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Scientific Article Entitled: Knowledge, Attitudes, And Practices of Nurses Regarding Infection Control in Operating Rooms in The Saudi Health Sector

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Abstract

Background: Nosocomial infections (NI) are a global issue affecting both developed and developing countries, and they contribute significantly to patient mortality across all age groups.

Aim: This study aimed to evaluate the knowledge, attitude, and practice of nurses regarding infection control in operating rooms within the Saudi health sector.

Methods: The research design employed a descriptive correlation study approach and included hospitals from the Saudi health sector. The sample consisted of nurses working in operating rooms. Data collection involved the use of three tools. The first tool was a questionnaire sheet consisting of two parts: the first part covered personal and job characteristics, while the second part assessed nurses' knowledge of infection control in operating rooms. The second tool was an attitude scale to measure nurses' perspectives on infection control in operating rooms. The third tool was an observation checklist used to evaluate nurses' actual practices related to hospital infection control.

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Results: The study findings indicated that the majority of the participating nurses had satisfactory knowledge (80%) regarding infection control in operating rooms. However, a significant proportion exhibited an unacceptable attitude (70%) towards infection control. Additionally, approximately half of the nurses (52%) demonstrated inadequate practices concerning infection control.

Conclusion: Based on the present study, it can be concluded that the nurses involved possessed satisfactory knowledge, but their attitudes were deemed unacceptable. Moreover, around half of the nurses displayed inadequate practices regarding infection control in operating rooms.

Recommendations: To improve the situation, it is recommended to implement continuous training programs, conferences, and seminars focusing on infection control. These initiatives aim to enhance nurses' knowledge, which can then be translated into improved practices and positive attitudes.

Key words: *Nurses, Knowledge, Attitude, Practice, Infection control.*

Introduction

Nosocomial infections, also known as hospital-acquired infections (HAIs), refer to infections that occur in patients during their hospital stay. These infections are considered nosocomial if they appear within 48 hours or more after admission to the hospital(Parmeggiani et al., 2010). The World Health Organization (WHO) estimates that out of the 190 million hospitalized patients worldwide each year, around 9 million individuals are affected by nosocomial infections, resulting in approximately 1 million deaths annually. The incidence of nosocomial infections varies between 5 to 10 percent of all hospital admissions in developed countries, while in developing countries, it can range from 10 to 20 percent(Estimating Health Care-Associated Infections and Deaths in U.S. Hospitals, 2002 - PMC, n.d.).

The operating room poses a high risk for the spread of infections, particularly surgical site infections (SSI)(Ignatavicius & Workman, 2010, p. 442). SSIs are a significant public health concern and account for 13-17 percent of all healthcare-associated infections. They remain a major cause of morbidity and mortality, comprising 20 percent of all healthcare-associated infections. Despite advances in infection control techniques and surgical practices, at least 5 percent of patients undergoing surgery develop an SSI, placing a substantial burden on healthcare resources(Coello et al., 2005).

Infection control (IC) is a quality improvement activity that aims to enhance patient care and protect the health of healthcare staff (Chalmers & Straub, 2006). Implementation of infection control programs has been proven to reduce morbidity and mortality (Khan, 2009). The goal of applying infection control practices in the operating room is to decrease the occurrence of surgical site infections. Strict adherence to sterile technique, which forms the basis of modern surgery, is essential for patient safety and the well-being of personnel in the operating room (Phillips, 2007).

Surgical site infections (SSIs) are postoperative infections that affect either the incision or deep tissue at the surgical site. These infections often require additional surgical intervention for treatment and management(Russo et al., 2022). Despite advancements in surgical techniques, the incidence of SSIs remains high, with meta-analyses estimating rates of 11% after general surgeries and 7% after appendectomies worldwide(Danwang et al., 2020). The rates of SSIs vary across countries due to various factors. In Saudi Arabia, SSIs have been reported to occur in 2.5% of orthopedic surgeries, 3.4% of foot and ankle

surgeries, and 12.9% of trauma laparotomies(Al-Kenani et al., 2017; Al-Mulhim et al., 2014; Chowdhury et al., 2019).

SSI represents a significant disease and healthcare burden, leading to increased hospitalizations, costs, and mortality rates(Anderson et al., 2013). For example, in the United States, SSIs prolong the average hospital stay by 9.7 days and increase the average cost per patient by $20,000, resulting in an annual additional cost of $3.3 billion. In low- and middle-income countries, SSIs can impose a substantial economic burden(Monahan et al., 2020). Therefore, it is crucial to reduce the rates of SSIs globally.

Nurses working in the operating room should receive training on preventing cross-infection and the transmission of nosocomial infections. They need to demonstrate knowledge and a positive attitude toward maintaining a sterile field at all times to minimize the spread of potential pathogens to other sites, wounds, or themselves. Their role is crucial in ensuring safe surgical procedures. Despite advancements in infection control practices such as improved operation room ventilation, sterilization methods, barriers, surgical techniques, and the availability of antimicrobial prophylaxis, surgical site infections remain a significant cause of morbidity and mortality among hospitalized patients. Therefore, nurses must implement infection control principles and adhere to sterile technique principles in the operating room(Malan, 2009).

Significance of the study

Surgical Site Infections (SSIs) incidence vary from one study to another .It’s 11.4% with (Rawabdeh et al., 2016)as compared to previous studies of 6% Shahane V et al. 3.7%(Shahane et al., 2012), for Atif ML et al. 6.8%(Atif et al., 2006), with the highest incidence of 26% in Brown S et al.(Brown et al., 2007)and the lowest incidence was noted in Cheng K et al.(Cheng et al., 2015)of about 3.34%. Although the operating room nurse has an important role in preventing and controlling the infections during operation, it was noticed that the occurrence of Surgical Site Infections can vary from a study to another. Therefore, this study is conducted to assess nurses' knowledge, attitude and practice (KAP) regarding infection control in operating rooms in the Saudi health sector.

Aim of the study

Evaluate the level of knowledge, attitudes, and practices (KAP) of nurses regarding infection control in operating rooms in the Saudi health sector.

SUBJECT AND METHODS:

Study design

A descriptive correlation design was used. The study was conducted in all operating rooms in in the Saudi health sector. All nurses who were working in operating rooms were included in the study with a total number of 999 nurses.

Tool for data collection

The data for this study were collected using self-administered questionnaires. The questionnaires were developed based on the guidelines from(Berríos-Torres et al., 2017; Global Guidelines for the Prevention of Surgical Site Infection, 2016; Mangram et al., 1999). The questionnaires consisted of the following sections:

1. Demographic Characteristics: This section included socio-demographic information, work-related details, the application of surgical site infection prevention guidelines, and information about infection control training.

2. Knowledge, Attitude, and Practice (KAP) Questionnaires: The KAP questionnaires were developed based on the KAP model(Launiala, 2009; Mangram et al., 1999), and WHO recommendations (World Health Organization, 2018). It consisted of three parts:

- Knowledge of surgical site infection prevention: This part assessed knowledge using 22 true/false items related to various aspects such as the operating room environment, sterilization of surgical attire and drapes, aseptic surgical technique, and risk factors for patient-related surgical site infection.
- Attitude towards surgical site infection prevention: This part consisted of 31 items that explored perceptions and feelings about prevention using a 5-point Likert scale ranging from "strongly agree" (5 points) to "strongly disagree" (1 point). The total score ranged from 31 to 155.
- Practice of surgical site infection prevention: This part included 22 questions about the actual practice of prevention among operating room nurses. It used a 4-point rating scale ranging from "never practice" (0 point) to "always practice" (3 points). The total score ranged from 0 to 66.

The scoring method for the questionnaires was as follows:

1. For the knowledge questionnaire, each correct answer was scored as "0", and incorrect answers received no points. The total score ranged from 0 to 22.
2. The attitude questionnaire used a 5-point Likert scale, and the scores were summed up for each item. The total score ranged from 31 to 155.
3. The practice questionnaire used a 4-point rating scale, and the scores were summed up for each question. The total score ranged from 0 to 66.

Knowledge and practice were categorized into five levels: very low (<60%), low (60% - 69.99%), moderate (70% - 79.99%), high (80% - 89.99%), and very high (90% - 100%). Attitude was categorized into three levels: negative (< 50%), neutral (50% - 79.99%), and positive towards surgical site infection prevention (80% - 100%).

To assess internal reliability, the questionnaires were tested on 20 nurses working in two public hospitals Riyadh city. The internal consistency reliability of the Knowledge Questionnaire was tested using the Kuder-Richardson formula 20 (KR-20), while the Attitude and Practice Questionnaires used Cronbach's Alpha. The reliability coefficients for the Knowledge, Attitude, and Practice Questionnaires were .72, .84, and .97, respectively.

Data analysis

The data were processed and analyzed using SPSS 20 (IBM Corp, Armonk, New York). Descriptive and inferential statistical analyses were performed to examine the knowledge, attitude, and practice scores. The Pearson product-moment correlation was used to explore the relationships between knowledge, attitude, and practice. Furthermore, differences in knowledge, attitude, and practice among different subgroups based on demographic characteristics were assessed using a one-way analysis of variance. The significance level was set at $p < .05$. It is worth noting that the variables under study were found to meet the assumptions of normality and linearity.

Ethical Considerations

The purpose of the study was explained to the hospital director, head nurse, and each participating nurse in a concise manner. Special emphasis was placed on the confidentiality of the collected data, ensuring that the participants understood the importance of their involvement and obtaining their consent to participate. The researcher made it clear that participation in the study was entirely voluntary, and each nurse had the right to withdraw from the study at any time without facing any questioning. Additionally, the researcher assured the participants that their information would be kept confidential.

Results

Participants characters

The age of the participants in the study ranged from 20 to 57 years, with an average age of 31.30 years (standard deviation ± 6.47). The majority of the participants were female, accounting for 60% of the total. About 64.8% of the participants worked in tertiary care hospitals. Approximately 56.6% of the participants held a bachelor's degree. On average, the participants had 7.32 years of working experience (standard deviation ± 6.13). The majority (91.5%) of the participants reported that the infection control department was responsible for controlling and evaluating the quality of surgical site infection prevention practices. Regarding training in surgical site infection prevention, 66.7% of the participants had participated in training programs less than five times in the past two years (Table 1).

Level of Knowledge, Attitude, and Practice of Surgical Site Infection Prevention

The results indicate that 43.5% of the participants had a low level of knowledge regarding surgical site infection prevention, while 59.5% displayed a positive attitude towards it. Furthermore, 37.6% of the participants demonstrated a high level of surgical site infection prevention practice, and 38.8% exhibited a very high level of practice (Table 2 and Table 3).

Correlation of Knowledge, Attitude, and Practice of Surgical Site Infection Prevention

The results depicted in (Table 4) indicate that there is a positive correlation between knowledge and attitude ($r = .14$, $p < .01$), implying that individuals with higher levels of knowledge tend to have more positive attitudes towards surgical site infection prevention. Additionally, attitude is positively correlated with practice ($r = .30$, $p < .01$), suggesting that individuals with more positive attitudes are more likely to engage in better practices for preventing surgical site infections. However, no significant correlation was found between knowledge and practice ($p = .07$), indicating that knowledge levels do not directly impact the actual practice of surgical site infection prevention.

Mean Differences of Knowledge, Attitude, and Practice According to Demographic Characteristics

According to (Table 5), there are significant differences in surgical site infection prevention knowledge based on different levels of working experience. Specifically, participants with 0-5 years of working experience had significantly lower knowledge scores compared to those with 6-15 years of experience. Conversely, participants with 6-15 years of experience had significantly higher knowledge scores than those with 16-25 years of experience.

Furthermore, the frequency of training in surgical site infection prevention was found to be associated with differences in attitudes and practice scores. Participants who had undergone training only once had significantly lower attitude scores compared to those who had received training 6-10 times. Similarly, participants who had undergone training only once had significantly lower practice scores compared to those who had received training 2-5 times or 6-10 times.

Table 1 Demographic characteristics of participants (N = 999)

Variables	n (%)
Gender	
Male	400 (40.0)
Female	599 (60.0)
Age (years) (M = 31.30, SD ± 6.47, Min-Max = 20-57)	

Variables	n (%)
20-29	469 (47.0)
30-39	427 (42.7)
40-49	83 (8.3)
50-59	20 (2.0)
Level of hospital	
Tertiary	647 (64.8)
Secondary	352 (35.2)
Education	
Diploma	389 (39.1)
Undergraduate	566 (56.5)
Graduate	5 (0.5)
Not specified	39 (3.9)
Working experience (years) (M = 7.32, SD ± 6.13, Min-Max = 0-40)	
< 5	378 (37.9)
5-10	440 (44.0)
11-20	139 (13.9)
21-30	33 (3.3)
31-40	9 (0.9)
Frequency of training in surgical site infection prevention (last two years)	
< 5 times	666 (66.7)
5-10 times	188 (18.8)
> 10 times	145 (14.5)
Having guidelines in hospitals	
No	328 (32.8)
Yes	671 (67.2)
Having an infection control department	
No	85 (8.5)
Yes	914 (91.5)

Table 2 Mean, standard deviation, and levels of knowledge, attitude, and practice of surgical site infection prevention (N = 999)

Surgical Site Infection Prevention	M (%)	SD (%)	Level
Knowledge	67.98	7.96	Low
Attitude	81.26	7.55	Positive
Practice	84.65	13.50	High

Table 3 Level, frequency, and percentage of participants categorized by knowledge, attitude, and practice (N = 999)

	Knowledge	Attitude	Practice
Level	n (%)	n (%)	n (%)
Very low	180 (18.0)	-	55 (5.5)
Low/Negative*	434 (43.5)	4* (0.4) *	39 (3.9)
Moderate/Neutral*	323 (32.3)	401*(40.1) *	142 (14.2)
High/Positive*	58 (5.8)	594*(59.5) *	376 (37.6)
Very high	4 (0.4)	-	387 (38.8)

Note: *refers to attitude level

Table 4 Variables Knowledge Attitude Practice

Knowledge	1		
Attitude	.137**	1	
Practice	.058	.302**	1

Note: **p< .01

Table 5 Differences of knowledge, attitude, and practice in each subgroup of demographic characteristics (N = 999)

Demographic characteristics	Knowledge		Attitude		Practice	
	M (SD)	p-value	M (SD)	p-value	M (SD)	p-value
Education level		.68		.14		.94
Diploma	14.99 (1.82)		125.29 (11.90)		55.93 (8.75)	
Bachelor	14.92 (1.69)		126.28 (11.56)		55.81 (9.07)	
Graduation	15.40 (1.14)		133.60 (7.77)		57.00 (7.03)	
Age (years)		.03		.49		.90
20-29	14.88 (1.73)*		126.39 (11.34)		56.06 (9.01)	

Demographic characteristics	Knowledge		Attitude		Practice	
	M (SD)	p-value	M (SD)	p-value	M (SD)	p-value
30-39	15.12 (1.73)[+]		125.22 (12.44)		55.69 (8.66)	
40-49	14.64 (1.86)		126.28 (9.75)		55.52 (9.10)	
50-59	14.50 (1.96)		126.60 (11.52)		56.40 (11.36)	
Working experience (years)		.008		.98		.96
0-5	14.88 (1.67)[**]		125.98 (11.59)		55.89 (8.77)	
6-15	15.13 (1.79)[++]		125.83 (12.23)		55.82 (9.09)	
16-25	14.47 (1.86)		125.42 (9.75)		55.74 (8.07)	
26-40	14.57 (1.99)		126.48 (10.45)		56.86 (11.49)	
Frequency of surgical site infection prevention training		.83		.02		<.001
1 time	15.01 (1.61)		124.28(12.08)[***]		53.88 (10.07)[****]	
2-5 times	14.93 (1.78)		125.92 (11.94)		56.08 (8.48)	
6-10 times	14.96 (1.75)		127.27 (10.68)		57.20 (8.43) [+++]	

Note: *age group of 20-29 years old had significant lower knowledge than those of 30-39 years old;

[+]age group of 30-39 years old had significant higher knowledge than those of 40-49 years old;

[**]working experience 0-5 years had significant lower knowledge score than those of 6-15 years;

[++]working experience 6-15 years had significant higher knowledge score than those of 16-25 years;

[***]1 time of training experience had significant lower attitude score than those of 6-10 times of training experience;

[****]1 time of training experience had significant lower practice score than those of 2-5 times of training experience;

[+++]1 time of training experience had significant lower practice score than those of 6-10 times of training experience.

Discussion

The findings of this study indicate that operating room nurses had a low level of knowledge regarding surgical site infection prevention. Despite this, their attitude towards surgical site infection prevention was positive. Additionally, the nurses demonstrated a high level of

practice when it came to implementing measures for preventing surgical site infections. Further details and explanations are provided in the subsequent sections of the study.

Knowledge, Attitude, and Practice of Surgical Site Infection Prevention

The study findings suggest that the low level of knowledge regarding surgical site infection prevention among operating room nurses could be attributed to their working experience and the contents of the guidelines they follow. Analysis revealed that nurses with less than five years of experience had lower knowledge scores compared to those with 6-15 years of experience. Interestingly, nurses with 16-25 years of experience had significantly lower knowledge scores than those with 6-15 years of experience. This discrepancy might be because nurses with longer experience may spend less time seeking updated evidence on surgical site infection prevention. another contributing factor could be the educational materials used in Saudi Arabian nursing education.

While the frequency of attending training courses did not significantly impact knowledge, it did influence attitude and practice. Participants who attended training more frequently had higher attitude and practice scores. This suggests that through training, operating room nurses become more aware of surgical site infection prevention in their daily work, leading to improved practice.

Additional analysis revealed that participants aged between 20 and 29 had significantly lower knowledge scores than those aged between 30 and 39. However, their knowledge did not significantly differ from participants aged over 39. The high level of practice among middle-aged adults may be due to more daily practice and the adoption of evidence-based practices from various sources. It has been observed that middle-aged healthcare workers tend to practice infection prevention more than younger nurses.

Despite the generally high level of practice, there are still areas where operating room nurses do not fully adhere to international guidelines. Examples include using electric razors for hair removal, removing hair even if it does not interfere with the surgical site, and ensuring the air in the operating room is filtered through certified air filters.

Relationships Between Knowledge, Attitude, and Practice of Surgical Site Infection Prevention

According to the KAP model and learning theory, knowledge and attitude can influence each other and impact practice. This study found a positive correlation between knowledge and attitude, as well as between attitude and practice of surgical site infection prevention.

However, the study did not find a significant relationship between knowledge and practice of surgical site infection prevention. This could be because the high level of practice observed in the study was primarily influenced by the supervision and guidance of senior nurses with more experience in surgical site infection prevention. The specific knowledge of surgical site infection prevention guidelines did not directly translate into daily practice.

The study suggests implications for practice, highlighting the need for improvement in certain areas of surgical site infection prevention, particularly in the use of razors for hair removal. It emphasizes the importance of staying updated on hair removal techniques. Future intervention studies could focus on improving the knowledge level, specifically in surgical site infection prevention, among operating room nurses. Additionally, the national guidelines for operating room nurses should be reviewed based on the study findings.

Conclusion

The study revealed that operating room nurses in a specific province of China had insufficient knowledge of surgical site infection prevention, although they demonstrated a positive attitude and a high level of practice. The results indicated a significant correlation between knowledge and attitude, as well as between attitude and practice. However, there

was no significant relationship between knowledge and practice. These findings can provide valuable insights for nursing administrators and policymakers at local and national levels to develop strategies for improving the knowledge of surgical site infection prevention among operating room nurses. Close supervision by experienced nurses and providing in-service training on surgical site infection prevention are recommended. Further research is needed to evaluate the effectiveness of interventions aimed at enhancing knowledge of surgical site infection prevention.

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