of SSIs. Responses were quantitatively scored, ranging from 0 (indicating no correct answers) to 20 (indicating all answers correct). Based on these scores, participants were categorized into three knowledge levels: good knowledge for scores of 80% and above, fair knowledge for scores between 50% and 79%, and poor knowledge for scores below 50%.

Data analysis was conducted using Graphpad Prism software and MS Excel. The analysis involved the calculation of mean scores, standard deviations, and categorizations of knowledge levels among participants, with confidence intervals set at 95% to ensure statistical reliability. Ethical approval for the study was secured from the bioethics department of the participating hospitals before the commencement of data collection, guaranteeing that all research activities upheld the highest standards of ethical conduct and respected the rights and well-being of all involved.

RESULTS

In our comprehensive study conducted across district hospitals in Khyber Pakhtunkhwa, Pakistan, 250 surgical department staff were assessed for their knowledge of surgical site infections (SSIs). The results revealed a variable understanding of SSIs among the participants. Notably, 113 participants (45.2%) accurately understood the definition of SSIs, highlighting a foundational grasp of the concept.

A detailed examination of the results showed that while 150 participants (60%) correctly identified *Staphylococcus aureus* and *Escherichia coli* as common organisms causing SSIs, knowledge about other critical aspects of SSIs was limited. 50% of participants demonstrated good overall knowledge concerning the prevention and management of SSIs, including the timing for prophylactic antibiotics—emphasizing their administration within one hour before surgery to optimize efficacy, a detail less understood among the majority.

Regarding preventive measures, less than half of the participants were aware of the distinctions between different types of surgical wounds and their implications for infection risk, such as understanding that clean-contaminated wounds involve an incision under sterile conditions into a hollow viscus with no active infection. Additionally, practical aspects of infection control, such as the preferred method for hair removal before surgery, were correctly identified by only a minority.

Overview of Participant Response Rate

In this comprehensive study aimed at assessing the knowledge of surgical site infections (SSIs) among surgical staff in district hospitals across Khyber Pakhtunkhwa, Pakistan, a total of 300 questionnaires were distributed among potential participants. The target audience included a diverse range of surgical personnel, such as consultants, specialists, residents, medical interns, surgical technologists, and technicians, reflecting a wide scope of professional roles within the surgical departments.

Out of the 300 questionnaires distributed, 250 were completed and returned, resulting in an 83.3% response rate. This high rate of participation underscores the commitment and interest of the surgical staff in enhancing their understanding of SSIs and participating in efforts to improve patient safety and care quality. The substantial response also provides a robust data set for

evaluating the current levels of knowledge regarding SSIs and identifying specific areas where educational interventions could be most effectively applied.

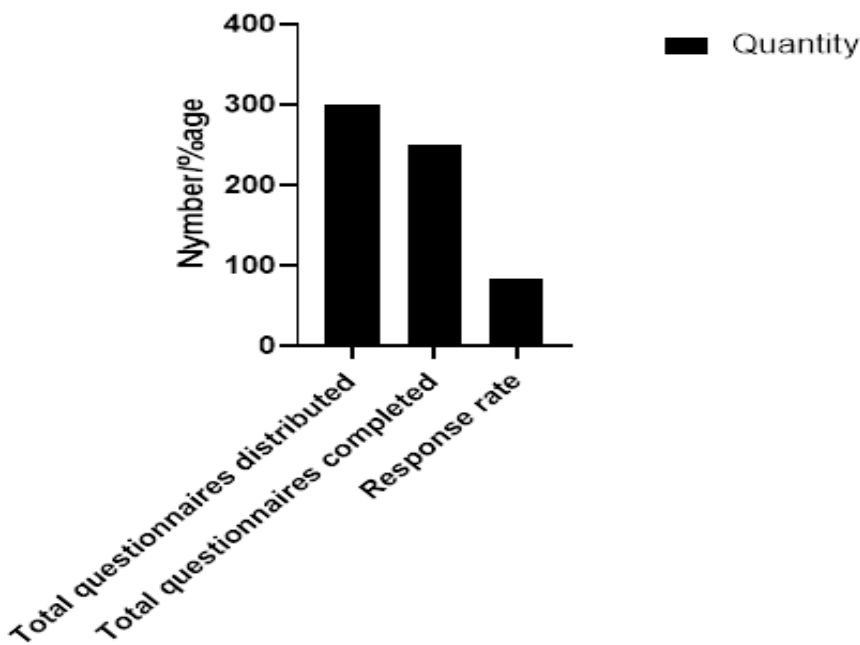


Figure 1 Participant Response Rate

Demographic and Professional Characteristics of Participants

The participants in this study included a diverse group of 250 surgical staff members from various district hospitals across Khyber Pakhtunkhwa, Pakistan, spanning multiple roles within surgical teams. The breakdown of these roles comprises 132 medical interns (52.8%), 50 resident doctors (20%), 20 surgical technologists (8%), 33 surgical technicians (13.2%), and 15 specialist doctors (6%). This range from interns, who are at the initial stages of their medical careers, to specialist doctors, who are seasoned surgeons leading surgical teams and managing complex cases, underscores the breadth of experience and expertise within the study group.

In terms of experience, the participants' years in the field also varied widely: 155 participants (62%) had less than 5 years of experience, typically including many of the medical interns and some residents new to the surgical field. Another 72 participants (28.8%) had between 5 and 10 years of experience, encompassing more established residents and some specialists and technologists with substantial clinical expertise. The remaining 23 participants (9.2%) had more than 10 years of experience, generally consisting of highly experienced specialist doctors and senior technologists.

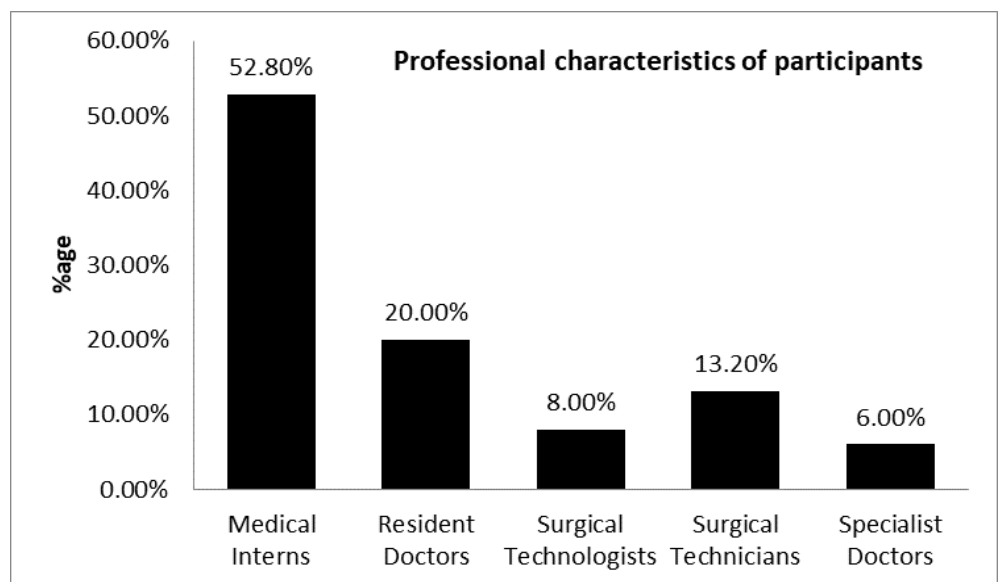


Figure 2 Professional characteristics of participants

Many of these participants also held specialized certifications that are pertinent to their roles, highlighting their commitment to maintaining high standards of care. These certifications often focus on advanced surgical techniques, infection prevention, and patient safety protocols, essential for their daily roles within surgical departments.

This composition of participants ensures a comprehensive overview of the surgical team's capabilities and learning needs, providing valuable insights into the broad spectrum of knowledge about surgical site infections across different levels of medical and surgical experience.

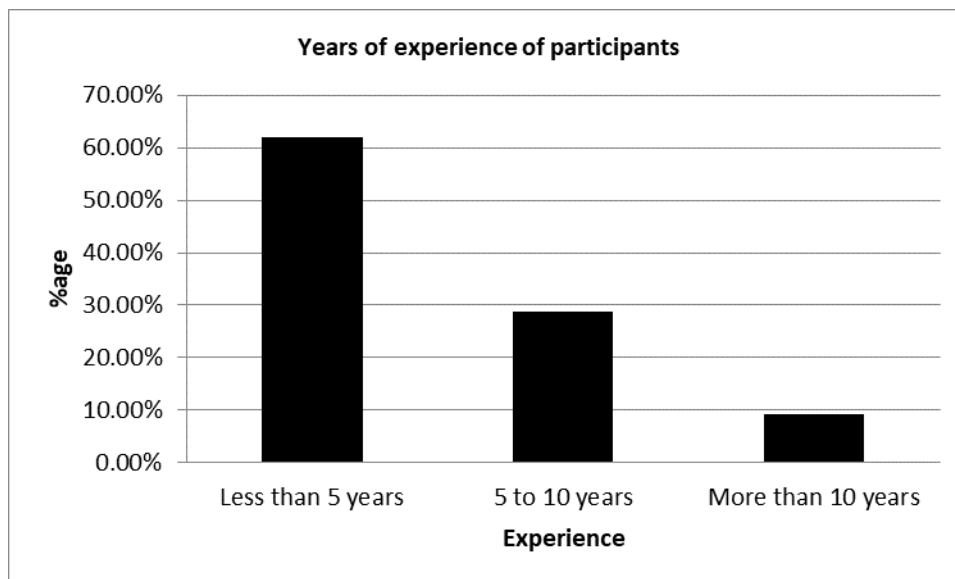


Figure 3 Experience of participants

Knowledge Categorization

In this study, the knowledge of surgical site infections (SSIs) among 250 surgical department staff was assessed and categorized into three distinct levels: good, fair, and poor, based on their responses to a structured questionnaire. A total of 50 participants, which accounts for 20% of the surveyed group, demonstrated a high level of understanding by scoring at least 80% correct answers, indicating a robust grasp of the essential concepts and practices related to SSIs. The majority, comprising 166 participants or 66.4%, fell into the fair knowledge category, scoring between 50% and 79% correct

answers. This level suggests that while these individuals have a foundational understanding, there is considerable room for improvement in their knowledge depth. Conversely, 34 participants, representing 13.6% of the total, were classified as having poor knowledge, with less than 50% of the questions answered correctly, highlighting significant gaps in understanding that could potentially impact patient care.

Overall, the assessment reveals that a substantial majority, 86.4%, possess at least a fair level of knowledge concerning SSIs, which is encouraging. However, the presence of 13.6% in the poor knowledge category underscores the critical need for targeted educational interventions. Such initiatives are imperative to not only bridge the knowledge gaps but also to enhance the overall effectiveness of infection control practices and elevate patient safety standards within these surgical settings.

Table 1: Knowledge Categorization of Surgical Site Infection (SSI) Understanding

Knowledge Level	Number of Participants	Percentage of Total
Good	50	20.00%
Fair	166	66.40%
Poor	34	13.60%

Discussion on Knowledge Gaps

The results of this study highlight significant knowledge gaps among surgical staff in district hospitals across Khyber Pakhtunkhwa, Pakistan, particularly in areas crucial for the prevention and management of surgical site infections (SSIs). Despite a reasonable percentage of participants demonstrating fair to good knowledge levels, the fact that 13.6% of participants scored poorly indicates critical areas of deficiency that require immediate attention.

One significant knowledge gap identified was the limited understanding of SSI incidence, which only 113 participants (45.2%) could correctly define. This gap is concerning as a comprehensive understanding of SSI incidence is essential for effective prevention and management. The low scores in this specific area suggest a lack of awareness or misunderstanding of how frequently SSIs occur and under what circumstances they are most likely to develop.

Educational interventions appear to be most needed in areas including the definition and incidence of SSIs, risk factors, and preventive measures. Training programs should be developed to target these specific areas, focusing on enhancing understanding of SSI risk factors, the importance of aseptic techniques, and the implementation of standardized infection control protocols. Workshops, seminars, and ongoing training sessions could be implemented to address these gaps. Additionally, incorporating regular

assessments and feedback mechanisms can help ensure that the educational interventions are effective and that the knowledge is being applied in clinical settings.

Moreover, considering the varying levels of experience among the staff, with a substantial number having less than five years of experience, it is crucial that these educational initiatives are tailored to meet the diverse needs of the participants. Those with less experience may benefit from more foundational training, while those with more experience could engage in more advanced discussions on SSI management strategies and case studies.

Overall, this study underscores the need for structured and continuous professional development to enhance the capacity of all surgical staff to manage SSIs effectively, thereby improving patient outcomes and reducing healthcare-associated costs.

Table 2: Addressing Knowledge Gaps—Educational Interventions for Surgical Site Infections (SSIs)

Knowledge Area	Percentage Understanding Correctly	Suggested Interventions
Definition of SSIs	45.2%	Develop detailed training modules on SSI basics, including definition and types.
Incidence of SSIs	Not specifically mentioned in data	Include statistical data on SSI rates in training, highlight risk factors and consequences.
Risk Factors	Indicated as limited understanding	Conduct workshops focusing on identification and management of SSI risk factors.
Preventive Measures	Indicated as a gap	Organize regular seminars on the latest SSI prevention techniques and standard protocols.

Distribution of SSI Knowledge Across Surgical Team Job Roles

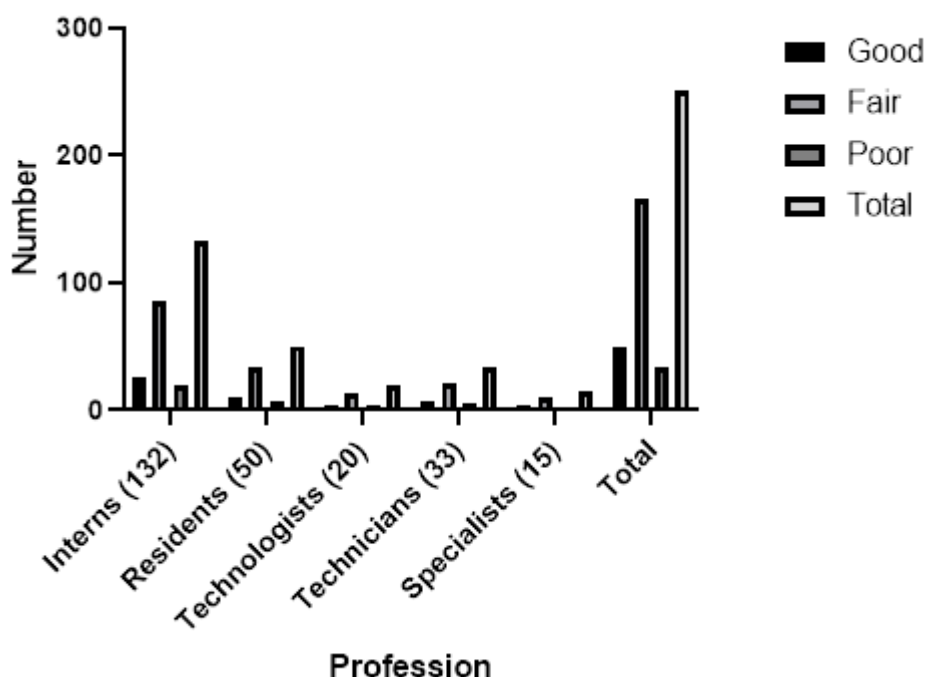


Figure 4 Distribution of SSI Knowledge Across Surgical Team Job Roles

This results in a total of 50 participants with good knowledge, 166 with fair knowledge, and 34 with poor knowledge out of 250 evaluated, underscoring the necessity for targeted educational interventions to bridge these knowledge gaps, especially for those with only fair or poor understanding. The subsequent Chi-square analysis, which yielded a statistic of 0.2668 with 15 degrees of freedom and a P value greater than 0.9999, indicated no statistically significant differences in knowledge levels across job roles, suggesting that the job role does not significantly affect an individual's knowledge of SSIs. This finding highlights that all professional

The figure 4 illustrates the distribution of knowledge levels regarding surgical site infections (SSIs) among various job roles within surgical teams at district hospitals in Khyber Pakhtunkhwa, Pakistan, classifying participants into good, fair, and poor knowledge categories based on their assessment performance. Among the 132 interns, 26 showed good understanding, 86 fair, and 20 poor; of the 50 residents, 10 exhibited good knowledge, 33 fair, and 7 poor; from the 20 technologists, 4 demonstrated good knowledge, 13 fair, and 3 poor; among the 33 technicians, 7 had good knowledge, 21 fair, and 5 poor; and of the 15 specialists, 3 were categorized with good knowledge, 10 fair, and 2 poor.

categories within the study exhibited similar distributions of SSI knowledge, showing no notable disparities in SSI understanding across different job roles.

Knowledge Levels of Surgical Site Infections (SSI) by Years of Experience Among Surgical Staff

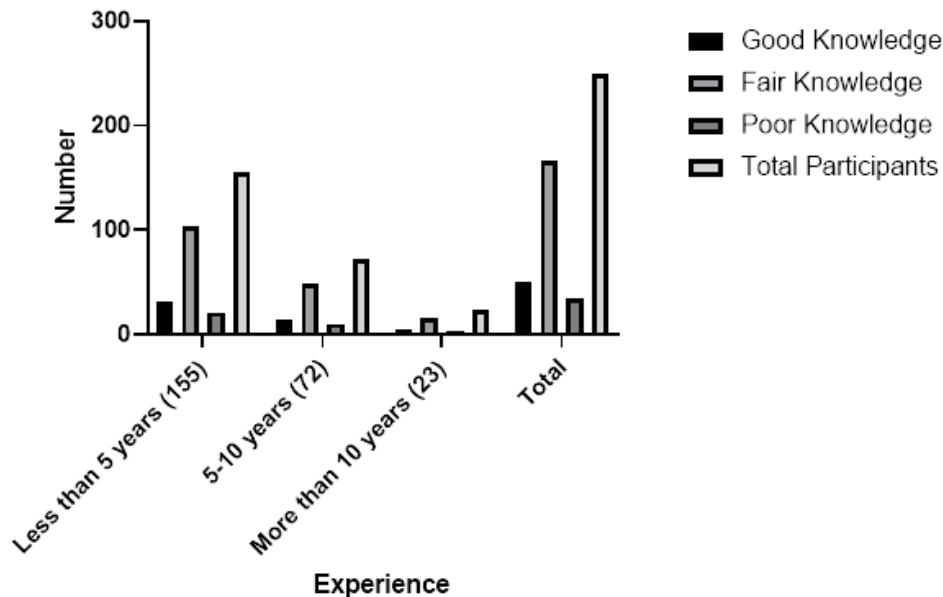


Figure 5 Knowledge Levels of Surgical Site Infections (SSI) by Years of Experience Among Surgical Staff

seeks to explore if there is a significant difference in knowledge levels across different experience brackets.

The Chi-square test conducted on this data resulted in a Chi-square statistic of 0.06153 with 9 degrees of freedom and a P value greater than 0.9999. This extremely high P value suggests there is a very high likelihood that any observed differences in SSI knowledge across the experience categories could occur purely by chance, indicating no significant association between years of experience and the levels of SSI knowledge. This result is summarized as 'not significant' (ns), meaning that the test did not find any statistically significant differences in SSI knowledge related to how long participants have been practicing. The test concludes that variations in SSI knowledge are not dependent on the years of experience among surgical staff, suggesting that other factors might play a more critical role in influencing SSI knowledge rather than just the duration of professional experience.

DISCUSSION

Surgical site infections (SSIs), defined by the Centers for Disease Control and Prevention as the proliferation of causative microorganisms at the surgical site, can manifest in superficial, deep, or organ/cavity forms (8). The literature indicates that SSIs affect between 3% to 5% of surgical patients (9). This multi-center study in district hospitals across Khyber Pakhtunkhwa, Pakistan, sought to assess the knowledge of surgical site infections among a diverse group of surgical staff. Out of the 250 participants, only 45.2% displayed awareness of the definition of SSI, a figure slightly lower than that reported in another study where 55.5% of doctors were knowledgeable about the definition (10). The assessment also revealed that 20% of participants had good knowledge, 66.4% had fair knowledge, and 13.6% had poor knowledge regarding SSIs, aligning with findings from other regions (11-13).

The study underscores a critical need for enhanced knowledge and practices concerning SSIs, particularly in low-income settings where infection rates are significantly higher than in developed countries. Reports from countries like India and Ethiopia indicate high incidence rates due to suboptimal infection control practices and a general lack of awareness (14-16). The level of knowledge in Khyber Pakhtunkhwa, although comparatively better, still necessitates significant improvements to reach global standards. The analysis revealed no significant differences in knowledge across various professional roles, suggesting that educational deficiencies are widespread and not confined to specific job categories.

A notable strength of this study is its broad participant base, which provides a comprehensive overview of the current state of knowledge across different tiers of surgical staff. However, the study's limitation lies in its focus on district hospitals only, potentially overlooking variations that might exist in tertiary care centers or specialized surgical facilities. Additionally, while the questionnaire provided quantitative insights into knowledge levels, it did not capture qualitative aspects of how knowledge translates into practice (17,18).

To address these gaps, the implementation of comprehensive educational programs is imperative. These programs should cater to all levels of surgical staff, tailored to their varied experiences and prior knowledge. Effective educational interventions, as demonstrated in a study from Bangladesh, can significantly enhance knowledge and practices regarding SSIs among nurses following specific training sessions (15, 19). Such models could be adapted for the Khyber Pakhtunkhwa context, potentially incorporating case-based learning for more experienced staff and foundational training for novices (20).

In conclusion, while the study highlights the existing deficiencies in SSI knowledge among surgical staff in Khyber Pakhtunkhwa, it also lays the groundwork for targeted educational interventions. By improving the understanding of SSIs across all levels of surgical staff, there is an opportunity to not only ameliorate patient outcomes but also raise the standards of surgical care to align with international best practices, thereby reducing the global health burden of surgical site infections.

CONCLUSION

This study across district hospitals in Khyber Pakhtunkhwa, Pakistan, has revealed considerable knowledge deficiencies among surgical staff regarding surgical site infections (SSIs), underscoring the urgent need for targeted educational programs. While there is some awareness of causative agents like *Staphylococcus aureus* and *Escherichia coli*, a deeper understanding necessary for effective prevention and management is lacking. Tailored educational interventions that are aligned with international standards could significantly improve infection control practices, thereby enhancing patient safety, reducing healthcare costs, and improving surgical outcomes. Such initiatives would not only meet immediate educational needs but also lay the groundwork for ongoing enhancements in healthcare quality throughout the region.

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