



Operating Room Nurses' Knowledge Levels on Preventing Surgical Site Infections

Ameliyathane Hemşirelerinin Cerrahi Alan Enfeksiyonlarını Önlemeye Yönelik Bilgi Düzeylerinin Değerlendirilmesi

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Cite this article as: Akbulut İ, Atalay S. Operating room nurses' knowledge levels on preventing surgical site infections. FLORA 2025;30(1):91-99.

ABSTRACT

Introduction: Surgical site infections (SSIs) are among the major causes of morbidity and mortality associated with healthcare-associated infections in Türkiye. The prevention of SSIs in Türkiye is largely based on evidence-based practices, as outlined in global and national guidelines published by the World Health Organization and the Turkish Ministry of Health. Operating room nurses play a critical role in preventing SSIs by adhering to aseptic techniques and ensuring appropriate patient preparation and wound care.

Materials and Methods: This descriptive study assessed the knowledge levels of 60 operating room nurses working at Health Sciences University İzmir Tepecik Training and Research Hospital regarding evidence-based practices for SSI prevention. Data were collected through a 40-item questionnaire administered between November 15 and November 25, 2024. Statistical analyses, including the Mann-Whitney U and Kruskal-Wallis tests, were conducted to compare knowledge scores based on educational background and type of training received.

Results: The mean knowledge score among nurses was 23.2 ± 4.1 out of a maximum of 30. Nurses who participated in continuous education programs scored significantly higher than those who only received in-service training ($p = 0.034$). While high scores were obtained in fundamental areas such as hand hygiene and sterilization, deficiencies were observed in topics related to surgical prophylaxis and skin preparation. Although nurses with six or more years of experience had higher knowledge levels, this difference was not statistically significant.

Conclusion: Although operating room nurses generally possess adequate knowledge regarding SSI prevention, the type and continuity of education significantly influence knowledge levels. Expanding and enhancing continuous education programs and revising the content of in-service training are crucial for addressing knowledge gaps and improving patient safety.

Key Words: Surgical wound infection; Infection control; Evidence-based practice

Received/Geliş Tarihi: 11/01/2025 - Accepted/Kabul Ediliş Tarihi: 14/02/2025



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Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Available Online Date: 21.03.2025

ÖZ

Ameliyathane Hemşirelerinin Cerrahi Alan Enfeksiyonlarını Önlemeye Yönelik Bilgi Düzeylerinin Değerlendirilmesi

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Giriş: Cerrahi alan enfeksiyonları (CAİ), Türkiye’de sağlık hizmeti ilişkili enfeksiyonlar arasında önemli morbidite ve mortalite nedenleri arasında yer almaktadır. Türkiye’de CAİ’nin önlenmesi, Dünya Sağlık Örgütü ve Türkiye Cumhuriyeti Sağlık Bakanlığı tarafından yayımlanan küresel ve ulusal kılavuzlarda ana hatlarıyla belirtilen kanıta dayalı uygulamalara dayanmaktadır. Ameliyathane hemşireleri, aseptik tekniklere bağlı kalarak, uygun hasta hazırlığı ve yara bakımı sağlayarak CAİ’lerin önlenmesinde kritik bir rol oynamaktadır.

Materyal ve Metod: Bu tanımlayıcı çalışmada, Sağlık Bilimleri Üniversitesi İzmir Tepecik Eğitim ve Araştırma Hastanesinde görev yapan 60 ameliyathane hemşiresinin CAİ’nin önlenmesine yönelik kanıta dayalı uygulamalara ilişkin bilgi düzeyleri değerlendirildi. Veriler, 15-25 Kasım 2024 tarihleri arasında uygulanan 40 maddelik bir anket aracılığıyla toplandı. İstatistiksel analizlerde, eğitim geçmiş ve eğitim türüne göre bilgi puanlarını karşılaştırmak amacıyla Mann-Whitney U ve Kruskal-Wallis testleri kullanıldı.

Bulgular: Hemşirelerin ortalama bilgi puanı, maksimum 30 üzerinden 23.2 ± 4.1 olarak hesaplandı. Sürekli eğitim programlarına katılan hemşireler, yalnızca hizmet içi eğitim alanlara kıyasla anlamlı düzeyde daha yüksek puan aldı ($p=0.034$). El hijyeni ve sterilizasyon gibi temel konularda yüksek puanlar elde edilirken, cerrahi profilaksi ve cilt hazırlığı gibi alanlarda bilgi eksiklikleri gözlemlendi. Altı yıl veya daha fazla deneyime sahip hemşirelerin bilgi düzeyleri daha yüksek olmasına rağmen bu fark istatistiksel olarak anlamlı bulunmadı.

Sonuç: Ameliyathane hemşireleri genel olarak CAİ önleme konusunda yeterli bilgiye sahip olmakla birlikte, eğitimin türü ve sürekliliği bilgi düzeylerini önemli ölçüde etkilemektedir. Bilgi eksikliklerinin giderilmesi ve hasta güvenliğinin artırılması için sürekli eğitim programlarının kapsamının genişletilmesi ve hizmet içi eğitim içeriklerinin gözden geçirilmesi kritik önem taşımaktadır.

Anahtar Kelimeler: Cerrahi alan enfeksiyonu; enfeksiyon kontrolü; kanıta dayalı uygulama

INTRODUCTION

Surgical site infections (SSIs) are among the major causes of morbidity and mortality associated with healthcare-associated infections in Türkiye^[1]. The prevalence of healthcare-associated infections ranges from 1% to 16.5%, and evidence-based practices play a significant role in their prevention^[1-3].

According to data published by the United States Centers for Disease Control and Prevention (CDC), healthcare-associated infections occur in approximately 5% to 10% of hospitalizations worldwide each year, leading to severe health and economic losses^[4].

Measures such as adherence to aseptic and antiseptic principles, advancements in surgical techniques, and proper sterilization and disinfection practices are critical in preventing SSIs. However, in addition to operating room conditions, the knowledge and practical skills of personnel play a significant role in reducing these infections^[5]. Operating room nurses hold key positions in this process by adhering to

aseptic techniques throughout surgical procedures, ensuring proper patient preparation, and maintaining effective postoperative wound care^[6].

In recent years, global and national guidelines developed for preventing SSIs have led to significant progress in reducing the incidence of these infections. Global guidelines published by the World Health Organization (WHO) provide evidence-based standards for infection prevention practices before, during, and after surgery, aiming to enhance the knowledge and skills of healthcare professionals^[7]. Notably, WHO’s recommendations on intraoperative and postoperative infection prevention have significantly reduced SSI rates even in low- and middle-income countries^[3].

These guidelines emphasize not only technical methods but also the importance of staff training and continuous professional development. The systematic reviews of the WHO highlight the impact of educational programs on SSI prevention while recommending that global health standards be supported by local policies

to enhance their applicability^[3]. Such education-focused approaches contribute significantly to improving patient safety and advancing quality improvement efforts in healthcare services.

This study was descriptively designed to determine the knowledge levels of nurses working in the operating room unit at Health Sciences University İzmir Tepecik Training and Research Hospital regarding evidence-based practices for preventing SSIs. The research aims to evaluate nurses' knowledge levels and shed light on educational programs and improvement strategies that can be implemented in this area.

MATERIALS and METHODS

This study was designed as descriptive research to evaluate the knowledge levels of nurses working at Health Sciences University İzmir Tepecik Training and Research Hospital on evidence-based practices for preventing SSIs.

Participants and Data Collection Process

The study population consisted of 60 nurses employed in the operating room unit of Health Sciences University İzmir Tepecik Training and

Research Hospital. A total of 62 nurses work in the operating room unit of our hospital, with a participation rate of 96.7%. The entire population was included in the study on a voluntary basis, without any sampling restrictions.

The data were collected between November 15, 2024, and November 25, 2024. Nurses individually completed the questionnaires during their working hours, ensuring no interaction among participants. Completing the questionnaire took approximately 20-25 minutes per participant.

Measurement Tools

A questionnaire developed by the researchers, based on a review of the relevant literature, was used as the data collection tool. The questionnaire consisted of 10 questions covering sociodemographic information and 30 closed-ended questions on evidence-based practices for preventing SSIs, totaling 40 questions (Supplementary document 1). The maximum score obtainable from the questionnaire was 30, while the minimum was zero. The reliability of the questionnaire was evaluated using Cronbach's alpha coefficient, which was calculated to be 0.75.

Supplement 1. Operating room nurse questionnaire

Section 1: Sociodemographic Information

1. What is your age?
2. What is your educational background?
 - High school
 - Associate degree
 - Undergraduate degree
 - Postgraduate degree
3. How many years have you been working in the operating room?
 - Less than one year
 - 1-5 years
 - 6 years or more
4. Have you received any training on surgical site infections before?
 - Yes
 - No
5. Please specify the type of training you received:
 - In-service training
 - Certification program
 - Continuous education (e.g., postgraduate studies)
 - Books, journals, etc.
6. What is your weekly working hours?
 - 40 hours
 - 41-48 hours
 - 49 hours or more
7. What is your work schedule?
 - Daytime
 - Day and Night

Supplement 1. Operating room nurse questionnaire (continue)

8. What is your position?
 - Scrub nurse
 - Circulating nurse
 - Scrub + Circulating nurse
9. Do you think evidence-based practices are implemented in your institution to prevent surgical site infections?
 - Yes
 - No
10. Do you think the management in your institution supports these practices?
 - Yes
 - No

Section 2: Evidence-Based Practices

1. Operating room doors should only be kept open in mandatory situations. (True/False)
2. The operating room should have positive pressure ventilation with at least five filtered air changes per hour. (True/False)
3. Hand hygiene should be observed during preoperative preparation. (True/False)
4. Surgical caps should cover all hair. (True/False)
5. Surgical gloves should be changed every two hours. (True/False)
6. Alcohol-based solutions can be used for skin antisepsis. (True/False)
7. Antibiotic prophylaxis for surgical site infection prevention should only be applied when clinically necessary. (True/False)
8. Sterile techniques must be followed during wound care. (True/False)
9. Positive pressure ventilation should extend from the operating room to the corridor. (True/False)
10. Surgical instruments used during the operation must be sterilized beforehand. (True/False)
11. Nails should not be longer than 2 mm. (True/False)
12. The use of artificial nails or nail polish is appropriate during surgery. (True/False)
13. Preoperative skin cleaning of the patient should be done using antiseptic agents. (True/False)
14. Wearing sterile gowns during the surgical procedure is mandatory. (True/False)
15. There is no need to change surgical garments if they become wet during surgery. (True/False)
16. Surgical caps and shoe covers are required in the operating room. (True/False)
17. If alcohol-based products are contraindicated, other antiseptics can be used for skin antisepsis. (True/False)
18. Topical antibiotic use is routine in preventing surgical site infections. (True/False)
19. Antimicrobial-coated sutures can be used to reduce the risk of infection. (True/False)
20. Maintaining normothermia during surgery reduces the risk of infection. (True/False)
21. Adequate oxygenation must be ensured during and after surgery. (True/False)
22. When a drain is placed after wound closure, additional antibiotic prophylaxis is required. (True/False)
23. Oxygen saturation should be monitored throughout surgery for patients undergoing endotracheal intubation. (True/False)
24. Preoperative patient preparation should comply with infection control protocols. (True/False)
25. Blood glucose levels during surgery should be kept below 100 mg/dL. (True/False)
26. If hair removal is necessary, sterile electric clippers should be used. (True/False)
27. Antiseptic preparation of the surgical site should be done on the day of surgery. (True/False)
28. Prophylactic antibiotics should be completed before the incision begins. (True/False)
29. Gloves should be changed every two hours in the operating room. (True/False)
30. Equipment used during surgery should be re-sterilized if contamination occurs. (True/False)

Data Analysis

The collected data were analyzed using SPSS 25.0 statistical software. Frequencies and percentages were calculated for categorical variables, while means, standard deviations, and minimum and maximum values were determined for continuous variables. For group comparisons of non-normally distributed variables, the Mann-Whitney U test and the Kruskal-Wallis test were

employed. A p-value of <0.05 was considered statistically significant for all analyses.

Ethical Considerations

Ethical approval for the study was obtained from the ethics committee of Health Sciences University İzmir Tepecik Training and Research Hospital (approval number: 2024/12-02) and the hospital administration overseeing participant recruitment.

RESULTS

Demographic Characteristics of Participants

The mean age of the nurses participating in the study was 36.5 ± 8.2 years (minimum= 24, maximum= 54). The age distribution of the participants is presented in Table 1. The majority of participants (33.3%) were in the 31-40 age group, followed by 28.3% in the 41-50 age group. Regarding educational background, 60% of the participants held an undergraduate degree,

23.3% had an associate degree, and 10% had postgraduate education. In terms of operating room experience, 70% of the nurses had six or more years of experience, representing the highest percentage among the groups (Table 1).

All nurses reported having received training on surgical site infections, with 50% citing in-service training, 20% certificate programs, 25% continuous education programs, and 5% self-study from books or journals as the sources of their education.

Table 1. Demographic and professional characteristics of participants

Question	Options	Number of Participants n (%)
Age	20-30	15 (25)
	31-40	20 (33.3)
	41-50	17 (28.3)
	>51	8 (13.3)
Educational level	High school	4 (6.6)
	Associate degree	14 (23.3)
	Undergraduate degree	36 (60)
	Postgraduate	6 (10)
Years of experience	<1	5 (8.8)
	1-5	13 (21.1)
	>6	42 (70)
Training on surgical site infections	Yes	60 (100)
	No	0 (0)
Type of training	In-service training	30 (50)
	Certification program	12 (20)
	Continuing education	15 (25)
	Books/Journals	3 (5)
Weekly working time (hours)	40	16 (26.6)
	41-48	29 (48.3)
	>49	15 (25)
Working schedule	Day shift	18 (30)
	Day and night shifts	42 (70)
Nursing role	Scrub nurse	10 (16.6)
	Circulating nurse	3 (5)
	Scrub + Circulating nurse	47 (78.3)
Do you think evidence-based practices to prevent surgical site infections are implemented in your institution?	Yes	35 (58.3)
	No	25 (41.6)
Do you think the management in your institution supports these practices?	Yes	42 (70)
	No	18 (30)

Knowledge Levels

The mean total knowledge score of the nurses on evidence-based practices for preventing surgical site infections was 23.2 ± 4.1 (minimum= 12, maximum= 30).

The participants' knowledge levels regarding evidence-based practices are summarized in Figure 1. In the technical procedures and sterilization category, the mean score was 5.2, with a maximum score of 7. In the hand hygiene category, 96.6% of participants achieved near-maximum scores. When comparing knowledge scores by type of

education, nurses who participated in continuous education programs had significantly higher scores (mean= 25.0) compared to those who received in-service training ($p= 0.034$, Table 2).

Although no significant difference was found between years of experience and knowledge scores, nurses with six or more years of operating room experience had higher average knowledge scores (mean= 24.0, $p= 0.7$). Similarly, nurses with postgraduate education demonstrated higher knowledge scores compared to other groups, though this difference did not reach statistical significance ($p= 0.09$, Table 2).

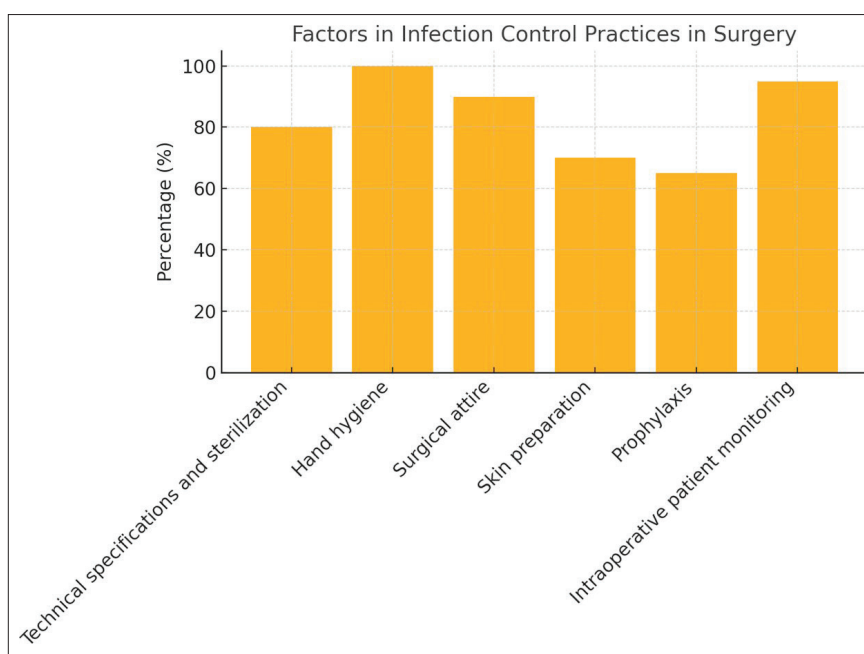


Figure 1. Factors in infection control practices in surgery.

Table 2. Factors affecting knowledge levels on evidence-based practices

Factors	Number of Participants	Mean Knowledge Score	Statistical Significance
Educational Level			
Postgraduate	6	24.0	p= 0.09
Undergraduate	36	22.5	
Associate degree/High school	18	21.8	
Years of Experience			
Six years or more	42	24.0	p= 0.7
Five years or less	18	22.0	
Type of Training			
Continuing education	15	25.0	p= 0.034
Others	45	22.1	

In conclusion, continuous education programs were found to be effective in increasing knowledge levels. This finding suggests that the type of education plays a critical role in enhancing nurses' knowledge.

DISCUSSION

Surgical site infections hold a significant place among healthcare-associated infections, and their prevention plays a critical role in enhancing patient care quality^[4]. This study examined the knowledge levels of operating room nurses regarding evidence-based practices for preventing SSIs. The results indicate that the overall knowledge level of nurses is sufficient (23.2/30). However, the type and continuity of education were found to be effective in enhancing knowledge levels.

This finding aligns with other studies investigating the impact of continuous education programs. International reviews emphasize the importance of multidisciplinary approaches and training programs in preventing SSIs^[8,9]. Similarly, studies highlighting the critical role of patient education and awareness initiatives in improving the success of infection control measures further support these results^[10,11].

As shown by multicenter studies, surgical site infections vary in Türkiye^[1]. Education is a vital tool in the prevention of SSIs among nurses. Continuous education programs ensure the correct implementation of infection control procedures, enhancing patient safety and reducing infection rates^[5,8]. Alemkere et al. demonstrated that structured and ongoing educational programs improve nurses' effectiveness in essential procedures such as antibiotic prophylaxis and aseptic techniques. Nurses who participated in these training programs were found to be more successful in reducing SSI rates. Additionally, the use of visual learning tools has shown significant positive impacts on infection control^[12]. Maharjan et al. highlighted that educational videos enhanced awareness of sterilization and disinfection procedures and supported error-free practice among nurses^[13]. Similarly, Waliu and Muojekwu emphasized that simulation-based training was effective in developing nurses' clinical skills and reducing SSI rates^[14].

Multidisciplinary approaches to infection control are also noteworthy. Moreal et al. underscored the benefits of team-based training for infection control in the post-pandemic period. Such approaches have improved collaboration by enabling nurses to take more active roles in infection control teams^[15]. The importance of continuous education programs was further highlighted in a recent study, which found that regular training not only increased knowledge levels but also ensured the retention of this knowledge over time. The continuity of education also supported the transformation of theoretical knowledge into practical applications^[16]. Furthermore, the role of local and cultural factors in education emerged as a critical finding. Hill et al. revealed that aligning educational programs with local contexts contributed to more cohesive and effective teamwork among nurses^[17].

In this study, while nurses demonstrated high knowledge levels in fundamental topics such as hand hygiene and sterilization, deficiencies were identified in subcategories such as surgical prophylaxis and skin preparation. These findings suggest that the content of evidence-based training programs should be revised to address these gaps. A study conducted in Türkiye similarly underscores the necessity of comprehensive and continuous training programs for the effective implementation of infection prevention strategies^[18,19].

The relationship between the type of training and management support also emerged as significant in this study. The higher knowledge scores among trained nurses highlight the critical role of management support in integrating infection control measures. Recent studies indicate that training interventions not only improve nurses' practical skills but also contribute to reducing infection rates^[20,21].

Additionally, the role of patient involvement in reducing SSIs is gaining increasing recognition. Patient education and awareness campaigns are identified as effective strategies for enhancing the success of infection control measures.^[22]

Limitations

This study has several limitations. First, as the study was conducted solely in the operating

room unit of a single hospital, the results are not generalizable. Second, the self-reported questionnaires used for data collection may not fully reflect the nurses' knowledge levels and carry a risk of bias. Furthermore, the study assessed knowledge levels without evaluating actual behaviors in practice.

The fact that all participants had received training on SSIs limited the variation in knowledge levels and restricted the ability to analyze the effects of different training types in detail. Finally, the short data collection period did not allow for the evaluation of long-term changes. These limitations suggest the need for future research with larger participant groups and longitudinal designs.

CONCLUSION

This study was conducted to evaluate the evidence-based knowledge levels of operating room nurses regarding the prevention of SSIs. The findings revealed that nurses generally have sufficient knowledge, but the type and continuity of education are determining factors in enhancing knowledge levels. The higher knowledge scores among nurses who received continuous education highlight the need to prioritize such programs in structuring educational initiatives.

The study calls into question the adequacy of in-service training and recommends revisiting the content and delivery methods of such programs. Additionally, developing specific training modules targeting areas where knowledge deficiencies were identified could be an important step in improving patient care quality. In this context, the findings of this study may contribute to the development of strategies aimed at increasing the knowledge levels of nurses.

Acknowledgment

All authors have read and agreed to the published version of the manuscript.

ETHICS COMMITTEE APPROVAL

This study was approved by the Tepecik Training and Research Hospital Non-Invasive Researchs Ethics Committee (Decision no: 2024/12-02, Date: 09.01.2025).

CONFLICT of INTEREST

The authors have no conflicts of interest to declare that are relevant to the content of this article.

AUTHORSHIP CONTRIBUTIONS

Concept and Design: İA, SA

Analysis/Interpretation: İA, SA

Data Collection or Processing: İA

Writing: İA, SA

Review and Correction: İA, SA

Final Approval: SA

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