

Knowledge, Attitudes, and Practices of Nurses Regarding the Decontamination and Sterilization of Surgical Instruments and Devices Across Five Provinces: A Descriptive Analysis

Abstract

Background: Proper decontamination, disinfection, and sterilization of surgical instruments and medical devices are essential for preventing healthcare-associated infections.

Aim: This study aimed to assess nurses' knowledge, attitudes, and practices regarding decontamination, disinfection, and sterilization procedures and to examine the relationships among these domains.

Methods: This descriptive, cross-sectional study was conducted in 2025 and included 154 nurses working in hospitals across five provinces. Data were collected using a Sociodemographic Characteristics Form and a structured questionnaire comprising knowledge (25 items), attitude (10 items), and practice (10 items) subscales. Total scores ranged from 0 to 45. Data were analyzed using descriptive statistics, comparative analyses, reliability analysis, and correlation analysis. A p value <0.05 was considered statistically significant.

Results: The majority of participants were female and held a bachelor's degree. The questionnaire demonstrated excellent internal consistency (Cronbach's alpha=0.91). Statistically significant positive correlations were observed among nurses' knowledge, attitude, and practice scores ($p<0.001$). Higher educational attainment, employment in a sterilization unit, prior training on sterilization processes, and longer professional experience were associated with significantly higher scores ($p<0.05$). No significant differences were found according to gender, age, or work pattern.

Conclusion: Higher levels of knowledge were associated with more positive attitudes and higher practice scores related to sterilization processes. The findings may help identify priority areas for future educational and organizational initiatives aimed at improving sterilization practices.

Keywords: Attitude, decontamination, knowledge, nurse, practice, sterilization

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Introduction

Surgical procedures are among the most frequently performed invasive interventions in modern healthcare. Surgical instruments and devices used during these procedures can serve as vehicles for the transmission of infectious agents to patients. Consequently, proper decontamination, disinfection, and sterilization of surgical instruments and devices are fundamental components of infection prevention and control.^{1,2} Guidelines issued by the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) emphasize that appropriate decontamination and sterilization before the reuse of medical devices are essential for ensuring patient safety.³

Surgical site infections (SSIs), one of the most common types of healthcare-associated infections (HAIs), pose a substantial threat to patient safety. A substantial proportion of HAIs have been attributed to surgical site infections.^{1,4} These infections are associated with prolonged hospital stays, increased morbidity and mortality, and considerable economic burden on healthcare systems.^{1,4} Preventing SSIs depends not only on the effective sterilization of medical devices but also on the knowledge, attitudes, and practices of healthcare professionals responsible for performing these procedures.⁵

Studies conducted in various countries have reported high rates of SSIs, with inadequate cleaning and sterilization of reusable medical devices identified as important contributing factors.⁶⁻⁸ Likewise, studies conducted in primary and secondary public hospitals have reported high rates of steam sterilization failures and poor adherence to recommended protocols for medical device reprocessing and sterilization.^{9,10} Effective sterilization requires healthcare professionals to possess adequate knowledge of each stage of the decontamination and sterilization process.

Nurses, particularly those working in operating rooms and Central Sterile Supply Departments (CSSDs), play a pivotal role in the decontamination and sterilization of surgical instruments and devices. Errors at any stage of the reprocessing cycle may compromise sterility and place patients at increased risk of infection. Therefore, nurses must maintain current knowledge of infection prevention principles, adhere to standardized sterilization protocols, and demonstrate positive attitudes toward these practices.¹¹ However, studies conducted in Türkiye have shown that nurses' knowledge regarding SSI prevention and sterilization practices remains below the desired level and that educational needs in this area are not adequately

addressed.^{12,13} Similarly, other studies have reported only moderate compliance with infection prevention practices, with insufficient knowledge and inadequate training identified as major barriers to optimal performance.¹⁴

As part of national initiatives to improve healthcare quality in Türkiye, infection prevention and the sterilization of medical devices are recognized as key quality indicators.^{15,16} Guidelines issued by the Ministry of Health recommend that sterilization and decontamination processes be performed in accordance with established standards, by appropriately trained personnel, and under continuous quality monitoring.^{17,18} Despite these recommendations, studies evaluating nurses' knowledge, attitudes, and practices related to decontamination and sterilization remain limited. International evidence likewise suggests that nurses may have gaps in their knowledge of medical device reprocessing and that adherence to recommended practices can be improved through structured education, ongoing supervision, and continuous professional development.^{19,20} Taken together, these findings underscore the importance of evaluating nurses' knowledge, attitudes, and practices regarding decontamination and sterilization, given their critical role in infection prevention and control. Therefore, this study aimed to assess nurses' knowledge, attitudes, and practices regarding the decontamination and sterilization of surgical instruments and devices.

Study Questions

1. What are nurses' levels of knowledge, attitudes, and practices regarding the decontamination and sterilization of surgical instruments and devices?
2. Is there a relationship among nurses' knowledge, attitudes, and practices regarding the decontamination and sterilization of surgical instruments and devices?
3. Do nurses' knowledge, attitudes, and practices differ according to their sociodemographic and professional characteristics?
4. How do training and professional experience influence nurses' knowledge, attitudes, and practices regarding the decontamination and sterilization of surgical instruments and devices?

Materials and Methods

Study Design

This descriptive, correlational, cross-sectional study was conducted to evaluate nurses' knowledge, attitudes, and practices regarding the decontamination and sterilization of surgical instruments and devices.

Study Setting and Sample

The study was conducted between July and October 2025 among nurses working in operating rooms and sterilization units at one training and research hospital in Karabük, one training and research hospital in Ankara, one research and training hospital in Eskişehir, one training and research hospital in Kastamonu, and one private hospital in İzmir. These provinces were selected based on accessibility and feasibility, as the researchers had direct access to the participating healthcare institutions. The target population consisted of approximately 154 operating room and CSSD nurses employed at the participating hospitals during the study period.

The minimum required sample size was estimated based on the correlation analyses specified in the study objectives. Assuming a two-tailed test, a medium effect size ($r=0.30$), a significance level of $\alpha=0.05$, and 80% statistical power, the minimum required sample size was calculated as 84 participants. The final sample of 154 nurses therefore exceeded the minimum sample size required for the planned analyses. All eligible nurses who voluntarily agreed to participate were invited to participate. Initially, 179 nurses completed the questionnaire. Data from 20 nurses who participated in the pilot study and five questionnaires with incomplete responses were excluded. Consequently, data from 154 nurses were included in the final analyses.

The inclusion criteria were employment as an operating room or CSSD nurse, at least six months of work experience in the relevant unit, voluntary participation, and completion of the questionnaire in its entirety. Nurses who were absent during the data collection period because of leave, illness, or other reasons were excluded.

Data Collection Instruments

Data were collected using a structured questionnaire developed by the researchers based on the relevant literature.²¹⁻²⁵ The questionnaire consisted of two sections. The first section collected participants' sociodemographic characteristics, whereas

the second assessed their knowledge, attitudes, and practices regarding the decontamination and sterilization of surgical instruments and devices.

Sociodemographic Characteristics Form: This section consisted of 16 questions covering participants' demographic characteristics, including age, gender, educational level, years of professional experience, and work unit. One open-ended question asked, "What are the greatest challenges you encounter regarding sterilization?" Responses were categorized to identify the most frequently reported challenges experienced by nurses during the sterilization process (Table 1).

Knowledge, Attitude, and Practice Questionnaire: The questionnaire consisted of 45 items, including 25 knowledge items (Cronbach's $\alpha=0.887$), 10 attitude items (Cronbach's $\alpha=0.772$), and 10 practice items (Cronbach's $\alpha=0.846$). The overall Cronbach's alpha coefficient for the questionnaire was 0.92. Items were rated using three response options: Yes, No, and Not sure. The Not sure response was treated as a neutral response and excluded from scoring. The knowledge section also included open-ended questions designed to assess participants' understanding of key sterilization parameters. Participants were asked to report the sterilization temperature used in their hospital's autoclaves, the recommended sterilization time for medical devices (micromotors) at that temperature, and the maximum storage duration for wrapped sterile medical devices under standard conditions. Responses were scored as 1 for correct answers and 0 for incorrect answers.

The knowledge section also included items assessing participants' ability to identify the appropriate reprocessing method for selected medical devices, including otoscope tips, scalpel handles, and thermometers. Participants selected the appropriate method (cleaning, disinfection, or sterilization) for each item. Correct responses were scored as 1 and incorrect responses as 0.

Each participant's total knowledge score was calculated by summing the number of correct responses, with higher scores indicating greater knowledge. Consistent with previous studies, responses of Yes were scored as 1, indicating correct or positive knowledge, attitudes, or practices, whereas No responses were scored as 0, indicating incorrect or negative knowledge, attitudes, or practices.^{14,22-24}

Content validity was established before the pilot study using the Lawshe method based on evaluations from six academic experts in the field. Given the relatively small expert panel, content validity was interpreted according to expert consensus. Following expert review, the revised questionnaire was pilot-tested with 20 nurses who were not included in the main study. The reliability was subsequently evaluated using Cronbach's alpha coefficients calculated from the data collected in the main study.

Ethical Considerations

Ethical approval was obtained from Karabük University Non-interventional Clinical Research Ethics Committee (Approval Number: 2025/2326, Date: 23.05.2025), and institutional permission was obtained from the participating hospitals before data collection. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Data Collection

The questionnaire was converted into a Google Forms survey, and the survey link was distributed via WhatsApp. Participants were able to complete the online questionnaire only once. Paper-based questionnaires were also distributed by the researchers after explaining the purpose of the study, emphasizing that participation was voluntary, and informing participants of their right to withdraw at any time without consequence. Written informed consent was obtained from all participants before participation. Completion of the questionnaire required approximately 10–15 minutes, and participants were asked to answer all items.

Statistical Analysis

Data were analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables are presented as means, standard deviations, minimum values, and maximum values, whereas categorical variables are presented as frequencies and percentages. Welch's t-test was used to compare two groups, and one-way analysis of variance (ANOVA) was used for comparisons among three or more groups. Bonferroni post hoc tests were performed to identify pairwise differences. Internal consistency was evaluated using Cronbach's alpha coefficients. Relationships among

Table 1. Participant characteristics (n=154)

Variable	Category	n (%)
Province	Karabük	35 [22.73]
	Eskişehir	35 [22.73]
	Ankara	33 [21.43]
	Kastamonu	26 [16.88]
	İzmir	25 [16.23]
Gender	Female	118 [76.6]
	Male	36 [23.4]
Age (years)	20–25	9 [5.84]
	26–30	21 [13.64]
	31–35	28 [18.18]
	36–40	14 [9.09]
	41–45	34 [22.08]
	46–50	12 [7.79]
	≥50	36 [23.38]
Educational level	High school	9 [5.87]
	Associate degree	20 [12.98]
	Bachelor's degree	113 [73.37]
	Master's degree	10 [6.49]
	Doctorate	2 [1.29]
Professional experience	1–3 years	23 [14.93]
	4–7 years	11 [7.15]
	8–11 years	85 [55.19]
	12–15 years	30 [19.48]
	16–19 years	5 [3.25]
Current work unit	Operating room	96 [62.34]
	CSSD	58 [37.66]
Experience in OR/CSSD	1–3 years	65 [42.21]
	4–7 years	42 [27.27]
	8–11 years	33 [21.43]
	12–15 years	11 [7.14]
	16–19 years	3 [1.95]
Work schedule	Rotating day/night shifts	79 [51.3]
	Day shifts only	75 [48.7]
Position	Staff nurse	144 [93.51]
	Charge nurse	10 [6.49]
Received sterilization training	Yes	113 [73.38]
	No	41 [26.62]
Source of sterilization training	In-service training	97 [62.34]
	Course	40 [25.97]
	Other	17 [11.69]
Received infection control training	Yes	109 [70.78]
	No	45 [29.22]
OR/CSSD certification	Yes	93 [60.39]
	No	61 [39.61]
Compliance with sterilization standards	Always	127 [82.47]
	Most of the time	27 [17.53]

Table 1. Cont.

Variable	Category	n (%)
Main challenge	None	7 [4.54]
	Poor material quality	3 [1.94]
	Heavy workload, high work intensity, and shortages of personnel or equipment	125 [81.17]
	Communication problems	10 [6.5]
	Occupational accidents	3 [1.95]
	Instrument tracking and delivery	4 [2.6]
	Insufficient education or training	2 [1.3]
Interested in additional training	Yes	100 [64.94]
	No	54 [35.06]

Table 2. Knowledge, attitude, and practice scores

Subscale	Items	Mean±SD	Min–max
Knowledge	25	18.67±5.45	0–25
Attitude	10	9.41±1.35	0–10
Practice	10	7.91±2.53	0–10
Total	45	35.99±8.16	0–45

Values are presented as mean±standard deviation (SD).

knowledge, attitude, and practice scores were examined using Pearson's correlation analysis. A p value <0.05 was considered statistically significant.

Results

Of the 154 nurses included in the study, 22.73% were employed in hospitals located in Karabük and Eskişehir, 21.43% in Ankara, 16.88% in Kastamonu, and 16.23% in İzmir. Most participants were female (76.6%) and held a bachelor's degree (73.37%). Regarding professional characteristics, 55.19% had 8–11 years of overall professional experience, 62.34% worked in operating rooms, and 42.21% had 1–3 years of experience in operating rooms or Central Sterile Supply Departments. More than half of the participants worked rotating day–night shifts (51.3%), and 6.49% held charge nurse positions.

Most nurses reported having received training in sterilization (73.38%), primarily through institutional in-service education programs (62.34%). In addition, 70.78% had received infection prevention and control training, and 60.39% held certification in operating room or sterilization nursing. The majority reported always complying with standards for the sterilization of surgical instruments (82.47%). The most frequently reported challenges were heavy physical workload, high work intensity, and shortages of personnel and equipment (81.17%). Furthermore, 64.94% expressed a desire to receive additional training on sterilization and decontamination processes [Table 1].

Nurses' knowledge, attitude, and practice scores regarding decontamination and sterilization are presented as mean ± standard deviation. The mean knowledge score was 18.67±5.45 [range: 0–25], the mean attitude score was 9.41±1.35 [range: 0–10], and the mean practice score was 7.91±2.53 [range: 0–10]. The overall mean total score was 35.99±8.16 [range: 0–45] [Table 2].

Group comparisons demonstrated statistically significant differences in knowledge scores according to educational level (p=0.013), with nurses holding bachelor's degrees achieving higher scores than those with lower educational attainment. Nurses working in CSSDs also had significantly higher knowledge scores than those working in operating rooms (p=0.024). Likewise, nurses with at least five years of experience in operating rooms or CSSDs demonstrated significantly higher knowledge scores than those with less experience (p=0.041). Participants who had received sterilization training scored significantly higher than those who had not (p=0.001). No statistically significant differences were observed for the remaining variables; therefore, these findings are not presented in tabular form [Table 3].

Table 3. Factors associated with knowledge scores

Variable	Statistical test	p	Effect size
Educational level*	F=4.28	0.013	$\eta^2 \approx 0.07$
Current work unit*	F=3.96	0.024	$\eta^2 \approx 0.06$
Experience in OR/CSSD**	t=2.05	0.041	d=0.39
Sterilization training**	t=3.46	0.001	d=0.68

*: One-way analysis of variance (ANOVA) with Bonferroni post hoc test, **: Welch's t-test.
OR: Operating room, CSSD: Central Sterile Supply Department.

Pearson's correlation analysis demonstrated statistically significant positive correlations between knowledge and attitude scores ($r=0.619$, $p<0.001$), knowledge and practice scores ($r=0.579$, $p<0.001$), and attitude and practice scores ($r=0.536$, $p<0.001$). These findings indicate that higher knowledge scores were associated with more positive attitudes and higher practice scores (Table 4).

The findings of this study highlight several important patterns in nurses' knowledge, attitudes, and practices regarding decontamination and sterilization. These findings are discussed in the context of previous research to better understand their clinical and organizational implications.

Discussion

In this study, knowledge, attitude, and practice scores did not differ significantly according to demographic characteristics, including gender, age, and work schedule. Although most participants were female, the absence of gender-based differences suggests that knowledge and practices related to decontamination and sterilization are comparable across genders. This finding is consistent with a study conducted in Iraq, which reported no significant associations between nurses' knowledge of sterilization and the reuse of medical devices and either age or gender.²⁵ These findings suggest that nurses' knowledge, attitudes, and practices regarding decontamination and sterilization are influenced more by professional education, clinical setting, and work experience than by demographic characteristics.

In contrast, educational level, work setting, sterilization training, and years of experience in operating rooms or CSSDs were significantly associated with knowledge scores. Nurses holding bachelor's degrees, working in CSSDs, having received sterilization training, and possessing longer professional experience achieved higher knowledge scores. These findings underscore the importance of formal education, specialized training, and workplace experience in improving competence related to sterilization and infection prevention. Similar findings have been reported in Bangladesh, where educational level and training were positively associated with healthcare workers' knowledge, attitudes, and practices regarding sterilization and disinfection.²⁶ Nevertheless, because most participants in the present study held bachelor's degrees, the influence of educational level should be interpreted cautiously. Future studies including more balanced educational groups would help clarify this relationship.

Although participants demonstrated relatively high knowledge levels and highly positive attitudes, practice scores were comparatively lower. This finding supports previous reports describing a gap between healthcare professionals' knowledge and their actual clinical practice.²¹ Similar studies have shown that adequate knowledge and favorable attitudes do not necessarily translate into consistent adherence to recommended sterilization practices.^{8,27} Significant positive correlations were observed between knowledge and attitudes ($r=0.619$), knowledge and practices ($r=0.579$), and attitudes and practices ($r=0.536$). These findings indicate that higher knowledge scores were associated with more positive attitudes and higher practice scores.

However, the relatively weaker association between attitudes and practices indicates that practice is influenced by factors beyond individual beliefs and intentions. This interpretation is supported by participants' reports that heavy workload, staff shortages, and insufficient equipment were the most common barriers to effective sterilization. These findings emphasize the importance of organizational and systemic factors in determining adherence to recommended sterilization procedures.²⁷

Table 4. Correlations among knowledge, attitude, and practice scores

Variable	Knowledge	Attitude	Practice
Knowledge	1	$r=0.619$ $p=0.001$	$r=0.579$ $p=0.001$
Attitude	$r=0.619$ $p=0.001$	1	$r=0.536$ $p=0.001$
Practice	$r=0.579$ $p=0.001$	$r=0.536$ $p=0.001$	1

Pearson's correlation coefficients (r) are presented. All correlations were statistically significant ($p<0.01$).

Consistent with previous research, inadequate staffing, excessive workload, insufficient supervision, and limited availability of equipment remain important barriers to optimal sterilization practices. These findings suggest that efforts to strengthen sterilization safety may need to consider not only theoretical knowledge but also organizational factors, including workload, staffing, equipment availability, training opportunities, and quality monitoring.

Limitations

This study has several limitations. First, its cross-sectional design precludes the establishment of causal relationships among knowledge, attitudes, and practices. Second, because the findings were based on self-reported data, responses may have been influenced by social desirability bias. These limitations should be considered when interpreting the results.

Conclusion

This study demonstrated that sterilization safety requires attention to nurses' knowledge, attitudes, and practices. Although nurses demonstrated generally adequate knowledge and positive attitudes, gaps were identified in the consistent application of recommended sterilization practices. Knowledge scores were associated with educational level, work setting, previous sterilization training, and professional experience, while practice scores varied according to work setting and sterilization training. The findings therefore highlight specific areas and groups that may warrant greater attention in efforts to improve sterilization practices.

These findings may help identify priorities for future educational and organizational initiatives, particularly for nurses without prior sterilization training and those working outside dedicated sterilization units. However, because of the descriptive and cross-sectional design of the study, the effectiveness of specific educational or organizational interventions cannot be inferred from the present findings. Future studies using multicenter, interventional, and longitudinal designs are needed to evaluate strategies for improving sterilization knowledge and practices and to further clarify the relationships among knowledge, attitudes, and practices.

Ethics Committee Approval: The study was approved by the Karabük University Non-interventional Clinical Research Ethics Committee [Approval Number: 2025/2326, Date: 23.05.2025].

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