

SELF-REPORTED AWARENESS, APPROACH, AND APPLICATION OF INFECTION CONTROL PRACTICES AMONG NURSING STAFF IN INTENSIVE CARE UNITS AT KING SALMAN ARMED FORCES HOSPITAL IN TABUK, SAUDI ARABIA



Medical Science

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ABSTRACT

Background: Infection control in hospitals remains a challenge to healthcare policymakers and world healthcare leaders. This study was aimed to explore the factors associated with self-reported awareness, approach, and application of infection control practices and to describe the barriers and enablers to such practice among registered nurses in all intensive care units (ICUs) at King Salman Armed Forces Hospital in Tabuk, Kingdom of Saudi Arabia. **Methods:** A cross-sectional, descriptive and comparative study was conducted from January 2016 to June 2016. One hundred twenty-four registered nurses voluntarily participated in the study. Data was collected using a self-reported questionnaire. The data was analyzed using IBM Statistical Package for Social Sciences (SPSS) version 25 for Windows. Descriptive statistics and one-way ANOVA were used to analyze the data. **Results:** The registered nurses demonstrated high level of awareness, approach, and application of implementing infection control standard and guidelines. No statistically significant differences were found between mean awareness scores in age, gender, and education. Statistically significant differences were found between mean application scores in age and current working unit (p-values 0.05, 0.009 respectively). **Conclusion:** The awareness and application of implementing infection control standards and guidelines among the registered nurses were good. However, there is still a wide scope of improvement with regular educational training programs.

KEYWORDS

Application, barriers, infection control guidelines, nursing staff, intensive care unit.

INTRODUCTION

Hospital-acquired infections have a significant impact on the morbidity and mortality rates within and outside the hospital. They continue to pose a threat to patients, visitors, and personnel in the healthcare environment despite efforts from various organizations to ensure implementation of basic infection control guidelines and standards (World Health Organization, Centers for Disease Control and Prevention). Nurses in particular stay in direct and prolonged contact with patients, and they are subject to exposure to microorganisms and pathological substances. Nurses play a vital role in preventing the spread of the infection using the standard precautions. Therefore, it is important for nursing staff to have up to date knowledge and good skills in infection management (Donati et al., 2019).

Research has found that healthcare workers' knowledge, attitudes, and the barriers they encounter are very likely to influence their behavior and work practices (Kim & Hwang, 2020). When healthcare workers do not have the required knowledge to perform the prescribed infection control practices, their actions might be inaccurate or discrepant. This can increase risk of infection among healthcare workers, their colleagues, and patients (Alsaifi & Cheng, 2016). Intensive care units (ICUs) are specialized sections of the hospital that provide comprehensive and continuous care for critically unwell patients. Therefore, if the staff working in ICUs achieves a high level of adherence to infection control standards and guidelines, then hospitalized patients have reliable protection against health care-associated infections (June & Choi, 2016).

In a study conducted by Kamunge (Kamunge, 2013), there is a recommendation to replicate her study, which included registered nurses (RNs) working in target specialty units, with the barriers they have faced to implement these guidelines included as additional study barriers. For this reason, the present study focused specifically on RNs working in different ICUs at KSAFH. Although there have been several studies on very few studies have investigated the barriers experienced by RNs and the hospital support to maintain these guidelines (Salem, 2019), (Al Qahtani & Almetrek, 2017), (Baniyousef, Mehlab, Al Sobhi, & Hussain, 2015).

This cross-sectional, descriptive and comparative study was conducted among registered nurses employed in various intensive and high dependency units at KSAFH in Tabuk, Kingdom of Saudi Arabia, and it had three aims: (1) to describe the self-reported Awareness, Approach, and Application of infection control standards and guidelines in the study group; (2) to examine the relationship between sub-scale scores (for each of Awareness, Approach, and Application) and different sub-sample groups (e.g. different age groups, work units, different levels of education or training etc.); and (3) to describe the perceived barriers to and enablers of compliance with infection control practices. This is the first infection control study conducted after King Salman Armed Forces Hospital got the JCI accreditation.

MATERIALS AND METHODS

Study Design and Study Setting

A cross-sectional design was used to carry out this study. The study included classified RNs who worked in all ICUs at KSAFH during the

study period. They were asked to provide their feedback with both open and closed-ended questions. The initial invitation to complete the study questionnaire was sent via letter by the medical administration office to all the heads of ICUs. The study questionnaires were distributed among all the registered nurses in all ICUs. Sealed boxes were available at the head nurse's office for depositing the completed questionnaires to preserve participants' confidentiality and anonymity. The study period was active from January 2016 to March 2016. The hard copy responses were entered into the electronic record by researchers and integrated into the data set without indication of the method received.

Sample Size Determination and Sampling Technique

To calculate the sample size for this study, the following formula was used:

$$n = \frac{Z_{\alpha/2}^2 * p(1 - p)}{\epsilon^2}$$

where,

Z = Z-value = 1.96 (for 95% confidence level);

p = proportion of good practice towards infection control standards = 0.50;

ε = Margin of error 9% = 0.09 were taken.

The sample size derived from the above formula was approximately 118. A convenient sampling technique was used to conduct this study. Registered nurses were requested to answer questionnaires. A total of 162 RNs were invited to participate in the study. One hundred thirty-three RNs willingly and voluntarily participated in the study.

Inclusion-Exclusion Criteria

King Salman Armed Forces Hospital has seven different ICUs, such as the Adult Intensive Care Unit (AICU), Neonatal Intensive Care Unit (NICU), Pediatric Intensive Care Unit (PICU), Cardiac Surgery Unit (CSU), Cardiac Care Unit (CCU), Burns Unit, and Progressive Care Unit. The RNs more than 20 years old, who had received qualifications in nursing (either through Diploma/Certificate, Bachelor's degree, Master's degree, or Ph.D. degree) and worked in ICUs at KSAFH were eligible to participate in the study. RNs not involved in direct patient cares were excluded from the study.

Study Instrument

To conduct the study, a comprehensive questionnaire was developed by a panel of three experts in infection control management. The face and content validity of this tool was assessed by two experts. The questionnaire was prepared in English. Two bilingual language experts translated it from English to Arabic. The semantic translation of the study instrument was done for the accuracy of translation. The questionnaire was comprised of six parts. The first part consisted of the questions regarding demographic details of the participants. The second, third, and fourth parts consisted of RNs' awareness, approach, and application of infection control standards and guidelines, respectively. The fifth part consisted of barriers experienced by them in implementing these standards and guidelines. The last part of the questionnaire consisted of support provided by the hospital to implement standard precautions successfully. While developing the questionnaire of the study, appropriate scales were defined. The questionnaire was pilot tested on a random sample of ten RNs. The questionnaire was revised based on the results of a pilot test. The questionnaire was comprised of three main types of questions: categorical questions (Yes, No, I don't know), open-ended text boxes, and checkboxes.

Study Variables and Scoring Method

The awareness, approach, and application of infection control standards and guidelines among RNs working in ICUs were considered as dependent variables. The socio-demographic characteristics (age, highest nursing education, work experience as a registered nurse, current working unit, current working unit experience, previous participation in infection control in-service training and education, previous participation in infection control workshops) of the participants, the barriers experienced by them and the institutional factor (the hospital support) were taken as independent variables. The awareness, approach, and application of infection control standards and guidelines was measured using the cumulative score of questions mentioned in the respective section of the questionnaire. Each response to the questions was recoded as: '1 as Yes', '(-1) as No', and '0 as I don't know. The mean score was

calculated for each specific subscale.

Data Management and Statistical Analysis

Two different researchers performed double data entry to ensure good quality data. The data was cleaned and analyzed using IBM Statistical Package for Social Sciences (SPSS) version 25 for Windows. Descriptive statistics, such as frequency, percentage, mean, and standard deviation were computed. The internal consistency of the questionnaire was tested using the Cronbach's alpha test. The significant statistical differences between the mean score of each specific subscale of the questionnaire (awareness, approach, and application) were compared across the socio-demographic characteristics of the participants using one-way analysis of variance (ANOVA) and an independent sample t-test. A p-value <0.05 was considered statistically significant.

Confidentiality and Ethical Considerations

A brief explanation was given by the research assistant during the departmental meeting regarding the purpose of the study. The study included bold-frame instructions indicating that this research will be kept confidential, and participants did not include their names on the questionnaire. RNs' voluntary submission of the completed questionnaire was considered as their full consent to participate. The adequate space was provided to complete the questionnaire with privacy. The ethical approval of the study was obtained from the local research and ethics committee at KSAFH (Ethical Approval Number: KSAFH-REC-2016-140).

RESULTS

Of the 162 RNs in all ICUs, 133 RNs responded to the study for an overall response rate of 82.0%. Nine incomplete questionnaires were discarded from the data analysis. Data from 124 respondents was considered for the final analysis. To test the reliability of this questionnaire, we conducted a test of internal consistency using the Cronbach's alpha test. It was reported that the reliability of this questionnaire was acceptable, with 0.703 as the reliability coefficient.

Socio-demographic Characteristics of the Study Participants

Table 1 shows the socio-demographic characteristics of study participants. More than 90% of the RNs were females. The majority (83.8%) of them were aged between 21-40 years, with a mean age of 32.6 years. Six out of ten RNs had a nursing diploma/certificate and 12.4 mean years of work experience, and approximately 88% of the respondents participated in infection control in-service training and education. (Table 1).

Table 1. Socio-Demographic Characteristics of Study Participants (Total n= 124)

Section 1. Socio-Demographics	Frequency	Percentage
Gender		
Male	10	8.1
Female	114	91.9
Total	124	100
Age		
< 20 years	1	0.8
21 - 30 years	54	43.5
31 - 40 years	50	40.3
41 - 50 years	17	13.7
> 50 years	2	1.6
Total	124	100
Mean±SD (years)	32.6±7.8	
Highest nursing education		
Nursing diploma / certificate	75	60.5
Bachelor's degree	47	37.9
Others	2	1.6
Total	124	100
Work experience as a registered nurse		
< 1 year	6	4.8
1 - 3 years	7	5.6
4 - 6 years	15	12.1
7 - 9 years	40	32.3
> 10 years	56	45.2

Total	124	100
Mean+SD (years)	12.4+7.2	
Current working unit		
Neonatal Intensive Care Unit (NICU)	29	23.4
Pediatric Intensive Care Unit (PICU)	19	15.3
Cardiac Care Unit (CCU)	20	16.1
Cardiac Surgery Unit (CSU)	6	4.8
Adult Intensive Care Unit (AICU)	15	12.1
Burns Unit	16	12.9
Progressive Care Unit	19	15.3
Total	124	100
Current working unit experience		
< 1 year	9	7.3
1 - 2 years	28	22.6
3 - 4 years	57	46
> 5 years	30	24.2
Total	124	100
Mean+SD (years)	6.2+6.5	
Previously participated in infection control in-service training and education		
Yes	109	87.9
No	15	12.1
Total	124	100
How long ago participated in infection control in-service training and education		
< 6 months	52	41.9
6 months to a year	32	25.8
More than 1 year		
Total	25	20.2
	124	100
Previously participated in infection control workshops		
Yes	68	54.8
No		
Total	56	45.2
	124	100
How long ago participated in infection control workshops		
< 6 months	23	18.5
6 months to a year	25	20.2
More than 1 year	20	16.1
Total	124	100

SD= Standard deviation

Self-reported Awareness, Approach, and Application of Infection Control Standards and Guidelines

Table 2 below represents participants self-reported awareness about implementation of infection control standards and guidelines. Almost 96.8% of the respondents were familiar with the infection control standards and guidelines in KSAFH. More than 90% of the RNs agreed that the infection control standards and guidelines would benefit the patients and decrease the infection rates in their unit. For hand hygiene practice, approximately 83.1% of the RNs agreed that they cannot use only alcohol-based hand rub solutions when dealing with organisms, such as *Clostridioides difficile*. Only 28.2% of participants were compliant with keeping to the recommended guidelines for infection control practices when the ICUs were busy. Overall, more than 96.0% reported that the use of personal protective equipment would ensure a reduction in transmission of infections (Table 2).

Table 2. Registered Nurses' Self-Reported Awareness, Approach, and Application of Infection Control Standards and Guidelines (Total n=124)

Items in the Questionnaire	Yes n (%)	No n (%)	I don't know n (%)
Section 5. Barriers			
1. Having the necessary supplies enables me to comply with infection control standards and guidelines.	70(56.5)	24(19.4)	30(24.2)

2. My workload prevents me from complying to the infection control standards and guidelines.	47(37.9)	31(25.0)	46(37.1)
3. Emergency at workplace prevents me from complying to the infection control standards and guidelines.	45(36.3)	22(17.7)	57(46.0)
4. The use of infection control standards and guidelines are realistic in our unit.	92(74.2)	0(0.0)	32(25.8)
5. Hand hygiene products are always readily available.	62(50.0)	23(18.5)	39(31.5)
6. Other stock pertaining to infection control practices are always readily available.	41(33.1)	32(25.8)	51(41.1)
Section 6. Hospital Support			
1. There is a budget available for implementation of infection control training and education in order to implement standards and guidelines.	51(41.1)	14(11.3)	59(47.6)
2. I know my Infection Control Practitioner (ICP) assigned to my unit.	111(89.5)	4(3.2)	9(7.3)
3. The hospital provides disinfectants for cleaning patient rooms.	94(75.8)	3(2.4)	27(21.8)
4. The hospital uses a campaign for the adherence to hand hygiene practices.	102(82.3)	0(0.0)	22(17.7)
5. I can request for in-service training pertaining to infection control issues at all times.	100(80.6)	0(0.0)	24(19.4)
6. There is enough infection control training conducted throughout the year.	96(77.4)	1(0.8)	27(21.8)

Factors Related to Awareness, Approach, and Application of Infection Control Standards and Guidelines

Table 4 shows the comparison of mean scores of awareness, approach, and application infection control standards and guidelines in relation to socio-demographic characteristics of the participants. Significant statistical differences were found in mean awareness scores in relation to current working unit (p-value=0.032). Significant statistical differences were found in mean approach scores and mean application score toward age group, and current working unit (p-value for mean approach score=0.00001, 0.006; p-value for mean application score=0.05, 0.009 respectively).

Table 4 Comparison of Mean Scores for Awareness, Approach and Application in Implementing the Infection Control Standards and Guidelines in Relation to Socio-demographic Characteristics (Total n=124)

Demographics	Awareness Score		Approach Score		Application Score	
	Mean (SD)	p-value	Mean (SD)	p-value	Mean (SD)	p-value
Gender		0.361		0.558		0.125
Male	0.8(0.7)		0.9(0.3)		0.9(0.4)	
Female	0.7(0.6)		0.9(0.3)		0.8(0.3)	
Age		0.077		0.00001		0.05
< 20 years	0.9(0.4)		1.0(0.0)		0.9(0.4)	
21 - 30 years	0.7(0.7)		0.9(0.3)		0.8(0.3)	
31 - 40 years	0.8(0.6)		0.9(0.2)		0.9(0.3)	
41 - 50 years	0.6(0.7)		0.9(0.2)		0.8(0.4)	
> 50 years	0.7(0.7)		0.4(0.4)		0.3(0.4)	
Highest nursing education		0.397		0.225		0.727
Nursing diploma / certificate	0.7(0.5)		0.9(0.3)		0.9(0.3)	
Bachelor's degree	0.7(0.6)		0.9(0.2)		0.8(0.3)	
Others	0.7(0.7)		1.0(0.0)		0.9(0.3)	
Work experience as a registered nurse		0.392		0.39		0.804
< 1 year	0.9(0.4)		0.9(0.3)		0.9(0.5)	
1 - 3 years	0.7(0.6)		1.0(0.4)		0.8(0.5)	

4 - 6 years	0.8(0.5)	1.0(0.1)	0.8(0.4)
7 - 9 years	0.7(0.7)	0.9(0.4)	0.9(0.3)
> 10 years	0.7(0.6)	0.9(0.2)	0.8(0.3)
Current working unit	0.032	0.006	0.009
Neonatal Intensive Care Unit (NICU)	0.7(0.7)	0.9(0.2)	0.9(0.3)
Pediatric Intensive Care Unit (PICU)	0.9(0.4)	0.9(0.3)	0.9(0.2)
Cardiac Care Unit (CCU)	0.7(0.6)	0.9(0.2)	0.8(0.4)
Cardiac Surgery Unit (CSU)	0.6(0.8)	0.7(0.8)	1.0(0.0)
Adult Intensive Care Unit (AICU)	0.7(0.7)	0.9(0.4)	0.9(0.3)
Burns Unit	0.7(0.6)	0.9(0.3)	0.8(0.3)
Progressive Care Unit	0.7(0.7)	0.9(0.2)	0.7(0.5)
Current working unit experience	0.424	0.856	0.606
< 1 year	0.8(0.6)	0.9(0.2)	0.9(0.2)
1 - 2 years	0.7(0.6)	0.9(0.2)	0.8(0.4)
3 - 4 years	0.7(0.6)	0.9(0.3)	0.8(0.3)
> 5 years	0.7(0.6)	0.9(0.2)	0.8(0.3)
Previously participated in infection control in-service training and education	0.215	0.854	0.699
Yes	0.7(0.6)	0.9(0.3)	0.8(0.3)
No	0.8(0.5)	0.9(0.1)	0.9(0.2)
Previously participated in infection control workshops	0.861	0.191	0.616
Yes	0.7(0.6)	0.9(0.2)	0.8(0.3)
No	0.7(0.6)	0.9(0.3)	0.8(0.3)

SD= Standard Deviation, Statistical significant at p-value <0.05

DISCUSSION

The fundamental element of infection prevention programs is to prevent the spread of infection in healthcare settings. When this element is present and practice consistently in the hospital, the risk of infection among healthcare providers and patients is reduced (Zingg et al., 2015), (Slyne, Clews, Beech, & Smilie, 2020). The infection control standards and guidelines are used to design policies and procedures for infection control programs in King Salman Armed Forces Hospital (KSAFH). These standards and guidelines were obtained from the Centers for Disease Control and Prevention (CDC), National Healthcare Safety Network (NHSN), Joint Commission International (JCI), and Medical Services Department (MSD) of the Ministry of Defense and Aviation (MODA) of Saudi Arabia. In early 2015, the MSD published a comprehensive infection control manual containing policies and procedures that need to be implemented in all armed forces hospitals in Kingdom of Saudi Arabia.

The primary finding of this study was that the majority of the participating RNs had good self-reported awareness, approach, and application of the infection control standards and guidelines. This finding is in agreement with that of other international studies (Rahiman, Chikte, & Hughes, 2018), (Maria, Samson, Cherry, Ivan, & Amy, 2020), (H. S. Oh, 2019). Variations were found in the mean scores of awareness, approach, and application toward the current working unit of the participants (p-values 0.032, 0.006 and 0.009, respectively). The reason behind this variation could be that some units were strict regarding the implementation of infection management. This may be due to high level of risk associated in working those units. This result is in concordance with the other studies (Kaur, Singh, & Kukreja, 2019), (Kaur et al., 2019), (Jayasinghe & Abeysena, 2020). In addition, the present study found significant statistical differences in the mean approach and application scores towards the various age group (p-values 0.00001 and 0.05 respectively). This result is in contrast with one cross-sectional study conducted in the gulf region (Nour, Babilghith, Natto, Al-Amin, & Alawneh, 2015).

In this present study, nearly five-sixths of the participants were aged between 21 and 40 years old. This finding is in similar with other studies (Abdulraheem, Amodu, Saka, Bolarinwa, & Uthman, 2012),

(Fashafsheh, Ayed, Eqtait, & Harazneh, 2015). This highlights that the hospital should give attention to this cluster of staff in infection management during their prime of life. A majority of participants (>83%) in this study claimed that they had good overall self-reported awareness regarding infection control standards and guidelines. This result is supported by the results of the other studies conducted to assess adherence to infection prevention and factors among nurses (Goje, Balami, Jarma, & Dauda, 2018), (Sodhi, Shrivastava, Arya, & Kumar, 2013). The current study revealed that more than 84% of the respondents had a good overall approach to these infection control standards and guidelines. This result is in line with the result of another study conducted in Australia (Barr, Holmes, Roiko, Dunn, & Lord, 2017). This study indicated that more than 90% of the participating RNs had a good self-reported overall application to these standards. This overall self-reported application is quite higher than the study conducted by Sheth (Sheth, Jani, Rangoonwala, & Kadri, 2015). When asked about the compliance of these standards during busy working hours, 25.8% of the respondents did not disclose the actual practice.

Regarding the barriers faced by RNs in implementing infection control standards and guidelines, more than 38% of the respondents agreed that workload prevents them from complying with the infection control standards and guidelines. This result was supported by the prospective observational study, which concluded that the higher the workload, the lower the compliance (Scheithauer, Batzer, Dangel, Passweg, & Widmer, 2017). In addition, only 33.1% of the respondents agreed that the stock pertaining to infection control practices were always readily available. This was the second most important barrier experienced by the registered nurses in implementing the infection control guidelines (Gupta, Gupta, & Bhaskar, 2018), (Mmereki, 2018). Seven out of ten respondents agreed that there is enough infection control training conducted throughout the year. Findings in this study suggest that nursing education, concerted efforts of infection control, state mandates, and organizational support play pivotal roles in reducing the spread of hospital acquired infections (Kamunge, 2013).

The level of practice of infection control standards and guidelines may also be influenced by the differences in infection control knowledge and nursing attitudes, depending on the varying types and levels of training received (Nofal, Subih, & Al-Kalaldeh, 2017), (E. Oh & Choi, 2019), (van Buijtene & Foster, 2019). In KSAFH, various nurses are recruited from across the globe, and there are different nursing qualifications and levels of expertise obtained in their respective countries. It must be noted that nursing personnel are very quickly blamed when ignoring infection control guidelines and standards when they are struggling to cope with daily staffing and resource shortages. The implementation of infection control standards, guidelines, and practices reduces hospital-acquired infection, reduces hospital-acquired infection costs, contributes to the best patient care outcomes, and protects healthcare workers in their daily tasks. If the influencing factors are better understood, the program can be better managed to ensure the best possible goals achieved for the organization, healthcare worker, and patients.

STRENGTHS AND LIMITATIONS OF THE STUDY

The major limitations of the study are recall bias and selection bias. To avoid the recall bias, a high-quality questionnaire was designed in such a way that the event is in chronological order. To avoid selection bias in the study, population was clearly defined, and simple random sampling was used. This study was not an observational study. The investigators did not supervise the practices of the nurses and solely depended on their subjective self-assessment. Therefore, these responses might be knowledge-based. However, the major strength of the study was the good response rate. This study provides insight into infection management practices, which will encourage other hospitals to review their practices and training strategies.

CONCLUSION

Based on the finding of this study, it can be concluded that the knowledge and practice of implementing infection control standards and guidelines among the RNs were fairly good. Their approach toward these standard precautions was satisfactory. However, the workload in the ICUs and the required hospital support to maintain these guidelines made nursing staff less compliant with the recommended guidelines. There is still a wide scope of improvement with regular educational training programs.

RECOMMENDATIONS

The current study recommends that the awareness and application regarding the infection control standards and guidelines among nursing staff should be updated through continuing medical education. Observational studies which include direct supervision for the implementation of these standards and guidelines among healthcare providers should be conducted in Saudi Arabia. More focus should be given to following the latest evidence-based practices of infection management during trainings and workshops.

DATA AVAILABILITY

The data used to support the findings of this study are available from the corresponding author upon request.

DECLARATION OF CONFLICTING INTEREST

The authors declare that there is no conflict of interest.

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