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Knowledge, attitudes, and practices among central sterile supply department staff in ministry of defense hospitals in the eastern province of Saudi Arabia: A cross-sectional study

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Abstract: This study evaluated the knowledge, attitudes, and practices (KAP) of Central Sterile Supply Department (CSSD) staff at Ministry of Defence hospitals in the Eastern Province of Saudi Arabia regarding sterilization protocols. A cross-sectional study was conducted using a self-administered online questionnaire distributed to 54 CSSD staff members. The questionnaire assessed demographic characteristics, knowledge, attitudes, and practices related to sterilization. KAP scores were categorized as poor, moderate, or good. Results: The findings indicated that 57.4% of participants had adequate knowledge, 55.6% adhered to good sterilization practices, and 24.1% displayed a positive attitude toward sterilization. A positive correlation was found between knowledge and attitude (rs=0.348, p=0.010) and practice scores (rs=0.302, p=0.027). However, some knowledge gaps were identified in areas such as spill kit use and the distinction between scopes. While the majority of CSSD staff demonstrated adequate knowledge and practice, there is a need for targeted training to address knowledge gaps and improve attitudes, particularly regarding specific sterilization practices. Hospitals should prioritize continuous education and targeted training programs for CSSD staff to enhance sterilization protocols, thereby improving infection prevention and control measures. Further research is needed across a broader range of hospitals to assess national trends.

Keywords: *Central sterile supply department, Hospital-acquired infection, Infection control, Knowledge, attitude, Practice, Scales, Sterilization.*

1. Introduction

The quality and safety of healthcare services have a significant impact on patient outcomes. Patient safety has been recognized as a fundamental element in the provision of quality healthcare in the Kingdom of Saudi Arabia, as outlined in Saudi Vision 2030 [1].

Hospital-acquired infections (HAIs) are infections that patients acquire while receiving treatment for other conditions in a healthcare setting. These infections constitute a significant public health problem, leading to increased morbidity, mortality, and healthcare costs [2].

The World Health Organization estimates that hospital-acquired infections (HAIs) impact millions of patients globally each year, especially in intensive care units. In high-income countries, around 7% of hospitalized patients develop at least one HAI, whereas the incidence increases to 15% in low- and middle-income countries [3].

The World Health Organization estimates that HAIs affect hundreds of millions of patients worldwide each year, particularly in intensive care units. In high-income countries, approximately 7% of hospitalized patients acquire at least one HAI, while in low- and middle-income countries, the rate rises to 15% [3].

Several studies have investigated HAI rates in Saudi Arabia. A survey conducted by Alshamrani, et al. [4] in six tertiary care hospitals found an overall HAI prevalence of 6.8%. Approximately 19.2% of

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these HAIs were device-related. In addition, Balkhy, et al. [5] reported high rates of resistance among Gram-negative pathogens causing device-associated HAIs in Saudi Arabia. A six-year surveillance study of central line-associated bloodstream infections (CLABSI) in tertiary care hospitals across three Arabian Gulf countries found a higher risk of CLABSI in these hospitals compared with those in the National Healthcare Safety Network [6]. These findings highlight the need for continuous efforts to develop infection control practices and reduce HAI rates in Saudi Arabia.

Sterilization practices in healthcare facilities play a critical role in the prevention of hospital-acquired infections. Effective sterilization aims to eliminate or destroy all forms of microbial life, including bacteria, viruses, fungi, and spores, from medical instruments, equipment, and surfaces. Conversely, inadequate or inconsistently applied sterilization protocols significantly increase the risk of HAIs [7, 8].

The Central Sterile Supply Department (CSSD) is integral to preventing hospital-acquired infections (HAIs) and minimizing their impact in healthcare settings. Key responsibilities of the CSSD include acquiring, receiving, cleaning, disinfecting, packaging, sterilizing, and distributing medical instruments to various hospital departments. CSSD personnel are essential members of healthcare teams, influencing the overall outcomes of healthcare facilities. As a result, it is crucial for hospitals to employ skilled staff with thorough knowledge and proper practices regarding sterilization, as well as maintaining an efficient CSSD operation [9, 10]. This study, therefore, sought to assess the knowledge, attitudes, and practices of CSSD staff at the Ministry of Defense Hospitals in the Eastern Province of Saudi Arabia.

2. Methods

Ethical Considerations: The study was conducted after obtaining ethical approval from the ethical review board at the Prince Sultan Military College of Health Sciences (Number: IRB-2022-DOH-045). Before completing the questionnaire, the aim of the study was explained to the participants, and informed consent was obtained. The data were kept confidential and analyzed anonymously. Study Design, Setting, and Duration: This cross-sectional survey study was carried out at the Prince Sultan Military College of Health Sciences Dental and Oral Health Department over 24 months, from 11 December 2022 to 11 December 2023.

Sample Size: The study population consisted of 90 participants distributed among the King Fahd Military Medical Complex (N=53), King Abdul Aziz Air Base Hospital in Dhahran (N=32), and the Armed Forces Hospital (N=5). The sample size was calculated using the following equation: $N = Z^2 \times P(1\text{-}P)/\text{error}^2$, where Z = 1.96 (value of 95% CI), P is the prevalence (25%) and error = 5%.

Eligibility Criteria: All male and female CSSD staff members, including specialists, technicians, and healthcare assistants working in Ministry of Defense hospitals in the Eastern Province of Saudi Arabia, were invited to participate in the study. The hospitals comprised the Armed Forces Hospital, King Abdul Aziz Naval Base in Jubail, King Abdul Aziz Air Base Hospital in Dhahran (AIR BASE), and King Fahd Military Medical Complex (KFMMC).

2.1. Process and Tool of Data Collection

We collected data using a self-administered questionnaire through an online survey created on the Google Forms platform. The survey was disseminated to participants via email. The questionnaire was utilized and validated in a previous similar study [11] with only minor modifications made in the first part related to demographic and work-related characteristics.

The questionnaire was in English and consisted of 39 close-ended questions distributed among four domains. The first domain includes six questions about personal information, such as age, sex, nationality, educational level, years of experience, and hospital site. The second domain consists of 14 questions regarding the knowledge of CSSD staff about sterilization practices. The third domain is composed of nine questions about attitudes towards sterilization practices. The fourth part contains ten

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items that inquire about the practices of the CSSD staff in Ministry of Defense hospitals in the Eastern Province of Saudi Arabia.

2.2. Scoring of the Knowledge, Attitude, and Practice (KAP) Scores

Scoring of the Knowledge, Attitude, and Practice (KAP) Scores the KAP scores were ranked on Likert scales as follows: Knowledge Scale: 4 points for "Yes, very well" - 3 points for "Yes, well" - 2 points for "Yes, to some extent" - 1 point for "No.", Attitude Scale: The first question was reverse-scored, with 1 indicating "strongly agree," 2 indicating "agree," 3 indicating "neutral," and 4 indicating "disagree." The remaining attitude questions were scored as follows: 4 for "strongly agree," 3 for "agree," 2 for "neutral," and 1 for "disagree." - Practice Scale: The responses were scored as follows: "4" indicated "always, "3" indicated "most of the time, "2" indicated "sometimes, and "1" indicated "rarely." The third question was scored differently, with "4" indicating "sometimes,"3" indicating rarely,"2" indicating "most of the time, and "1" indicating "always." The KAP scores were subsequently summed to obtain the overall levels and were graded as follows: Poor (if points < 50% of the total score), Moderate (if points covered 50–79% of the total score) - Good (if points covered 80–100% of the total score)

2.3. Statistical Analysis

Data were tabulated and analyzed using the statistical package SPSS (Statistical Package for the Social Sciences) version 27 (IBM Corp., Armonk, NY, USA). Categorical variables were presented as counts and percentages. Numerical data were first tested for normality distribution using the Shapiro-Wilk test and presented as mean ± standard deviation. Spearman rank correlations were performed to investigate the relationships among knowledge, attitude, and practice scores. Furthermore, comparisons of knowledge, attitude, and practice scores between different demographic and work-related characteristics were carried out using the Independent Samples t-test or one-way analysis of variance (ANOVA), followed by post hoc pairwise comparison if the results were significant. A p-value < 0.05 was considered statistically significant.

3. Results

The present study comprised a composite sample of 54 staff members, including specialists, technicians, and healthcare assistants, who were working in the CSSD at the Ministry of Defense Hospitals in the Eastern Province of Saudi Arabia. Approximately two-thirds of the participants (36, 66.7%) were aged between 31 and 40 years. Additionally, there was a preponderance of female participants (74.1%). The proportion of Saudi participants was notably higher than that of non-Saudi participants, at 61.1% and 38.9%, respectively. Regarding educational level, half of the participants (27, 50.0%) held a Bachelor's degree, while a smaller proportion (7, 13.0%) had pursued postgraduate studies. The range of years of experience was distributed as follows: 1-5 years (59.3%), 6-9 years (11.1%), and 10 years and above (29.6%). A high proportion (34, 63.0%) of the participants were employed by the King Fahd Military Medical Complex (KFMMC). Additionally, 12 participants (22.2%) were employed at the Armed Forces Hospital, located at King Abdul Aziz Naval Base in Jubail, while 8 individuals (14.8%) were employed at the King Abdul Aziz Air Base Hospital in Dhahran (AIR BASE) (Table 1).

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Table 1.
Demographic and work characteristics of the study participants (N=54).

		N=54	%
Age group, years	20-30	10	18.5%
	31- 40	36	66.7%
	41 and more	8	14.8%
Gender	Male	14	25.9%
	Female	40	74.1%
Nationality	Saudi	33	61.1%
	Non-Saudi	21	38.9%
Educational level	Bachelor	27	50.0%
	Diploma	20	37.0%
	Post-graduate	7	13.0%
Years of experience, years	1-5	32	59.3%
	6-9	6	11.1%
	10 and more	16	29.6%
Hospital site	King Fahd Military Medical Complex (KFMMC)	34	63.0%
	Armed Forces Hospital, King Abdul Aziz Naval Base in Jubail	12	22.2%
	King Abdul Aziz Air Base Hospital in Dhahran (AIR BASE)	8	14.8%

Source: N: number.

The survey results indicated that the majority of surveyed staff members demonstrated a high level of knowledge regarding proper hand hygiene methods (90.7%) and the appropriate use of personal protective equipment (92.6%). Their comprehension of the safe handling of contaminated instruments and the importance of pre-cleaning was rated as either "very well" (88.9%) or "well" (11.1%), and the majority (85.2%) reported having very good knowledge of the principles of manual cleaning. Additionally, a substantial proportion reported a very good understanding of the distinctions between thermal and chemical disinfection (77.8%), differences in packaging techniques (77.8%), Spaulding classification (74.1%), the differences between steam sterilization and low-temperature sterilization (74.1%), and the utilization of chemical/biological indicators (88.9%). Conversely, only approximately half of the respondents reported a very good understanding of the use of the spill kit (57.4%), the distinctions between rigid, semi-rigid, and flexible scopes (55.6%), and the application of tracking systems (48.1%) (Table 2).

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Table 2.
Distribution of the study participants' knowledge about sterilization (N=54).

		N=54	%
K1. Do you know the correct method of hand hygiene?	Yes, very well	49	90.7%
	Yes, well	5	9.3%
K2. Do you know the proper donning and doffing techniques of wearing PPE?	Yes, very well	50	92.6%
	Yes, well	4	7.4%
K3. Do you know about the safe handling of contaminated instruments?	Yes, very well	48	88.9%
	Yes, well	6	11.1%
K4. Do you know the correct method of operating the equipment's machines?	Yes, very well	42	77.8%
	Yes, well	11	20.4%
	Yes, to some extent	1	1.9%
K5. Do you know the importance of pre-cleaning?	Yes, very well	48	88.9%
	Yes, well	6	11.1%
K6. Do you know the principle of manual cleaning?	Yes, very well	46	85.2%
	Yes, well	8	14.8%
K7. Do you know the usage of the spill kit and the procedure to contain the hazardous spill?	Yes, very well	31	57.4%
	Yes, well	17	31.5%
	Yes, to some extent	6	11.1%
K8. Do you know the difference between Rigid, semi-rigid, and flexible scope?	Yes, very well	30	55.6%
	Yes, well	13	24.1%
	Yes, to some extent	10	18.5%
	No	1	1.9%
K9. Do you know how to use tracking systems if available?	Yes, very well	26	48.1%
	Yes, well	20	37.0%
	Yes, to some extent	6	11.1%
	No	2	3.7%
K10. Do you know the difference between thermal and chemical disinfection?	Yes, very well	42	77.8%
	Yes, well	11	20.4%
	Yes, to some extent	1	1.9%
K11. Do you know the difference between packaging techniques?	Yes, very well	42	77.8%
	Yes, well	11	20.4%
	Yes, to some extent	1	1.9%
K12. Do you know the Spaulding classification?	Yes, very well	40	74.1%
	Yes, well	12	22.2%
	Yes, to some extent	2	3.7%
K13. Do you know the difference between steam sterilization and low-temperature sterilization?	Yes, very well	40	74.1%
	Yes, well	13	24.1%
	Yes, to some extent	1	1.9%
K14. Do you know the usage of chemical indicator/biological indicator?	Yes, very well	48	88.9%
	Yes, well	5	9.3%
	Yes, to some extent	1	1.9%

Source: K: knowledge questions, N: number.

More than two-thirds agreed (40.7% strongly agree and 27.8% agree) that CSSD staff should wear the minimum personal protective equipment (PPE) inside clean areas. Only 16.7% of respondents expressed a divergent perspective. The majority (88.9% strongly agree and 9.3% agree) emphasized the importance of regular hand washing before and after entering the work area. Most respondents (72.2% strongly agree and 25.9% agree) acknowledged the need for arranging reusable medical devices in trays to ensure that all surfaces are exposed to cleaning agents. Regarding safety protocols for sharps, 79.6% of respondents strongly agreed and 20.4% agreed that staff should be trained in their proper handling. Furthermore, a substantial majority (68.5%) strongly agreed, and an additional 29.6% agreed, that staff training on spill kit usage is essential. Moreover, about 98% supported the importance of correctly disassembling reusable medical devices during manual cleaning. However, the level of agreement regarding the practice of drying instruments after manual cleaning was slightly lower, with 63% strongly agreeing, 22.2% agreeing, 7.4% being neutral, and 7.4% disagreeing. The majority (77.8%

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strongly agree and 22.2% agree) believed that staff should adhere to the correct procedures for donning and doffing PPE. Most participants (85.2% strongly agree and 14.8% agree) established that staff should test the sterilizer before using it (Table 3).

Table 3.
Distribution of the attitudes of the study participants towards sterilization (N=54).

		N=54	%
A1. CSSD staff should wear minimum PPE (gloves mask) inside clean areas.	Strongly agree	22	40.7%
	Agree	15	27.8%
	Neutral	8	14.8%
	Disagree	9	16.7%
A2. CSSD staff should apply hand wash regularly before and after entering the work area.	Strongly agree	48	88.9%
	Agree	5	9.3%
	Disagree	1	1.9%
A3. CSSD staff should arrange reusable medical devices in an orderly fashion in trays so that all surfaces are exposed to clearing action.	Strongly agree	39	72.2%
	Agree	14	25.9%
	Neutral	1	1.9%
A4. CSSD staff should know how to deal with a sharp disposable item if receive it by mistake.	Strongly agree	43	79.6%
	Agree	11	20.4%
A5. CSSD staff should be trained to use spill kits properly.	Strongly agree	37	68.5%
	Agree	16	29.6%
	Neutral	1	1.9%
A6. CSSD staff should open and disassemble all reusable medical devices correctly during manual cleaning.	Strongly agree	47	87.0%
	Agree	6	11.1%
	Disagree	1	1.9%
A7. CSSD Staff should dry the instrument after manual cleaning.	Strongly agree	34	63.0%
	Agree	12	22.2%
	Neutral	4	7.4%
	Disagree	4	7.4%
A8. Do you think that CSSD staff should follow the correct consequences for donning and doffing PPEs?	Strongly agree	42	77.8%
	Agree	12	22.2%
A9. CSSD Staff should test the sterilizer before operating (leak test, Bowie-Dick test, BI).	Strongly agree	46	85.2%
	Agree	8	14.8%

Source: A: attitude questions, CSSD: Central Sterile Supply Department, N: number.

Table 4 shows the distribution of participants' responses concerning sterilization practices. Most participants (79.6% always and 18.5% most of the time) follow the manufacturer's instructions for cleaning, disinfection, and sterilization of reusable medical devices. A high level of compliance with the utilization of biohazard signs on carts during the transportation of contaminated materials to the CSSD was observed. The data revealed that 85.2% of subjects always used the biohazard sign, while 9.3% did so most of the time. Furthermore, 70.4% of the respondents reported that they always lubricate the moving parts of surgical instruments, while a notable proportion (5.6%) did not perform this practice consistently. The compliance rate for manual cleaning before using the washer-disinfector was very high, with 87.0% of participants responding "always" and 13.0% "most of the time." Additionally, most participants ensured proper machine validation (87.0% "always" and 11.1% "most of the time"). A significant majority (92.6%) always inspected reusable medical devices after unloading them from the washer-disinfector. Moreover, 75.9% "always" checked sterilizer parameters for each cycle, while 14.8% did it "most of the time," and 9.2% sometimes or rarely performed these checks. Most participants adhered to cooling time requirements, with 83.3% "always" and 14.8% "most of the time" following this practice. The majority exhibited a high degree of compliance, with 94.4% responding "always" and 5.6% responding "most of the time" when asked about their adherence to full PPE protocols in contaminated environments. The practice of conducting regular sterilizer tests before operation showed a high degree of consistency, with 88.9% of respondents reporting that they always perform these tests and 11.1% reporting that they do so most of the time.

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Table 4.
Distribution of the sterilization practices responses among the study participants (N=54).

		N=54	%
P1. Do you implement manufacturer instructions (IFU) for cleaning, disinfection, and sterilization of reusable medical devices?	Always	43	79.6%
	Most of the time	10	18.5%
	Rare	1	1.9%
P2. Do you put a biohazard sign on the cart during dirty transportation to CSSD?	Always	46	85.2%
	Most of the time	5	9.3%
	Sometimes	3	5.6%
P3. Do you lubricate the moving parts for surgical instruments?	Always	38	70.4%
	Most of the time	13	24.1%
	Sometimes	3	5.6%
P4. Do you perform manual cleaning before loading the instrument inside the washer-disinfector?	Always	47	87.0%
	Most of the time	7	13.0%
P5. Do you perform routine validation tests for the machines (washer-disinfector, sterilizer…)?	Always	47	87.0%
	Most of the time	6	11.1%
	Rare	1	1.9%
P6. Do you inspect the reusable medical devices after unloading them from the washer-disinfector for (cleanliness stains, corrosion, cracks, breakage..)?	Always	50	92.6%
	Most of the time	4	7.4%
P7. Do you check the sterilizer parameters printout for each cycle?	Always	41	75.9%
	Most of the time	8	14.8%
	Sometimes	3	5.6%
	Rare	2	3.7%
P8. Do you allow the instrument to cool down after unloading from the sterilizer?	Always	45	83.3%
	Most of the time	8	14.8%
	Rare	1	1.9%
P9. Do you wear full PPE inside dirty areas?	Always	51	94.4%
	Most of the time	3	5.6%
P10. Do you test the sterilizer regularly before operating (leak test, Bowie-Dick test, BI)?	Always	48	88.9%
	Most of the time	6	11.1%

Note: CSSD: Central Sterile Supply Department, N: number, P: practices questions.

The evaluation of the calculated knowledge, attitude, and practice scores indicated that only 31 participants (57.4%) demonstrated adequate knowledge, while the remaining participants exhibited either moderate (18, 33.3%) or poor levels of knowledge (5, 9.3%). The data further revealed a negative attitude towards sterilization practices among 11 participants (20.4%), while 30 participants (55.6%) maintained a neutral attitude, and 13 participants (24.1%) exhibited a positive attitude. Furthermore, more than half of the respondents (55.6%) reported adhering to good sterilization practices; while 18 participants (33.3%) exhibited moderate compliance and 6 participants (11.1%) Table 5.

Table 5.
Levels of knowledge, attitude, and practice scores among the study participants.

	Descriptive				Level		
	Minimum	Maximum	Mean	SD	Poor	Moderate	Good
Knowledge score	37.0	56.0	52.1	4.3	5 (9.3%)	18 (33.3%)	31 (57.4%)
Attitude score	25.0	36.0	32.0	3.0	11 (20.4%)	30 (55.6%)	13 (24.1%)
Practice score	29.0	39.0	35.8	2.2	6 (11.1%)	18 (33.3%)	30 (55.6%)

Source: SD: Standard Deviation.

Table 6 presents a significant positive weak correlation between knowledge score and attitude score (rs= 0.348, p=0.010), and a similar relationship between knowledge and practice scores (rs=0.302, p=0.027). Alternatively, there was no significant correlation between the attitude and practice scores ($p<0.05$).

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Table 6.
Spearman Rank correlations between the knowledge, attitude, and practices scores.

Score	r_s Correlation coefficient	P-Value
Knowledge-Attitude	0.348	0.010*
Knowledge-Practice	0.302	0.027*
Attitude-Practice	0.189	0.170

*Significant at $p<0.05$

Comparison of the knowledge, attitude, and practice scores between different categories of the demographic and work characteristics revealed non-significant differences in the knowledge score (All p values >0.05). The attitude score showed a significant difference in relation to the age groups (p=0.003); the mean attitude score was higher in the 20-30 than in the 31-40 age groups. Furthermore, the staff members of the Armed Forces Hospital, King Abdul Aziz Naval Base in Jubail showed (36.8±0.9) a significantly slightly higher mean practices score compared to those belonging to King Fahd Military Medical Complex (35.8±2.0) (Table 7).

Table 7.
Comparison of the knowledge, attitude, and practice scores between different demographic and work-related characteristics of the study participants.

		Knowledge score		Attitude score		Practices score	
		Mean	SD	Mean	SD	Mean	SD
Age, years	20-30	54.3	2.7	32.0[a]	1.9	36.6	1.0
	31- 40	51.3	4.7	29.6	2.5	35.4	2.6
	41 and more	53.1	3.3	30.5	2.3	36.4	1.2
	P-Value	0.119		0.003*		0.255	
Gender	Male	53.2	3.7	31.2	2.6	36.4	.7
	Female	51.7	4.5	29.8	2.4	35.6	2.5
	P-Value	0.237		0.157		0.095	
Nationality	Saudi	52.3	4.5	30.2	2.6	35.7	2.3
	Non-Saudi	51.8	4.1	30.1	2.5	36.0	2.2
	P-Value	0.662		0.868		0.683	
Education	Diploma	52.0	4.0	30.4	2.8	35.9	2.2
	Bachelor& postgraduate	52.2	4.6	30.0	2.4	35.7	2.3
	P-Value	0.863		0.465		0.794	
Years of experience	Less than 10	52.1	4.2	30.3	2.4	35.7	2.4
	10 and more	52.3	4.7	29.9	2.9	36.1	1.6
	P-Value	0.851		0.590		0.409	
Hospital site	Hospital 1	52.9	4.2	30.2	2.1	36.8[b]	.9
	Hospital 2	50.6	6.0	28.8	3.0	34.4	3.6
	Hospital 3	52.2	4.0	30.5	2.5	35.8	2.0
	P-Value	0.512		0.368		0.036*	

Note: Hospital 1: Armed Forces Hospital, King Abdul Aziz Naval Base in Jubail, Hospital 2: King Abdul Aziz Air Base Hospital in Dhahran (AIR BASE), Hospital 3: King Fahd Military Medical Complex (KFMMC).
*Significant at $p<0.05$. [a]: Indicates a significant difference between 20-30 and 31-40 age groups, [b]: Indicates a significant difference between hospital 1 and hospital 3.

4. Discussion

Healthcare facilities should centralize the cleaning, disinfection, and sterilization of patient care equipment to ensure adequate quality control. The goal of central processing is the systematic sterilization of medical and surgical instruments to protect patients from infection while reducing risk to staff and maintaining the value of the instruments being processed [12, 13].

Ensuring reliable sterilization practices in the CSSD requires operator competence and adherence to established evidence-based guidelines for sterilization methods. It also necessitates following appropriate methods for cleaning and wrapping instruments, packing and operating the sterilizer, and monitoring the entire process. Adequate training and education of CSSD personnel, along with regular

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monitoring and surveillance of sterilization processes to identify breaches in infection control and implement corrective actions, are also of paramount importance [14].

The present study found that CSSD staff had a good overall understanding of most sterilization practices. More than half (57.4%) had adequate knowledge, while 33.3% had moderate knowledge and 9.3% had poor knowledge levels. The participants demonstrated a high level of knowledge regarding hand hygiene (90.7%), proper donning and doffing of PPE (92.6%), safe handling of contaminated instruments (88.9%), the importance of pre-cleaning (88.9%), and the principles of manual cleaning (85.2%). Participants also showed strong recognition of disinfection methods, packaging techniques, Spaulding classification, sterilization methods, and indicator use, with rates ranging from 74.1% to 77.8%. This is a promising finding that suggests a strong basis for infection prevention and control in the studied facilities. Adequate knowledge is a criterion for the proper implementation of sterilization protocols and is necessary to minimize the risk of hospital-acquired infections [15]. However, some gaps were identified in knowledge regarding the use of spill kits, distinctions between scopes, and tracking systems, representing areas where further training or education may be needed to ensure complete competency. Several studies have underscored the importance of regular training and professional development in disseminating updated information, strengthening best practices, and improving infection control. They also highlighted the significance of continuous educational programs in hospitals for enhancing the competency and quality of CSSD staff [16-18].

This study also revealed that 24.1% of participants had positive attitudes toward the implementation of sterilization practices and training, while 11 participants (20.4%) exhibited negative attitudes. Participants reported strong agreement on key sterilization practices, such as hand hygiene (88.9%), proper manual cleaning protocols (87.0%), instrument testing (85.2%), proper sharps handling (79.6%), and the use of personal protective equipment (PPE) (77.8%). However, some areas, such as drying instruments after manual cleaning, showed minor disagreement or neutrality (14.8%). Additionally, only 68.5% of staff expressed high motivation to receive training on the proper use of spill kits. Furthermore, most participants in this study exhibited a good level of adherence to sterilization practices (55.6%), while a smaller proportion (11.1%) demonstrated poor compliance. While overall adherence to sterilization protocols was high, a few inconsistencies were noted in practices such as instrument lubrication and checking sterilizer parameters for each cycle, highlighting areas for improvement.

The current study investigated the possible relationships between knowledge, attitude, and practice scores. Knowledge positively influenced both attitude and practice scores to a weak but significant degree; however, there was no relationship between attitude and practice scores. This highlights the role of knowledge in shaping both attitudes and practices, although attitudes alone may not translate directly into enhanced practices. It is important to mention that knowledge alone does not guarantee optimal practice. Studies have shown that there can be a gap between knowledge and practice, even among healthcare professionals [19]. Therefore, objective assessment of the actual practices of CSSD staff should be considered in future research.

The personal and work characteristics did not show significant associations with the levels of knowledge, attitude, and practice scores, with the exception of some observations. There was a significantly higher attitude score among younger staff aged between 20 and 30 years compared to older staff (31–40 years). Additionally, staff at the Armed Forces Hospital, King Abdul Aziz Naval Base in Jubail, exhibited slightly better practice scores compared to those at the King Fahd Military Medical Complex.

Studies assessing knowledge, attitudes, and practices related to sterilization protocols in Saudi Arabia are lacking, highlighting a critical research gap. A previous study involving CSSD staff in Saudi MOH hospitals concluded that most CSSD staff have sufficient knowledge, a highly positive attitude toward the use of sterilization techniques, and are effectively practicing the sterilization protocols. This study also revealed positive correlations between knowledge, attitude, and practice scores [11]. A similar study conducted by Mukesh, et al. [20] in India documented that CSSD staff at a hospital in

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Patna City had sufficient knowledge about sterilization techniques, were positively motivated, and possessed effective sterilization practices. Additionally, another study from Bangladesh involving both CSSD and hospital healthcare staff revealed a satisfactory level of awareness but also highlighted some areas of dissatisfaction that require further education and training [21].

5. Conclusion

The findings indicate that most CSSD staff in the Ministry of Defense Hospitals in the Eastern Province of Saudi Arabia have adequate to high knowledge of most sterilization practices, including hand hygiene, PPE use, and sterilization techniques. However, notable gaps were identified in areas such as spill kit use, scope distinctions, and tracking systems. The attitude toward the use of sterilization techniques varied mainly from neutral to positive, and some areas require further intervention and clarification, such as drying instruments after manual cleaning and the proper use of spill kits. Additionally, adherence to sterilization protocols was high, with minor inconsistencies noted in some practices, such as instrument lubrication and checking sterilizer parameters for each cycle. The identified gaps highlight the need for targeted training and education to ensure comprehensive competency among staff. Expanding future research to include all types of hospitals and CSSD staff nationwide is essential to gain a comprehensive understanding of their knowledge, attitudes, and practices. This would contribute significantly to enhancing infection prevention and control efforts in Saudi hospitals.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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