JOURNAL OF INTERNATIONAL CRISIS AND RISK COMMUNICATION RESEARCH
ISSN: 2576-0017
2024, VOL 7, NO S6

Operating Room Nurses' Knowledge Performance and Attitudes regarding Respiratory Instrument Processing process in Hospital at Saudi Arabia, 2024

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Abstract:

Background: 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. The fundamental elements of hospital infection control procedures are sterilization and disinfection. Numerous invasive operations are carried out daily in various medical facilities. A higher risk of nosocomial infection is linked to improper sterilization or disinfection of devices. By following infection prevention and control procedures, nurses play a crucial part in the reprocessing of breathing equipment. **This study aimed:** To assess operating room nurses' knowledge performance and attitudes regarding respiratory instrument processing process in hospital. **Methods:** A cross-sectional study design was utilized in Hospital at Makkah, Saudi Arabia. We selected a convenience sample of 50 operating nurses who handle instrument processing. Data were collected between January and March, 2024 through four tools. **The first tool:** Nurses' socio demographic and occupational characteristics self-administrated questionnaire. **The second tool:** self-administrated questionnaire to assess the nurses' knowledge about instrument processing process (cleaning, disinfection, inspection, packing, sterilization, transport, storage, and use and infection control measure). **The third tool:** Rubric observational checklist of respiratory instrument processing performance. **The fourth tool:** Self-administered scale to assess attitude of nursing staff about the management of respiratory instrument processing. **Results:** According to the current study, 60% of the nurses under investigation have bad overall knowledge scores, and 66% execute improperly when it comes to processing respiratory instruments. **Conclusion:** According to the study's findings, the majority of the nurses under investigation performed poorly when it came to processing respiratory instruments, had a mean total positive attitude of 44.8 (5.1), and had poor overall knowledge scores. Create a protocol for nursing personnel about the processing of respiratory instruments in hospital.

Keywords: Infection preventive measures; knowledge; Nurses; Performance, Respiratory instrument processing.

Introduction:

A sterile technique is a set of different practices and procedures done to make materials and places free from all microorganisms, and it is a vital patient safety standard that reduces the danger of microbial transmission during surgery [1]. Creating and keeping a sterile technique requires knowledge and practice, and it is among the most essential responsibilities of perioperative nurses to decrease surgical site infections. So, perioperative nurses must coordinate with all operation room team members, and they should be empowered to talk about breaks in sterile techniques [2-4]. World Health Organization (WHO) guidelines imply that health professionals in many settings have a gap in hand hygiene, decontamination, aseptic technique, and sterilization practice [5].

The contaminated hands of health-care workers (HCWs) and health-care equipment have been identified as the primary sources of HAIs [6, 7]. The pathogens of HAIs are commonly transmitted from one patient to another when HCWs do not perform hand hygiene properly following caring for one patient and contacting another patient [8]. Upper or lower respiratory tract infections (RTIs) rank as the world's fifth leading cause of death. Around two million die from acute respiratory infections (ARI) each year. Nosocomial infections account for the majority of respiratory tract infection causes [9].

Poor infection control practices connected with the improper use of flexible bronchoscopes and intrusive devices like ventilators and catheters are the root cause of infections linked to healthcare. Ventilator-associated pneumonia is one of the most common infections [10]. In order to respond to infectious disease outbreaks and deliver safe, high-quality patient care in all healthcare settings, it is now essential to improve the infection control and prevention (ICP) program and follow and monitor infection prevention and control procedures [11].

According to study conducted by Talaat et al., (2016) [12] stated that health care providers need improving of decontamination techniques for respiratory instrument, surgical devices and the reduction, elimination of such infections. Whereas Mohapatra, (2017) [13] discovered that every hospital should have its own guidelines of sterilizing and disinfecting items based on their intended use of medical devices and associated infections.

Based on Caston et al. (2018) [14], Spaulding divided tools and equipment into three groups according to their intended use: non-critical, semi-critical, and critical. Critical instruments require sterilization, semi-critical instruments require disinfection, and noncritical instruments require cleaning. Apart from Mohapatra, (2017) [13], who explained that respiratory instruments were separated into five categories, single-use devices (such as nebulizer cups, face masks, and nasal cannulas) are pieces of equipment that are used just once before being thrown away. Patient personal equipment and non-critical environmental surfaces are examples of noncritical equipment that requires cleaning. Ambo bags and their masks are examples of semi-critical equipment that need cleaning. Equipment including endoscopes, and bronchoscopes, require a high level of disinfection. Sterilization is necessary for critical equipment, such as surgical instruments used in chest surgeries [13].

According to Cairo (2017) [15], the majority of respiratory therapy equipment such as things that come into touch with mucous membranes is regarded as semi-critical and should be thoroughly cleansed and disinfected between patients. After cleaning, breathing equipment undergoes high-level disinfection, which is usually achieved via physical techniques or chemical disinfectants [15]. Medical equipment and processing tools that come into touch with non-intact skin and mucous membranes should be cleaned, disinfected, and subjected to high-level disinfection. Reusable endoscopes are frequently processed using it because the majority of them are composed of materials that cannot tolerate high temperatures [16].

Instrument processing defined as all steps that are necessary to make a contaminated reusable medical device ready for its intended use. These steps may include pre clean, transport equipment to sterilization unit**,** cleaning, inspection functional testing, packaging**,** sterilization, storage &delivery, and quality assurance until arrive the instrument at the point of use. The process if instrument processing must be happened at the central Sterile Services Department (CSSD) at health care facility [(9)].

Decontamination and sterilizing procedures are intricate, necessitate specialized equipment and infrastructure, and entail a number of phases that must be done correctly, including device collection, unit receipt, processing, storage, and distribution across the facility. To evaluate if the equipment is operating correctly, quality management is crucial [(17)]. In order to guarantee safe and efficient patient outcomes, lower infection rates, shorten hospital stays, lower hospital-associated infection costs, lower complications costs, prolong the life of respiratory instruments, lower replacement costs, and enhance the standard of healthcare, it is critical to manage respiratory instrument processing effectively [(18)]. Therefore, the current study aimed to assess operating room nurses' knowledge performance and attitudes regarding respiratory instrument processing process in hospital.

Methods:

A cross-sectional study design was utilized in Hospital at Makkah, Saudi Arabia. We selected a convenience sample of fifty sterilization staff nurses who are responsible for instrument processing in sterilization unit and had at least one year of experience in sterilization units.

The researchers developed four tools for data collection after reviewing the relevant literature [(11-18)]. **The first tool:** Nurses' socio demographic and occupational characteristics self-administrated questionnaire used to assess socio demographic and occupational characteristics of nurses such as gender, age, educational level, and years of experience. **The second tool:** Nurses' knowledge self- administrated questionnaire used to assess nurse's level of knowledge regarding instrument processing as cleaning, disinfection, inspection, packing, sterilization, transport, and storage. In addition to use infection control measure such respiratory hygiene and cough etiquette. To explore in depth nurse's knowledge the researcher used open ended question. This tool was classified into 6 categories; all these categories were composed of 61 questions. One mark awarded for each correct response. Three levels of knowledge were distinguished based on the researcher's cutoff point: Poor: A score below 30.5, or less than 50% of the total. Fair: Total painful scores range from 50% to less than 65% (30.5 to less than 39.65). Excellent: Scores that are at least 65% of the total (39.65 and above).

The third tool: Rubric observational checklist of respiratory instrument processing performance used to assess nurse's level of performance regarding management of respiratory instrument processing (cleaning, disinfection, inspection, packing, sterilization, transport, storage, use and infection control measure precaution (hand washing, gloving, Personal Protective Equipment) during the different working shifts. The total scores of the nurses' staff' performance ranged from 0 to 224. One mark was awarded for each correct response based on the researcher cut of point; the performance level was categorized into two levels as: Improper: Score less than 75% (less than 168). Proper: Score more than 75% of total score (168 and more).

The fourth tool: Self-administered scale to assess attitude of nursing staff used to assess the attitude of nursing staff about the management of respiratory instrument processing by using Likert-rating scale. This tool consisted of 13 positive attitudes statements and 15 negative attitudes statements. These statements requiring a response on a

four-point Likert- rating scale (strongly agree, agree, disagree, and strongly disagree). A scoring system was used to quantify the nursing staffs' attitude; four marks to strongly agree, three marks to agree, two marks to disagree and one mark to strongly disagree. If the statements were negative, the scoring system was reversed in statistical product and service solutions (SPSS) program whereas one mark was given to strongly agree and two marks to agree, three mark to disagree and four marks to strongly disagree. That made up a total score of 112 marks as the following: Positive attitude (It includes 13 items = 52 marks), Negative attitude (It includes 15 items = 60 marks).

The researchers obtained approved from Research Ethics Committee of University and obtained verbal consent from each nurse before starting of the study after the explanation of the aim and process of the study. The researchers were emphasized that the participants' nurses are voluntary and the collected data will be treated confidentially and used only for research purpose. Any participant had the right to withdraw from the study at any time without any responsibility. The researchers get an official letter from the manager of hospital.

A jury group of experts tested the study tools, and evaluated the appropriateness and relevant items, to achieve the criteria of trust worthiness. Experts' elicited responses that were either agree or disagree for the face and content validity. The items in which 85% or more of the professors had agreed were included in the proposed tool. A pilot study was conducted on 10% of the studied nurses who met the predetermined criteria to test applicability feasibility of the study tools, and the time needed to complete tools and the required modifications were done. Participants in the pilot study are not included in the main study sample. Cronbach's coefficient alpha used to test the applicability of attitude scale 0.89.

Results:

Table (1): shows the socio-demographic and occupational characteristics of nursing staff. Results indicates that the mean age of the nursing staff was 32.2 (7.8) years. 52 % were less than 30 years old. Most of nursing personnel (96%) were female. Regarding the qualification 50% of nursing staff had nursing diploma. More than half of them (58%) had less than 10 years of experience and 74% of them had less than 5 years of experience in sterilization unit. Regarding the training courses about sterilization only 10% attended this training, 6% of them received last training less than a year.

Table (1): Socio-demographic and occupational characteristics of nursing staff

Item	N	%
Age/ years		
<30 years	26	52.0
30 - < 40 years	18	36.0
≥40	6	12.0
Mean (SD)	32.2 (7.8)	
Gender		
Male	2	4.0
Female	48	96.0
Qualification		
Nursing Diploma	25	50.0
Technical Nursing Institute	13	26.0
Bachelors of nursing	12	24.0
Years of experience		
<10 years	29	58.0
10- < 20 years	16	32.0

Item	N	%
≥ 20 years	5	10.0
Mean (SD)	11.4 (7.2)	
Years of experience in sterilization unit		
<5 years	37	74.0
5- <10 years	8	16.0
≥ 10 years	5	10.0
Mean (SD)	5.4(4.8)	
Training courses about sterilization	5	10
Last training course about sterilization		
<1 year	3	6.0
≥1 year	**2**	4.0

Table (2): shows knowledge of nursing staff according to all processing process. The nursing staff had poor level of knowledge regarding the definition of all process, disinfection, disinfectant, Timing and stage of processing endoscopes and processing endoscopes procedure as 78 %, 74%, 80%, and 60% respectively while 40% of nurses had fair level of knowledge regarding cleaning process and Sterilization process.

Table (2): Knowledge of nursing staff according to Instrument Processing process

Knowledge of nursing staff according to	Poor		Fair		Good	
	N	%	N	%	N	%
Definitions	39	78	0	0	11	22
Cleaning process	17	34	20	40	13	26
Disinfection and disinfectant	37	74	13	26	0	0
Timing and stage of processing endoscopes	40	80	10	20	0	0
Processing endoscopes procedure	30	60	14	28	7	14
Sterilization process	19	38	20	40	11	22

Table (3): shows nurses' total knowledge score level about respiratory instrument processing**.** It was observed that 60% of the nurses had poor knowledge score level.

Table (3): Nurses' total knowledge score level about respiratory instrument processing

Item	N	%
Poor	30	60
Fair	13	26
Good	7	14

Table (4): shows performance of nursing staff according to adherence of standard precautions in central Sterile Services unit .The nursing staff had improper performance regarding hand hygiene, Personal Protective Equipment (PPE), Respiratory Hygiene, Cough Etiquette and Environmental cleaning as 70%, 74%, 72%, and 60% respectively.

Table (4): Performance of nursing staff according to adherence of the standard precautions of infection control

performance of nursing staff according to	Proper		Improper	
	N	%	N	%
Hand hygiene	15	30	35	70

performance of nursing staff according to	Proper		Improper	
	N	%	N	%
Personal Protective Equipment (PPE)	13	26	37	74
Respiratory Hygiene / Cough Etiquette	14	28	36	72
Environmental cleaning	20	40	30	60

Table (5): shows performance of nursing staff according to sterilization processes, disinfection of bronchoscope, thorachoscope and disinfection of the respiratory instrument in central sterilization unit. The nursing staff had improper performance regarding Sterilization processes of surgical instrument, disinfection of bronchoscope, thorachoscope and disinfection of the respiratory instrument as 60%, 66% and 74% respectively in all the studied hospitals.

Table (5): Performance of nursing staff according to sterilization processes

Performance of nursing staff according to	Proper		Improper	
	N	%	N	%
Sterilization processes of surgical instrument	20	40	30	60
disinfection of bronchoscope and thoracoscope	17	34	33	66
disinfection of the respiratory instrument	13	26	37	74

Table (6): shows nurses' total performance score level about respiratory instrument processing. It was observed that 66% of the nurses had improper performance score level.

Table (6): Nurses' total performance score level about respiratory instrument processing

Item	N	%
Proper	17	34
Improper	33	66

Table (7): represents the availability of policies and design of central sterilization unit in hospital. Regarding policies in sterilization unit, design of central sterilization unit and occupational Health and Safety are not available 75% of the studied participants. Regarding education and training of staff about annual infection prevention and control (IP&C) education, it was observed that 50 % of the studied participants conducted this training.

Table (7): The availability of policies and design of central sterilization unit in hospital

Items	Available		Not available	
	N	%	N	%
Policies in sterilization unit	1	25	3	75
Design of central sterilization unit	1	25	3	75
Occupational health and safety	1	25	3	75
Education and training about disinfection, sterilization and infection control measure.	2	50	2	50
Hospital conducted annual infection prevention and control (IP&C) education for nursing staff	2	50	2	50

Table (8): shows that most of the studied nurses were strongly agree about cleaning step before any disinfection or sterilization process 78%,wearing PPE is protecting nurses from infection 80%, wearing PPE is protecting patients from infection 76%.While 58% of

the studied nurses were strongly agree about using sterilization or disinfection for medical equipment's. 62% were strongly agree for using respiratory hygiene and cough etiquette inside and outside the hospital and 52% were strongly agree for using respiratory hygiene and cough etiquette inside the home. The studied nurses were strongly agreeing of nursing training related wearing PPE, continuous training related handling contaminated materials for the sterilization staff and protection role of vaccination from infection 68%, 78% and 66% respectively.

Table 8: Nursing staff positive attitudes regarding respiratory instrument processing

Positive attitudes' categories	Strongly agree		Agree		Disagree	
	N	%	N	%	N	%
Explore your opinion about the cleaning step before any disinfection or sterilization process.	39	78.0	11	22.0	0	0
Explore your opinion about equipment processing in reducing the spread of infection.	15	30.0	31	62.0	4	8.0
Explore your opinion about that wearing PPE is protecting nurses from infection.	40	80.0	10	20.0	0	0
Explore your opinion about the wearing PPE is protecting patients from infection.	38	76.0	12	24.0	0	0
Explore your opinion about using sterilization or disinfection for medical equipment's.	29	58.0	21	42.0	0	0
Explore your opinion about using respiratory hygiene and cough etiquette inside and outside the hospital.	31	62.0	19	38.0	0	0
Identify your opinion about using respiratory hygiene and cough etiquette inside the home.	26	52.0	16	32.0	8	16.0
Identify your opinion about nursing training related wearing PPE.	34	68.0	16	32.0	0	0
Explore your opinion about continuous training related handling contaminated materials for the sterilization staff.	39	78.0	11	22.0	0	0
Explore your opinion about the protection role of vaccination from infection.	33	66.0	16	32.0	1	2.0
Explore your opinion about the concept of re-processing of respiratory equipment.	11	22.0	20	40.0	19	38
Total positive attitude						
Mean (SD)	44.8 (5.1)					

Table (9): shows that 58% of the studied nurses were disagreed that respiratory instrument spread the infection, whether processed or not. More than half 56% of the studied nurses disagreed that sterilization process may not be preceded by cleaning, 52% of them disagreed that sterilization or disinfection of the reusable medical instrument for the same patient. More than half 54% of the studied nurses disagreed of changing glove between the different procedures for one patient, 60 % disagreed of wearing a mask during washing equipment and 44 % disagreed to get rid of chemical decontaminants in the basin. The studied nurses strongly disagreed to shorten of sterilization procedures, wearing gloves is better than frequent hand washing, need of training and experience for handling respiratory instrument, using respiratory hygiene and coughing inside the hospital only, spread of infection from respiratory equipment does not limited by treatment, training sterilization staff to wear PPE, continuous training for sterilization staff responsible for handling

respiratory instrument 42%,66%,74%,62%,48%,66%,70% respectively. The mean of total negative attitude was 50.4 (6.2). In addition, the mean of total attitude was 95.2 (9.6).

Table (9): Nursing staff negative attitudes regarding respiratory instrument processing

Negative attitudes' categories	Agree		Disagree		Strongly disagree	
	N	%	N	%	n	%
Explore your opinion about respiratory instrument spread the infection, whether processed or not.	21	42	29	58.0	0	0
Explore your opinion about the sterilization process may not be preceded by cleaning	0	0	28	56.0	22	44.0
Explore your opinion about sterilization or disinfection the reusable medical instrument for the same patient	2	4	26	52.0	22	44.0
Explore your opinion about shorten of sterilization procedures	3	6.0	16	32.0	31	62.0
Explore your opinion about wearing gloves is better than frequent hand washing	9	18.0	20	40.0	21	42.0
Explore your opinion of changing glove between the different procedures for one patient	5	10.0	27	54.0	18	36.0
Explore your opinion of wearing a mask during washing equipment.	3	6.0	30	60.0	17	34.0
Explore your opinion about the get rid of chemical decontaminants in the basin.	13	26.0	22	44.0	15	30.0
Explore your opinion about the need of training and experience for handling respiratory instrument.	7	14	10	20.0	33	66.0
Explore your opinion about using respiratory hygiene and coughing etiquette inside the hospital only.	6	12.0	7	14.0	37	74.0
Explore your opinion spread of infection from respiratory equipment does not limit by treatment	5	10.0	14	28.0	31	62.0
Explore your opinion about training sterilization staff to wear PPE.	0	0	17	34.0	33	66.0
Explore your opinion about continuous training for sterilization staff responsible for handling respiratory instrument.	0	0	15	30.0	35	70.0
Explore your opinion about applying infection control measures in the sterilization unit does not reducing infection.	0	0	15	30.0	35	70.0
Total negative attitude						
Mean (SD)	50.4 (6.2)					
Total attitude						
Mean (SD)	95.2 (9.6)					

Discussion:

The current study's findings showed that the average age of the nursing staff was 32.2 (7.8) years. Of them, over half were under 30 years old. Women make up the majority of nursing workforce. About half of the nursing workforce was qualified with a nursing degree. Over half of the nursing staff had fewer than 10 years of experience, and around three-

quarters of them had worked in the sterilizing unit for less than five years. Only ten percent of them attended the sterilizing training sessions, and six percent had not gotten any training in less than a year.

This result is relatively similar to that of a study conducted in Palestine by Fashafsheh et al., (2015) [(19)] and in Nepal by Shrestha et al., (2018) [(20)], which found that most respondents had five years of job experience. , Additionally, Sana'a and Mahmud (2011) [(21)] study on nurses in Kirkuk City found that just 11% of respondents had received training; the other quarter reported more specialized training in areas including autoclave operation, sterilization, and disinfection. However, the vast majority of them had not engaged in ongoing education regarding infection management.

In the current study, the nurses' overall knowledge scores were low. These results contradict those of a study by Krause et al., (2021) [(22)] in a regional hospital in the Czech Republic, which found that the majority of sterilization staff members knew a good deal about the decontamination process, and the majority of nurses correctly used the Spaulding classification, mechanical cleaning, and more than half of nurses knew how to prepare the disinfectant solution. According to the results of the current investigation, the nursing staff knew a decent amount about the cleaning procedure. This result is similar to that of a study done in Nepal by Panta et al., (2018) [(23)], which found that the nursing staff knew a decent amount about the cleaning procedure (manual cleaning, cleaning supplies, and disinfection solution).

In contrast to the findings of Sahiledengle et al., (2019) [(24)], which showed that the nursing staff had good level of knowledge regarding the disinfection process and how to prepare a disinfectant solution with adequate concentration, the current study showed that the nursing staff had poor level of knowledge. According to the current study, the nursing staff's understanding of endoscope processing was lacking. This conclusion is at odds with the findings of a global study by Kenters et al., (2018) [(25)], which showed that respondents knew a decent amount about processing endoscopes.

The recent study found that nursing staff members lacked sufficient information. This result contradicts the findings of a study conducted in the Gastrointestinal Endoscopy Unit by Amer et al., (2015) [(26)], which found that most nurses had a fair level of understanding. A study by Parveen et al. (2021) [(27)] and a study by the California Department of Health Services (CDHS) (2018) [(28)] suggested that an ongoing educational and training program for endoscopy reprocessing will aid in efficient performance and infection control.

The current study indicated that the nursing staff had fair level of knowledge regarding the sterilization process; this finding is similar to Panta, et al., (2018) [(23)] reported that more than half of healthcare workers had fair knowledge about specific aspects of the sterilization of medical devices. The present study results presented that more than half of nursing staff had improper performance regarding hand hygiene, Personal Protective Equipment (PPE),respiratory hygiene/cough etiquette and environmental cleaning .This finding is inconsistence to Mustafa and Lahu (2019) [(29)] and Ampadu (2019) [(30)] revealed that about three quarters of nursing staff performance was proper regarding infections prevention and control measures.

The present study displayed that the nursing staff had improper performance regarding sterilization process of surgical instrument. This finding is inconsistent with Panta et al., (2018) [(23)] reported that nursing staff had proper performance regarding sterilization process. In this study, the nursing staff had improper performance regarding the disinfection bronchoscope and thorachoscope in all the studied hospitals. This finding is inconsistence with to Amer et al., (2015) [(26)] revealed that the majority of nurses had proper performance

in endoscopy unit. The current study documented that nursing staff had improper performance regarding disinfection of the respiratory instrument in all the studied hospitals. This finding is inconsistence with Panta et al., (2018) [23] revealed that about half of healthcare workers had proper performance regarding disinfection of respiratory instrument.

Concerning the availability of policies and the standard design of central sterilization unit and availability of occupational Health and Safety; the present study results revealed that three quarters of the studied participants doesn't meet the standard criteria. While half of the studied participants conducted education and training for staff on infection prevention and control (IP&C measures). El- sokkary et al., (2015) [31] revealed that infrastructure of central sterile services doesn't meet the standard criteria. Concerning the nursing staff positive and negative attitudes regarding respiratory instrument processing; the nursing staff had positive attitudes and agreed that respiratory instrument processing such as that cleaning is necessary before any disinfection or sterilization process, the respiratory equipment processing has an effective role in reducing the spread of infection, wearing PPE to protect nurses and patients from infection. While had negative attitude regarding respiratory instrument processing.

Panta et al., (2018) [23] revealed that positive attitudes of healthcare workers towards issues related to decontamination and reuse of medical devices. However, only a small proportion of healthcare workers strongly agreed that the number of staff involved in decontamination of medical devices in their hospital was adequate. The majority of healthcare workers strongly agreed that training on the operation of sterilizers/autoclaves helps ensure adequate sterilization of medical devices. The current study indicates that 60%, 66 % of studied nurses have poor total score level of knowledge and improper performance respectively.

Conclusion

According to the current study's findings, the majority of the nurses who were evaluated had positive views toward respiratory instrument processing but had inadequate overall knowledge and performance scores. The researchers advise creating a protocol regarding the processing of breathing instruments for nursing staff.

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