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NURSES' KNOWLEDGE AND PRACTICES TOWARD PREVENTION OF CATHETER-ASSOCIATED URINARY TRACT INFECTION AT KING ABDULAZIZ UNIVERSITY HOSPITAL

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**NURSES' KNOWLEDGE AND PRACTICES TOWARD PREVENTION OF
CATHETER-ASSOCIATED URINARY TRACT INFECTION AT KING ABDULAZIZ
UNIVERSITY HOSPITAL**

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Abstract

Purpose: Urinary catheterization is one of the most common procedures performed in hospitals especially in intensive care units. The urinary catheter is considered as a single biggest risk factor for acquired urinary tract infections (UTIs), and more than 80% of all acquired UTIs are attributable to catheter use. The purpose of this study was to assess nurses' knowledge and practices toward prevention of CAUTI at King Abdulaziz University Hospital (KAAUH).

Materials and method: A cross-section, correlational study was conducted with a convenience sample of 137 nurses recruited from medical and intensive care units at KAAUH in Jeddah, Saudi Arabia. Knowledge and Practices Questionnaire was completed by participants. It included two parts: Part I: Socio-Demographic Questionnaire. Part II: Level of Knowledge and Extent of Practices Questionnaire. Data collection was carried out from November 2017 to January 2018. Data were analyzed using the SPSS version 22.

Findings: The study findings revealed that more than half of nurses (62.77%) had a low level of knowledge and 83.94% of nurses had a poor level of practices. While 16.1% of nurses had a good level of practices. There was no significant relation between nurses' knowledge and practice toward CAUTI prevention. While there was a significant relation between nurses' knowledge and age and there was a significant relation between nurses' practices and current unit.

Unique contribution to practice and policy: Further studies need to investigate the barrier affecting nurses' knowledge, attitude and practice regarding CAUTI prevention. Nurses should be trained regularly in CAUTI prevention, also hospital administration in Saudi hospitals should make every effort to include CAUTI prevention in their high priority list.

Keywords: *Knowledge, Practices, Catheter-associated Urinary Tract Infection, Nurses*

1.0 INTRODUCTION

Urinary catheter insertion considered as the most important predisposing factor for catheter-associated urinary tract infection (CAUTI) (Lo et al., 2016). The daily risk varies from 3-7% for an acquisition of bacteriuria when the urinary catheter remains in situ (Nicolle, 2014). Catheter-associated urinary tract infection is one of the most common Hospital-Acquired Infections (HAIs). The global burden of HAIs is underestimated in developing countries due to lack of surveillance systems (Talaat *et al.*, 2016). The Association for Professionals in Infection Control and Epidemiology (APIC) in the United States (US) also reported that CAUTI is accounting for 25.6 % of all HAIs (APIC, 2014).

The National Healthcare Safety Network (NHSN) in 2013 reported that CAUTI pooled means were ranged from 1.2 to 4.1 per 1,000 urinary catheter days in medical-surgical and burn intensive care units (ICUs). While for Non-ICU rates ranged from 1.3 to 1.5 per 1,000 urinary catheter days in medical-surgical units (APIC, 2014). In Egypt, a national surveillance of HAIs program was conducted for ninety-one ICUs in 28 hospitals on three phases from April 2011 to February 2016, and the results show that there were 2,688 HAIs, in which about 15% of HAIs were UTIs (Talaat *et al.*, 2016). Al Nasser et al. (2016) conducted a study in three Arabian Gulf Countries: Saudi Arabia (SA), Oman, and Bahrain for a six year surveillance from 2008 to 2013. Their study findings revealed there were 140 CAUTI events in SA, 145 CAUTI events in Bahrain, and only one CAUTI event in Oman. Another study conducted in SA examining device-associated healthcare associated infection (DA-HAI) in 12 general Ministry of Health hospitals, among ICU patients between 2013- 2016. This study found that there were 13,492 DA-HAIs, in which about 28.4% of DA-HAIs was CAUTI (Gaid, Assiri, McNabb, & Banjar, 2017).

According to Mukakamanzi (2017), UTI cases are mostly related to the presence of urinary catheter although many catheters are used unnecessarily and for prolonged periods of time. Extended use of urinary catheter and inappropriate management increase the risk of infections (Shehab, 2017). The Association for Professionals in Infection Control (APIC) (2014) also indicated that CAUTI has been reported to be associated with increased morbidity, mortality, hospital cost, and length of hospital stay. Nurses play an important role in urinary catheter insertion, maintenance, and removal (Sobeih & Nasr, 2015). Therefore, nurses should have adequate knowledge regarding infection control in the use of urethral catheters and their practice must be adhered to healthcare setting's guidelines on infection control (Opina & Oducado, 2014). Catheter-associated urinary tract infection is considered as the most frequent and preventable infections, if nurses take into consideration the recommended catheter placement indications and evidenced-based practice of catheter maintenance (Mukakamanzi, 2017). Thus, avoidance of unnecessary catheterizations and remove catheters as soon as possible are the most effective preventive measures of CAUTI (Tenke, Mezei,

Bóde, & Köves, 2017).

Globally, there has been challenges and renewal interesting researches to reduce the incidence of CAUTI especially in US (Parker *et al.*, 2017). On the other hand, device-associated healthcare associated infection DA-HAI data and published studies to certain devices are limited in SA (Gaid *et al.*, 2017). Therefore, this study was conducted to assess the current knowledge and practices of nurses toward prevention of CAUTI at KAAUH. The study's findings may provide some evidence about areas of strengths and weakness of nurses regarding CAUTI prevention. This study may also be a guide for developing education and training programs on issues related to CAUTI in SA.

1.1 Problem Statement

Nurses are considered as the primary healthcare providers who are responsible for inserting and maintaining of urinary catheters, as well as production of desired outcomes (Banks, Abdella & Willmann, 2016). Nurses are also accountable to acquire appropriate knowledge and practices of catheter care that will prevent UTIs. In Saudi Arabia from 2008 to 2013, CAUTI in National Guard Hospitals in Riyadh, Jeddah, Alhasa, and Dammam rate per 1,000 catheter days were (4.1, 1.3, 1.6, 2.2) respectively (Al Nasser *et al.*, 2016). Recently, it has been observed that medical units and ICUs still have incidences of CAUTI at KAAUH. In female medical unit, CAUTI rate per 1,000 catheter days was two from June to July 2016, and total CAUTIs with device utilization ratio for the year 2016 was (0.88) in ICUs (King Abdulaziz University Hospital statistics, 2016). Therefore, it is crucial to assess the level of nurses' knowledge and practices towards prevention of CAUTI.

1.2 Aim of the Study

The aim of this study was to assess nurses' knowledge and practices toward prevention of CAUTI at KAAUH.

1.3 Research Questions

The specific research questions were:

1. What are the levels of nurses' knowledge and practices toward prevention of catheter-associated urinary tract infection at King Abdulaziz University Hospital?
2. Are there a relation between sociodemographic characteristics and nurses' knowledge and practices toward prevention of catheter-associated urinary tract infection at King Abdulaziz University Hospital?
3. Is there a relation between levels of nurses' knowledge and practices toward prevention of catheter-associated urinary tract infection at King Abdulaziz University Hospital?

2.0 MATERIALS and METHOD:

2.1 Materials

2.1.1 Study Design

A cross-section, correlational design was used to assess nurses' knowledge and practices toward prevention of CAUTI. This design allows to measure selected variables in a sample and determine the relationships among the main study variables (Grove, Burns, & Gray, 2014).

2.1.2 Setting

The study was conducted in medical units, medical intensive care unit (MICU), and surgical intensive care unit (SICU) at KAUH, Jeddah, SA. The KAUH started operation in 1396 H with a total capacity of 200 beds. Now, the hospital capacity is 845 beds with additional 157 beds dedicated for the critical care units, general and specialized clinics that exceeds two hundred clinics, including cardiovascular, specialized surgery, internal medicine, endocrinology, dermatology, hematology, orthopedic, ophthalmology, pediatric, obstetrics/gynaecology, dialysis unit and emergency department (KAUH website, 2018). This hospital serves the citizen and residents.

2.1.3 Sample

A convenience sample of 137 nurses were voluntarily participated in the study. Raosoft software was used for sample size calculation with response distribution 50 %, the margin of error 5%, and confidence level 95%. The nurses were selected based on the following criteria; age from 20- 60 years old, both gender, have at least one year experience of nursing in selected units, speak and read English fluently, and ready to participate in the study.

2.1.4 Tool

The researcher used Knowledge and Practices Questionnaire to assess the level of knowledge and extent practices of nurses toward prevention of CAUTI in English language. It included two parts:

2.1.4.1 Part I: Socio-Demographic Questionnaire

This part was developed by the researcher. It consists of 8 questions aimed to gather information about study participants' background, which included age, gender, nationality, marital status, highest level of education, years of nursing experience, current unit, attended any educational or training program on urinary catheter procedures, and number of attended.

2.1.4.2 Part II: Level of Knowledge and Extent of Practices Questionnaire

This part developed by Opina and Oducado (2014) to examine the level of knowledge and extent of practices of nurses on infection control in the use of urethral catheter. The questionnaire consisted of two sections as the following:

Knowledge on infection control in the use of urethral catheters: It used to measure the nurses'

level of knowledge toward prevention of CAUTI. It included 15 items; six items for considerations and techniques for catheter insertion, and four items for the different approaches of catheterization and specimen collecting methods while five items for proper urethral catheter maintenance. Each item had been coded in which, one indicates true answer, and two indicates false answer. Study participants were asked to check “True” if they think the statement is correct and “False” if otherwise in the column which corresponds to their answer. The total scores were ranged from 0 to 15 and were converted to a percentage. According to Opina and Oducado (2014), nurses' level of knowledge depended on the number of correct scores obtained. Every correct answer was given one point, and wrong answers were given zero. The total score of correct answers from all of items was computed and classified as follows; high level of knowledge (12-15), average level of knowledge (8-11), and low level of knowledge (0-7).

Practices on infection control in the use of urethral catheters: It used to measure the extent of nurses' practices toward prevention of CAUTI. It included 15 items; five items for practices of nurses before catheter insertion, and two items for practices of nurses during catheter insertion while eight items for practices of nurses after catheter insertion. Study participants were asked to choose the appropriate answer for each item in the questionnaire. The total scores were ranged from 0 to 15 and were converted to a percentage. According to Opina and Oducado (2014), nurses' level of practices depended on the number of correct scores obtained. Every correct answer was given one point and wrong answers were given zero. The total score for correct answers from all of the items was computed and classified as follows; good practice (10-15) and poor practice (0-9).

2.2 Method

2.2.1 Ethical Considerations

Ethical approvals were obtained from the ethical committee in Faculty of Nursing at King Abdulaziz University (KAU), and from King Abdulaziz University Biomedical Ethics Committee in KAAUH. The researcher explained the purpose, and data collection process to the participants. Written informed consent was obtained after explanation of the aim of the study. Nurses were informed that participation in the study was voluntarily, and they have the decision to withdrawal from the study at any time. Moreover, confidentiality and anonymity were ensured throughout the study. Each study participant had a code to ensure anonymity of collected data.

2.2.2 Validity

A total of five experts in the field of medical-surgical nursing at KAU reviewed the study tool. The content of each question was examined for accuracy and clarity. Comments and suggestion of jury were considered, and the tool modified accordingly. The answer of question six in the practices section was changed from (no larger than 5 ml, no larger than 10 ml, and larger than 10 ml) to (less than 5 ml, no larger than 10 ml, and larger than 10 ml)

because of the catheter manufacture. After modification, the tool were revised by research supervisors.

2.2.3 Reliability

In this study, the reliability of the tool was examined by using Cronabach's alpha to assess the internal consistency of the scale. The Cronbach's alpha value was .841 in this study.

2.2.4 Pilot Study

A pilot study was conducted on 10% of the study participants (21 nurses) to test clarity, visibility and applicability of the study and tool. The necessary modification was done accordingly. Participants in the pilot study were excluded from the original study.

2.2.5 Data Collection Procedures

A permission had been obtained from authors to use the questionnaire on measuring nurses' level knowledge and extent of practices toward prevention of CAUTI with needed modifications to suit the purpose of the study. The questionnaire of the study was administered in English as all nurses in KAAUH either Saudi or non-Saudi use English language in communication and documentation. The principle researcher met all head nurses at selected units before approaching the study participants. The study questionnaires were given to nurses who agreed to participate and met the inclusion criteria. The questionnaire took from nurses' time 20 minutes to complete. The best time for the data collection for each unit was in the morning shift. Meetings with nurses were held in the break time for nurses. The researcher was presented during filling the questionnaire to answer any question or concerns regarding study questionnaire. No electronic device was allowed to use during filling the questionnaires such as computer or cell phone. Data were collected from November 2017 to January 2018.

2.2.6 Data Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 22 for Windows (IBM Crop, Armonk, New York). Descriptive statistics have been conducted to describe sociodemographic data, frequency, percentage, means, and standard deviations. Analysis of variance Chi-square test was performed to examine the relation between nurses' knowledge and practices scores with sociodemographic variables. The Spearman correlational analysis was used to test the correlation between nurses' knowledge and practices scores.

3.0 RESULTS

Table (1) presents the frequency distribution of sociodemographic characteristic of nurses. The mean age of the nurses' was 33.60 ± 6.11 , and around one-third (32.8 %) of nurses were less than 30 years old. Near two-thirds of nurses were female (68.6%), and 59.2 % were married. Most of the nurses 97.8% were non-Saudi. Sixty two percent of nurses had a bachelor's degree in nursing, 35% had diploma, and only 2.9% had master or doctorate

degree.

More than half of nurses (53.2%) had years of experience ranged from 5 to 9 years, while only 0.7% had more than 30 year of experience. Out of 137 nurses who participated in the study, 23.4% nurses were working in the MICU, and 23.4% nurses were working in a SICU, while 53.2% of nurses were working in a medical units. The majority of nurses (91.2%) attended an educational or training program on urinary catheter procedures while only 8.8% had never attended. Nearly one-third of nurses (32.1%) attended an educational or training program on urinary catheter procedures more than three times.

Table 1: Sociodemographic Characteristics of Nurses (N= 137)

Variable	Category	Frequency (%)
Age		Mean \pm SD (33.60 \pm 6.11)
	≤ 30	45 (32.8)
	30-35	40 (29.2)
	36-40	33 (24.1)
	≥ 41	19 (13.9)
Gender	Male	43 (31.4)
	Female	94 (68.6)
Nationality	Saudi	3 (2.2)
	Non-Saudi	134 (97.8)
Marital Status	Single	38 (27.7)
	Married	81 (59.2)
	Divorce or Separate	14 (10.2)
	Widow	47 (2.9)
Level of Education	Diploma	48 (35.0)
	Bachelor	85 (62.1)
	Master or Doctorate	4 (2.9)
Years of nursing Experience		Mean \pm SD (2.15 \pm .800)
	1-4	26 (19.1)
	5-9	73 (53.2)
	10-19	31(22.6)
	20-29	6 (4.4)
	≥ 30	1 (0.7)
Current unit	Medical Intensive Care Unit	32 (23.4)
	Surgical Intensive Care Unit	32 (23.4)
	Medical Unit	73 (53.2)
Attending educational or training program	Yes	125 (91.2)
	one	30 (21.9)
	Two times	30 (21.9)
	Three times	21 (15.3)
	More than three times	44 (32.1)
	No	12 (8.8)

Table (2) reveals the levels of nurses' knowledge and practices toward prevention of CAUTI. More than half of nurses (62.77%) had low a level of knowledge. While about one-third (36.50%) of nurses had average level of knowledge, and only 0.73% of nurses had high level of knowledge. Regarding the levels of nurses' practices toward CAUTI prevention, it was noted that the majority of nurses (83.94%) had a poor level of practices. While 16.06% of nurses had a good level of practices.

Table 2: Nurses levels of knowledge and Practices toward CAUTI Prevention (N=137)

Knowledge and Practices	Frequency (%)
Level of knowledge	
High (12-15)	1 (0.73)
Average (8-11)	50 (36.50)
Low (0-7)	86 (62.77)
Level of Practices	
Good (10-15)	22 (16.06)
Poor (0-9)	115 (83.94)
Total	137 (100)

Table (3) shows frequency distribution of nurses' levels knowledge toward prevention of CAUTI. It was observed that around half (47.1%) of nurses answered correctly most of knowledge questions. Moreover, it was found that around one third (38.8%) of nurses were responds correctly for proper urethral catheter maintenance and around half of nurses (47.3%) were responds correctly for considerations and techniques for catheter insertion while more than half of nurses (56.9%) were responds correctly for different approaches to catheterization and specimen collecting methods. Regarding nurses' knowledge of considerations and techniques for catheter insertion; the majority of nurses (89.8%) knew that Silicone is preferable than Teflon-coated and latex catheter materials in reducing the risk of encrustation for long term catheterized patients who have frequent obstruction. More than half (56.9%) of nurses did not know that using alcohol hand sanitizer is comparable to hand washing in preventing CAUTI incidence. Furthermore, more than half (56.9%) did not know that routine use of antiseptic lubricants to decrease the risk of infection is not necessary for urinary catheter insertion.

Moreover, more than half of nurses (60.6%) mistakenly considered that antimicrobial prophylaxis offers greater benefit in reducing the incidence of CAUTI for patients requiring long-term catheterization. More than half of nurses (55.5%) incorrectly identified that antiseptic lubricants are more beneficial than non-antiseptic lubricants in reducing the incidence of CAUTI. Concerning nurses' knowledge of different approaches for catheterization and specimen collecting methods, nearly two thirds (69.3%) of nurses did not know that meatal cleansing with antiseptic solution post-catheterization does not offer greater advantage in preventing the incidence of CAUTI. Nearly two thirds (67.2%) of nurses knew that when obtaining small urine volume for examination, aspirate the urine from the needleless sampling port with a sterile syringe after cleansing the port with a disinfectant.

Regarding proper urethral catheter maintenance, two thirds of nurses did not know that silver coated catheters did not increase the risk of urethral irritation and antimicrobial resistance among catheterized patients and adding microbial solutions to drainage bags did not reduce the incidence of acquiring infection (71.5%), (70.1%) respectively. In addition, more than half of nurses mistakenly answered that changing indwelling catheters or drainage bags at

routine, fixed intervals is recommended for proper catheter maintenance and also, bladder irrigation, instillation, or washout using antiseptic or antimicrobial agent is beneficial in preventing CAUTI (65%), (66.4%), respectively.

Table 3: Frequency Distribution of Nurses' Knowledge toward CAUTI (N=137)

Nurses Knowledge	True	False
	n (%)	n (%)
Considerations and Techniques for Catheter Insertion		
Silicone is preferable than Teflon-coated and latex catheter materials in reducing the risk of encrustation for long term catheterized patients who have frequent obstruction	123 (89.8)	14 (10.2)
Using alcohol hand sanitizer is comparable to hand washing in preventing CAUTI incidence	59 (43.1)	78 (56.9)
Antiseptic meatal cleaning before catheter insertion is necessary in reducing the incidence of Catheter-associated urinary tract infection	33 (24.1)	104 (76)
Routine use of antiseptic lubricants to decrease the risk of infection is necessary for urinary catheter insertion	59 (43.1)	78 (56.9)
Antimicrobial prophylaxis offers greater benefit in reducing the incidence of CAUTI for patients requiring long-term catheterization	54 (39.4)	83 (60.6)
Antiseptic lubricants are more beneficial than non-antiseptic lubricants in reducing the incidence of CAUTI	61 (44.5)	76 (55.5)
Different Approaches to Catheterization and Specimens Collecting Methods		
Meatal cleansing with antiseptic solution post-catheterization offers greater advantage in preventing the incidence of CAUTI	42 (30.7)	95 (69.3)
When obtaining small urine volume for examination, aspirate the urine from the needleless sampling port with a sterile syringe after cleansing the port with a disinfectant	92 (67.2)	45 (32.8)
Obtain large volume of urine for special analysis aseptically from the drainage bag	94 (68.6)	43 (31.4)
If obstruction is anticipated, close continuous irrigation is suggested to prevent obstruction	84 (61.3)	53 (38.7)
Proper Urethral Catheter Maintenance		
Silver coated catheters increase the risk of urethral irritation and antimicrobial resistance among catheterized patients	39 (28.5)	98 (71.5)
Bladder irrigation, instillation, or washout using antiseptic or antimicrobial agent is beneficial in preventing CAUTI	46 (33.6)	91 (66.4)
Adding microbial solutions to drainage bags reduce the incidence of acquiring infection	41 (29.9)	96 (70.1)
Changing indwelling catheters or drainage bags at routine, fixed intervals is recommended for proper catheter maintenance	48 (35.0)	89 (65.0)
There is no benefit of clamping versus free drainage before catheter removal in reducing the risk of bacteriuria in catheterized patients	92 (67.2)	45 (32.8)

Table (4) shows frequency distribution of nurses' practices toward prevention of CAUTI. It was observed that more than half (55.7%) of nurses responds correctly to overall practices toward prevention of CAUTI. Regarding nurses' practices before catheter insertion, most of the nurses (83.2%) performed hand washing before urinary catheter insertion. More than half of nurses (54.7%) had a good practice due to used sterile gloves when inserting a catheter, but

it is alarming that a little more than one third of nurses (45.3%) were not. More than half of nurses (59.9%) had poor practices, while more than one third (40.1%) of nurses had good practices in the number of times of using a single pack lubricant jelly in their catheter insertions. Concerning of nurses' practices during catheter insertion nearly three quarters (73.7%) of nurses had correct practices in keeping the collecting bag and tube free from kinking to maintain an unobstructed urine flow for the indwelling catheter. Finally, regarding nurses' practices after catheter insertion, more than half of nurses (54.7%) incorrectly placed the collecting bag after insertion which is a poor practices. Nearly three quarters (73%) of nurses had good practices on wearing of gown during any manipulation of the indwelling catheter's collecting bag. Nearly two thirds of nurses (62.8%) when draining the catheter, contents of the collecting bag had contact with the collecting container through the drainage spigot. More than half (56.9%) of nurses had good practices on the use of one collecting container for each patient in emptying the collecting bag of the indwelling catheter. More than three quarters (75.9%) of nurses had good practices on implementing quality improvement strategies to reduce CAUTI.

Table 4: Frequency Distribution of Nurses' Practices toward CAUTI (N=137)

Practice Question	True n (%)	False n (%)
Practices Before Catheter Insertion		
Did you wash your hands before you inserted the catheter?	114 (83.2)	23 (16.8)
Did you use a pair of sterile gloves when you inserted the catheter?	75 (54.7)	62 (45.3)
How many times did you use a single pack lubricant jelly?	55 (40.1)	82 (59.9)
Did you clean the urethra with an antiseptic solution before you inserted the catheter?	77 (56.2)	60 (43.8)
How did you open and handle the indwelling catheter from its packaging?	88 (64.2)	49 (35.8)
Practices During Catheter Insertion		
How many ml of sterile water did you inject in the needleless port to inflate the balloon?	79 (57.7)	58 (42.3)
How did you maintain an unobstructed urine flow for the indwelling catheter?	101 (73.7)	36 (26.3)
Practices After Catheter Insertion		
Where did you place the collecting bag after insertion?	62 (45.3)	75 (54.7)
What did you do after inserting the catheter?	35 (25.5)	102 (75)
Did you wear a gown when you manipulate the collecting bag of the indwelling catheter?	100 (73.0)	37 (27.0)
Did you use a pair of clean gloves when you drained the collecting bag?	82 (59.9)	55 (40.1)
When emptying the collecting bag, how many collecting container did you use for each patient?	78 (56.9)	59 (43.1)
How did you pull out the catheter?	43 (31.4)	94 (68.6)
How do you implement Quality Improvement strategies to reduce CAUTI?	104 (75.9)	33 (24.1)

Table (5) shows relation between nurses' knowledge, practices and sociodemographic characteristics. There were no significant relation between gender, education level, years of nursing experience, and educational or training program attended on urinary catheter

procedures, and the nurses' knowledge with $P > 0.05$. While there was a significant relation between nurses' knowledge and age with $P = 0.05$. In addition, there were no significant relation between age, gender, education level, years of nursing experience, and educational or training program attended on urinary catheter procedures, and the nurses' practices with $P > 0.05$. While there was a significant relation between nurses' practices and participants working in different units with $P < 0.001$.

Table 5: Relation between Nurses' Knowledge, Practices and Sociodemographic Characteristics (N=137)

Variables	knowledge		χ^2	Sig. (p-value)	Practices		χ^2	Sig. (p-value)
	True	False			True	False		
	F (%)	F (%)			F (%)	F (%)		
Age								
≤ 30	37 (27.0)	8 (5.8)	7.573	0.050*	35 (25.5)	10 (7.3)	6.748	0.080
(30-35)	41 (29.2)	0 (0.0)			26 (19.0)	14 (10.2)		
(36-40)	29 (21.2)	4 (2.9)			27 (19.7)	6 (4.4)		
≥ 41	16 (11.7)	3 (2.2)			10 (7.3)	9 (6.6)		
Gender								
Male	41 (29.9)	2 (1.5)	2.546	0.110	31(22.6)	12 (8.8)	0.010	0.922
Female	81 (59.1)	13 (9.5)			67 (48.9)	27 (19.7)		
Nationality								
Saudi	2 (1.3)	1 (0.7)	0.021	0.884	2 (1.8)	1 (0.2)	3.426	0.064
Non-Saudi	124(90.7)	10 (7.3)			104 (76.1)	30 (21.9)		
Marital Status								
Single	32 (23.4)	6 (4.4)	4.024	0.259	30 (21.9)	8 (5.8)	5.641	0.130
Married	75 (54.7)	6 (4.4)			58 (42.3)	23 (16.8)		
Divorce or Separate	11 (8.0)	3 (2.2)			9 (6.6)	5 (3.6)		
Widow	4 (2.9)	0 (0.0)			1 (0.7)	3 (2.2)		
Education level								
Diploma	43 (31.4)	5 (3.6)	0.564	0.754	33 (24.1)	15 (10.9)	0.289	0.865
Bachelor	75 (54.7)	10 (7.3)			62 (45.3)	23 (16.8)		
Master or Doctorate	4 (2.9)	0 (0.0)			3 (2.2)	1 (0.7)		
Years of Experience								
(1-4) year	23 (16.8)	3 (2.2)	0.593	0.964	19 (13.9)	7 (5.1)	1.461	0.834
(5-9) year	66 (48.2)	7 (5.1)			54 (39.4)	19		

						(13.9)		
(10-19) year	27 (19.7)	4 (2.9)			20 (14.6)	11 (8.0)		
(20-29) year	5 (3.6)	1 (0.7)			4 (2.9)	2 (1.5)		
More than 30 year	1 (0.7)	0 (0.0)			1 (0.7)	0 (0.0)		
Current unit								
MICU	27 (19.7)	5 (3.6)	4.955	0.084	30 (21.9)	2 (1.5)	14.15	0.001*
SICU	26(19.0)	6 (4.4)			25 (18.2)	7 (5.1)		
Medical Units	69 (50.4)	4 (2.9)			43 (31.4)	30 (21.9)		
Attending educational or training program								
Yes	112 (81.8)	13 (9.5)	0.441	0.507	89 (65.0)	36 (26.3)	0.078	0.781
No	10 (7.3)	2 (1.5)			9 (6.6)	3(2.2)		
Times of attending program								
One	27(21.6)	3 (2.4)	3.214	0.360	23 (18.4)	7 (5.6)	6.982	0.072
Two times	26 (20.8)	4 (3.2)			24 (19.2)	6 (4.8)		
Three times	21 (16.8)	0 (0.0)			17 (13.6)	4 (3.2)		
> three times	38 (30.4)	6 (4.8)			25 (20.0)	19 (15.2)		

Table (6) shows the correlation between nurses' levels of knowledge and practice toward Prevention of CAUTI. Regarding the association between nurses' level of knowledge and practices toward CAUTI, it was observed that there was no significant relation between nurses' knowledge and practice toward CAUTI prevention with $p = 0.223$.

Table 6: Correlation between Nurses' Levels of Knowledge and Practice toward Prevention of CAUTI

Levels of Knowledge and Practice Correlation		
		Level of Knowledge
Level of Practices	Spearman Correlation	- 0.105
	Sig. p-value	0.223

4.0 DISCUSSION

In latest years, a lot of efforts have been done to determined effective strategies for decreasing IUC utilizations and prevent its related complications. In general, most of these interventions aimed to changing beliefs and behaviors of nurses toward CAUTI as well concerning limiting an IUC usage and safe management of IUC (Niederhauser, Züllig, Marschall, & Schwappach, 2018). The current study was aimed to assess nurses' knowledge

and practices toward prevention of CAUTI.

4.1 Sociodemographic Characteristics of Nurses

This study revealed that near two-thirds of nurses were female. This result is in line with Zachariah (2016) who found that 67% of nurses in India were females, and Mukakamanzi (2017) who found that 66% of participants in Rwanda were female. This might be related to the high ratio of female nurses comparing to male nurses in KAUH. According to the MOH (2016), the total number of female nurses at KAAUH is 1174 while the number of male nurses is only 60. In another study conducted in SA by Alsaqri (2014) examining the nurses' intention to leave, job stress, burnout, and job satisfaction, among 297 of nurses working in the northern province of Ha'il in SA shares a similar finding with the current study. Alsaqri (2014) found that the total number of male nurses were 699, and female nurses were 18080 of the total number of nurses. Regarding nationality, the majority of nurses were non-Saudi in this study. The possible explanation of this result may be the nature of work in KAAUH is not like MOH hospitals in terms of working hours and salaries, which is consistent with a previous study by Alsaqri (2014), who mentioned that Saudis are not willing to have a job with long hours and low salaries. Moreover, other contributing factors for Saudis nursing shortage are high job demand, lack of control, length of working hours, night shifts, working in a public holidays and weekends, lack of professional growth, poor salary, gender or cultural concerns, and absence of social support (Almalki, FitzGerald, & Clark, 2011).

More than half of nurses had a bachelor degree in this study. This is consistent with a study conducted by Opina and Oducado (2014), who found that 76.7% of nurses in Philippines were holding a bachelor degree, and contradicted with another study conducted by Sobeih and Nasr (2015) who reported that 75.5% of nurses in Egypt have a diploma in nursing. Mukakamanzi (2017) also found that the majority of nurses (81.1%) in Rwanda had a diploma, and only 1% had a bachelor degree in nursing. This may be explained by the fact that hospitals in SA recruit nurses with high educational qualifications. The American Association of Colleges of Nursing (AACN) (2014) emphasized that level of nurses' education is essential for their knowledge and competency, and many courses related to physical, social, research, and community science enable nurses to use their critical thinking, decision making, and leadership skills in providing a safe and high quality nursing care. In addition, the present study revealed that more than half of nurses had five to nine years of nursing experience in SA. Researchers indicate that most of non-Saudi nurses incline to use the SA healthcare settings as a temporary site to obtain teaching and practice then after some years of attained experiences and proficiency; they leave SA to work in developed countries like the USA (Almalki et al., 2011).

Most nurses in this study attended an educational or training program on urinary catheter procedures. A similar result was found by Mukakamanzi (2017), who revealed that 79.2% of nurses had training on infection control practices. While this result contradicted with Sobeih and Nasr (2015), who stated that all nurses did not attend any training regarding urinary

catheter, as well as Shehab (2017), who noted that 100% of nurses did not participate in any trainings regarding urinary catheter and infection control practices. This result indicated that KAAUH encourages nurses to attend an educational or training program on urinary catheter procedures which may have a significant impact on preventing CAUTI. Opina and Oducado (2014), emphasized that nurses need continuous education and training program to prevent CAUTI.

4.2 Nurses' Knowledge toward Prevention of CAUTI

Nurses in this study had poor knowledge regarding proper urethral catheter maintenance followed by considerations and techniques for catheter insertion and finally, different approaches to catheterization and specimen collecting methods. The findings are contradicted with those found by Opina and Oducado (2014), who stated that the nurses were least knowledgeable about different approaches to catheterization and specimen collecting methods followed by proper urethral catheter maintenance and finally, considerations and techniques for catheter insertion. Regarding considerations and techniques for catheter insertion, the majority of nurses in this study knew that Silicone is preferable than Teflon-coated and latex catheter materials in reducing the risk of encrustation for long-term catheterized patients who have a frequent obstruction. This result contradicted with Shah et al. (2017), who found that 50% of nurses in Pakistan did not know that Silicone is preferable than Teflon-coated and latex catheter materials. Concerning the catheter materials, Silicone is better than others in reducing the encrustation risk (Gould, Umscheid, Agarwal, Kuntz, & Pegues, 2017). In addition, more than one-half of the nurses in this study did not know that using alcohol hand sanitizer is comparable to hand washing in preventing CAUTI incidence. This finding is consistent with Opina and Oducado (2014), who found that 60% of nurses did not realize that using alcohol hand sanitizer is comparable to hand washing in preventing CAUTI, while the result contradicted with Shah et al. (2017), who found that 70% of nurses know that using alcohol hand sanitizer is comparable to hand washing in preventing CAUTI. Gould et al. (2017) mentioned that there was no significant difference between alcohol hand sanitizer and hand washing in reducing CAUTI incidence.

In this study, more than half of nurses did not know that the routine use of antiseptic lubricants to decrease the risk of infection is not necessary for urinary catheter insertion. This result congruent with the finding of Opina and Oducado (2014), who stated that 66.7% of nurses did not know that routine use of antiseptic lubricants is not necessary for decrease the infection caused by urinary catheter insertion. On the other hand, more than half of nurse in this study incorrectly identified that antiseptic lubricants are more beneficial than non-antiseptic lubricants in reducing the incidence of CAUTI. This result congruent with the finding of Opina and Oducado (2014), who found that 80% of nurses incorrectly identified that antiseptic lubricants are more beneficial than non-antiseptic lubricants in reducing the incidence of CAUTI. According to Mitchell et al. (2011) and Gould et al. (2017), there was no significant difference between antiseptic lubricants and non-antiseptic lubricants in

preventing CAUTI, despite the fact there is very low-quality evidence advising to use lubricants during indwelling urinary catheter insertion to decrease the risk of CAUTI.

This study result also revealed that more than half of nurses mistakenly considered that antimicrobial prophylaxis offers greater benefit in reducing the incidence of CAUTI for patients requiring long-term catheterization. Similar to this finding, Opina and Oducado (2014) found that 70% of nurses mistakenly believed that antimicrobial prophylaxis offers greater benefit. In addition, Shah et al. (2017) indicated that 55.7% of nurses mistakenly considered that antimicrobial prophylaxis offers greater benefit, while only 44.3% considered that antimicrobial prophylaxis does not provide greater benefit. Moreover, it is not routinely recommended the use of systemic antimicrobial agents to prevent CAUTI (Gesmundo, 2016). Gould et al. (2017) reported that there is a low-quality evidence suggested that no benefit of antimicrobial prophylaxis in patients undergoing long-term catheterization.

Regarding different approaches to catheterization and specimens collecting methods, nearly two-thirds of nurses did not know that meatal cleansing with antiseptic solution post-catheterization does not offer a greater advantage in preventing the incidence of CAUTI. This congruent with the finding of Opina and Oducado (2014) and Shah et al. (2017), who mentioned that most nurses did not know that meatal cleansing with antiseptic solution post-catheterization does not offer a greater advantage in preventing of CAUTI. However, Gesmundo (2016) emphasized that there is no benefit had been shown when using antiseptics solutions for daily meatal cleansing if the catheter is in place and may also raise the rate of bacteriuria. There is also low-quality evidence strongly recommended that cleansing the meatal surface with soap and water during daily bathing or showering is more appropriate (Gesmundo, 2016). This is supported by Loveday et al. (2014), who reported that there are studies compared meatal cleansing with a variety of antiseptic or antimicrobial solutions or soap and water which revealed that no decreasing in bacteriuria and may increase the risk of infection when comparing the use of antiseptic or antimicrobial solutions with soap and water, and routine daily personal hygiene is only required.

In this study, nearly two-thirds of nurses knew that when obtaining small urine volume for examination, aspirate the urine from the needleless sampling port with a sterile syringe after cleansing the port with a disinfectant. This result similar to Opina and Oducado (2014), who found that 60% of nurses know that when obtaining small urine volume for examination, aspirate the urine from the needleless sampling port with a sterile syringe after cleansing the port with a disinfectant. While this result contradicted with Kose et al.(2016), who found that only 31.9% of nurses in Turkey while taking culture or sample, aspirate the urine from the needleless sampling port with syringe after cleansing the port with a disinfectant. According to Gesmundo (2016), there is a strong recommendation, supported by evidence, that if urine sample needed for urinalysis or culture, aspirate the urine from the needleless sampling port with a sterile syringe after cleansing the port with a disinfectant.

Regarding proper urethral catheter maintenance, two-thirds of nurses did not know that

silver-coated catheters do not increase the risk of urethral irritation and antimicrobial resistance among catheterized patients. This result congruent with the finding of Opina and Oducado (2014), who found that 53.3% of nurses did not know that silver-coated catheters not increase the risk of urethral irritation. According to Gould et al. (2017), there is low-quality evidence recommended a benefit of silver-coated catheters over standard latex catheters in reducing the risk of bacteriuria, but there was no evidence of increased urethral irritation or antimicrobial resistance in studies that stated information regarding microbiological outcomes. Moreover, two-thirds of the nurses did not know that adding microbial solutions to drainage bags not reduce the incidence of acquiring an infection. This result contradicted with Opina and Oducado (2014), who found that 66.7% of nurses knew that adding microbial solutions to drainage bags not reduce the incidence of acquiring an infection. In addition, this result contradicted with Kose et al. (2016), who found that 50% of nurses knew . In this regard, Loveday et al. (2014) mentioned that no effect on CAUTI when adding bacterial solutions to drainage bags.

The result of this study revealed that more than half of the nurses had a low level of knowledge toward CAUTI prevention. This result is congruent with Opina and Oducado (2014), who found that 70% of nurses had a low level of knowledge, while 30% had an average level of knowledge. Also, Mukakamanzi (2017) found that 64.52% had a low level of knowledge regarding CAUTI, and Shehzadi et al. (2018) found that near to half of participants in Pakistan had poor knowledge towards CAUTI prevention. This result is contradicted with Prasanna (2015), who stated that 46.7% of Indian nurses had an adequate knowledge, while 33.3% had a moderate knowledge, and only 20% had inadequate knowledge regarding catheter care. Up to this time, there is a great number of nurses' unknowledgeable regarding prevention of CAUTI which may lead to mistakes and negligence in IUC care which in turn may cause a great risk in getting CAUTI for patients during their hospitalization (Opina & Oducado, 2014).

4.3 Nurses' Practice toward Prevention of CAUTI

Regarding nurses' practices before catheter insertion, most of the nurses performed hand washing before urinary catheter insertion. This result consistent with Kose et al. (2016), who found that 88.2% of nurses performed hand washing before urinary catheter insertion. Mukakamanzi (2017) also found that 100% of the nurses performed hand washing before and after insertion. While contradicted with Shehab (2017), who found that only 36% of nurses performed hand washing before and after insertion. Hand washing before urinary catheter insertion is one step of proper techniques for urinary catheter insertion (Gould et al.,2017).

More than half of nurses had poor practices in the number of times of using a single pack lubricant jelly in their catheter insertions in this study. This result contradicted with Opina and Oducado (2014), who found that 66.7% of nurses use a single bottle for lubricant in their catheter insertions, and Mukakamanzi (2017), who found that 64.2% of nurses use a single bottle for lubricant. The Centers for Disease Control and Prevention (CDC) strictly

recommends use of single pack lubricant jelly for single-use to reduce urethral discomfort, trauma and the risk of infection (Gould et al., 2017; Loveday et al., 2014). In this study, more than half of nurses had good practice due to use sterile gloves when inserting a catheter. This result is similar to the previous studies (Kose et al., 2016; Mukakamanzi, 2017; Opina & Oducado, 2014; Shehab, 2017) who found that the majority of nurses used sterile gloves when inserting a catheter. Concerning the nurses practices during catheter insertion, nearly three quarters of nurses had correct practices in keeping the collecting bag and tube free from kinking to maintain an unobstructed urine flow for the indwelling catheter. This finding consistent with Opina and Oducado (2014), who indicated that 73.3% of nurses had correct practices in keeping the collecting bag and tube free from kinking. Mukakamanzi (2017) also reported that 94.3% of nurses had correct practices in keeping the collecting bag and tube free from kinking. The CDC recommends to keep the catheter and collecting tube free from kinking for maintaining urine flow unobstructed (Gould et al., 2017).

Regarding nurses' practices after catheter insertion, more than half of nurses incorrectly placed the collecting bag after insertion which is a poor practices in this study. This result contradicted with Opina and Oducado (2014), who found that 100 % of nurses placed the collecting bag below the bladder. In addition, Mukakamanzi (2017) indicated that 90.6% of the nurses placed the collecting bag below the bladder. There is association between reflux of urine and infection, therefore as recommended by CDC collecting bag should be place below the level of the bladder all times to make sure that free flow of urine and prevents back flow, in the same time collecting bag should not touch the floor by hung on an appropriate stand (Gould et al., 2017; Loveday et al., 2014). Nearly three quarters of nurses had good practices on wearing of gown during any manipulation of the indwelling catheter's collecting bag. This result is consistent with Mukakamanzi (2017), who stated that 90.6% of nurses wearing of gown during any manipulation of the indwelling catheter. While contradicted with Opina and Oducado (2014), who found that 100% of nurses did not wearing of gown during any manipulation of the indwelling catheter. The CDC to use gown during any manipulation of the catheter or collecting bag as standard precautions (Gould et al.,2017).

In this study, more than three quarters of nurses had good practices on implementing quality improvement strategies to reduce CAUTI through using a system of alerts and reminders for patients with catheter, and assess the need for continued catheterization. The result is contradicted with Opina and Oducado (2014), who found that 96.7% of nurses did not implementing quality improvement strategies to reduce CAUTI. The CDC recommends to use the system of alerts or reminders to identify patient with urinary catheter, and assess the need for continued catheterization as implementation quality improvement programs or strategies to enhance appropriate use of indwelling catheters, and to reduce the risk of CAUTI (Gould et al., 2017).

The result of the present study revealed that the majority of nurses had poor practices toward CAUTI prevention. This finding is consistent with Sobeih and Nasr (2015), who stated that

only 12.5% of the studied nurses had competent level of practices as regards urinary catheter care while this result contradicted with Selim et al. (2018) and Mukakamanzi (2017), who found that a high percentage of nurses has shown a good implementation of different practices towards catheter CAUTI prevention. The reason of poor nurses' practice may be linked to lack of effective complete guidelines toward CAUTI prevention in KAAUH. Lo et al. (2016) stated that one of the recommended strategies for CAUTI prevention as basic practices in acute care hospitals is providing an appropriate infrastructure through the implementation of written guidelines for catheter use, insertion, and maintenance.

4.4 Relation between Nurses' Levels of Knowledge, Practices, and Sociodemographic Characteristics

In this study, the result revealed that there was no significant relationship between nurses' levels of knowledge and practices. This result is in agreement with Anwar et al. (2017), who found that no significant relationship between nurses' knowledge and practice regarding CAUTI. While contradicted with Zachariah (2016), who found that there is a significant positive relationship between knowledge and practices of nurses regarding the prevention of CAUTI. Another study conducted in Iran by Kalantarzadeh et al. (2014) also reported that there was a positive relationship between knowledge and practice, which shows that with enhanced knowledge, the practice can be enhanced. However, Anwar et al. (2017) indicated that even though the relationship between nurses' knowledge and practices concerning the CAUTI was not significant, the possible cause for that was the levels of nurses' knowledge and practices were very poor. The current finding was not supported KAP model which suggests a liner relationship between nurses' knowledge and practices. According to KAP model knowledge can lead to a change in practice (Launiala, 2009). In addition, Opina and Oducado (2014) stated that nurses with required knowledge would have a good performance in their professional practice toward HAIs prevention. There is a little literature examining nurses' knowledge and practices concerning management of IUC while it has been reported that proper management of IUC needs that nurses have good knowledge and practice (Ismail, 2017).

Regarding the relation between nurses' knowledge, practices and sociodemographic data there was a significant relation between nurses' knowledge and age, while there was no significant relationship between nurses' practices and age. Desta et al.(2018) revealed that there was a significant relation between nurses' knowledge and practices with age. Kose et al.(2016) revealed that there was a significant positive relation between nurses' knowledge and age, while Prasanna (2015) stated that there was no significant relation between nurses' knowledge and age. Anwar et al. (2017) stated that there was no significant relationships between nurses' knowledge and practices with age. According to Desta et al. (2018), when healthcare providers get older they are more expected to be advance in their knowledge through experience and working with senior colleagues. But in the current study more than half of nurses had a low level of knowledge and this might be attributed to the fact that near

two third of nurses age were from 35 or less and more than half of them had years of experience ranged from five to nine years.

Moreover, there were no significant relation between gender, education level, years of nursing experience, and educational or training program attended on urinary catheter procedures, and the nurses' knowledge or practices. This result in contrast with Desta et al.(2018), who found that there were significant relation between gender, education level, years of nursing experience, and training in the infection control, and the nurses' knowledge or practices. Prasanna (2015) stated that there were no significant relation between nurses' knowledge and gender. Also, the result of present study was in line with Mukakamanzi (2017) and Anwar et al. (2017), who found no significant relation between nurses' knowledge or practices with level of education and years of experience, but Kose et al. (2016) found a significant positive relation between nurses' knowledge and years of nursing experience. The absences of a significant relation between nurses' practices and years of experience in this study might be explained by Ismail (2017), who mentioned that nurses who have been practiced for at least ten years, would be predictable to have at least a basic understanding of best practice for the IUC management. Moreover, this might be related to the fact that increasing years of experience, healthcare providers are susceptible to repetitively and became more experienced through working with senior personnel (Ismail, 2017). In contrast, Prasanna (2015) and Kose et al. (2016) found a significant positive relation between nurses' knowledge and level of education. However, Pieper and Zulkowski (2014) mentioned that the different between gaining knowledge in classroom and between knowledge acquired and applied to clinical practice is a huge. Similarly, Altun and Karakoç (2010) indicated that there was a big variance between memorizing something heard in a teaching session and real knowing, remembering and using what was learned in practice.

There was no significant relation between nurses' knowledge, practices, and attending educational or training program on urinary catheter procedures. This finding is consistent with Mukakamanzi (2017), who found no significant relation between nurses' knowledge or practices and training on infection control. This result is contradicted with Prasanna (2015), who found a significant positive relation between nurses' knowledge regarding catheter care and attended continuous nursing education program. Finally, in the present study there was significant relationship between nurses' practices and the current unit. Regardless that the majority of nurses had a poor practices, nurses who are working in the intensive care unit more knowledgeable than nurses who are working in the medical units. The possible explanation for this finding could be the fact that the nurses who are working in the intensive care units have more confidence in complying with recommended guidelines and there are available supply to implement the infection prevention practices.

5.0 CONCLUSION AND RECOMMENDATIONS

Conclusions

One of the most common healthcare-associated infections is CAUTI. It is largely preventable if catheterization indications, catheterization care methods, and other preventative measures are carefully followed. In this study, there were knowledge deficit and poor practices about CAUTI prevention among nurses in SA. There were no statistical, significant relation between nurses' knowledge and practices toward CAUTI. Also, there was no significant relation between sociodemographic variables and knowledge or practices mean scores. While there was a significant relation between nurses' knowledge and age and there was a significant relation between nurses' practices and current unit.

Recommendations

The findings of the current study provided a baseline direction to the studies aimed to assess nurses' knowledge and practices toward prevention of CAUTI. Further studies may be required to investigate the barrier affecting nurses' knowledge, attitude and practice regarding CAUTI prevention. Another possible area of further study is required to examine the nurses' knowledge, attitude and practice regarding CAUTI prevention in others setting at Jeddah city using different approaches and larger sample size to promote the credibility and generalizability of the study findings. Nurses should be trained regularly in CAUTI prevention, also hospital administration in Saudi hospitals should make every effort to include CAUTI prevention in their high priority list. This study may be a guide for developing education and training programs on issues related to CAUTI in SA.

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CONFLICT OF INTERST

The authors have no conflict of interest to declare.

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References

- Almalki, M., FitzGerald, G., & Clark, M. (2011). The nursing profession in Saudi Arabia: An overview. *International Nursing Review*, 58(3), 304-311.
- Al Nasser, W., El-saed, A., Al-jardani, A., Althaqafi, A., Alansari, H., Alsalman, J, ... Balkhy, H. H. (2016). American Journal of Infection Control rates of catheter-associated urinary tract infection in tertiary care hospitals in 3 Arabian Gulf countries: A 6-year surveillance study. *American Journal of Infection Control*, 44(12), 1589–1594. <http://doi.org/10.1016/j.ajic.2016.06.030>
- Alsaqri, S.H. (2014). *A survey of intention to leave, job stress, burnout and job satisfaction*

- among nurses employed in the Ha'il region's hospitals in Saudi Arabia.* (Doctoral dissertation). Retrieved from <https://researchbank.rmit.edu.au/eserv/rmit:160699/Alsaqri.pdf>
- Altun, İ., & Karakoç, A. (2010). The impact of an interactive workshop on the management of urinary catheterization on nurses. *International Journal of Urological Nursing*, 4(3), 125-132.
- American Association of Colleges of Nursing (AACN). (2014). *The impact of education on nursing practice*. Retrieved from <http://www.aacn.nche.edu/media-relations/fact-sheets/impact-of-education>.
- Anwar, G., Nawaz, G., Afzal, M., Majeed, I., & Waqas, A. (2017). Assessment of perceptions and practices of the nurses to prevent indwelling catheter associated infection: Jinnah Hospital Lahore, Pakistan. *International Journal of Applied Sciences and Biotechnology*, 5(2), 150. <http://doi.org/10.3126/ijasbt.v5i2.17317>
- Association for Professionals in Infection Control. (2014). *Guide to Preventing Catheter-Associated Urinary Tract Infections*. Retrieved from http://apic.org/Resource_/EliminationGuideForm/0ff6ae59-0a3a-4640-97b5-eee38b8bed5b/File/CAUTI_06.pdf
- Banks, H., Abdella, R., & Willmann, Y. (2016). Nursing Interventions Aimed at Reducing the Incidence of Hospital Acquired Catheter-Associated Urinary Tract Infections. <http://www.theseus.fi/handle/10024/112505>
- Desta, M., Ayenew, T., Sitotaw, N., Tegegne, N., Dires, M., & Getie, M. (2018). Knowledge, practice and associated factors of infection prevention among healthcare workers in Debre Markos referral hospital, Northwest Ethiopia. *BMC health services research*, 18(1), 465.
- Gaid, E., Assiri, A., McNabb, S., & Banjar, W. (2017). Device-associated nosocomial infection in general hospitals, Kingdom of Saudi Arabia, 2013-2016. *Journal Epidemiology and Global Health*, 1589-1594. <http://doi.org/10.1016/j.jegh.2017.10.008>
- Gesmundo, M. (2016). Managing indwelling urinary catheters. *Kai Tiaki Nursing New Zealand*, 22(6), 14-15.
- Gould, C.V., Umscheid, C.A., Agarwal, R.K., Kuntz, G., Pegues, D. A., & Healthcare Infection Control Practices Advisory Committee. (2017). Guideline for prevention of catheter-associated urinary tract infections 2009. *Infection Control and Hospital Epidemiology*, 31(4), 319-26. doi: 10.1086/651091.
- Grove, S.K., Burns, N., & Gray, J. (2014). *Understanding nursing research: Building an evidence-based practice*. Elsevier Health Sciences: USA.
- Ismail, S.I.A. (2017). *Impact of an educational program on nurses' knowledge and practice of urethral catheterization.* (Doctoral dissertation). Retrieved from

- http://medicine.ribat.edu.sd/public/uploads/upload/repository/cover%20_7457524645.pdf
- Kalantarzadeh, M., Mohammadnejad, E., Ehsani, S.R., & Tamizi, Z. (2014). Knowledge and practice of nurses about the control and prevention of nosocomial infections in emergency departments. *Archives of clinical infectious diseases*, 9(4).
- Kose, Y., Leblebici, Y., Akdere, S.S., Cakmakci, H., & Otunctemur, S., Egici, M.T., & Bektemür, G. (2016). Level of knowledge of the nurses work in a public hospital about the prevention of catheter-associated urinary tract infections. *The Medical Bulletin of Sisli Etfal Hospital*, 50(1), 70-79. <http://doi.org/10.5350/SEMB.20151216103044>
- Launiala, A. (2009). How much can a KAP survey tell us about people's knowledge, attitudes and practices? Some observations from medical anthropology on malaria in pregnancy in Malawi Background: KAP surveys. *Anthropology Matters Journal*, 11(1), 1–13.
- Lo, E., Nicolle, L.E., Mph, S.E.C., Gould, C., Mph, L.L. M., Meddings, J., ... Gould, C. (2016). Strategies to prevent catheter-associated urinary tract infections in acute care hospitals: 2014 update. *Infection Control & Hospital Epidemiology*, 35(5), 464-479. <http://doi.org/10.1086/675718>
- Loveday, H.P., Wilson, J.A., Pratt, R.J., Golsorkhi, M., Tingle, A., Bak, A., ... Wilcox, M. (2014). National Evidence-Based Guidelines for preventing healthcare-associated infections in NHS Hospitals in England. *Journal of Hospital Infection*, 86(S1), S1–S70. doi: 10.1016/S0195-6701(13)60012-2.
- Ministry of Health (MOH). (2016). *Kingdom of Saudi Arabia statistical year book*. Retrieved from <https://www.moh.gov.sa/en/Ministry/Statistics/Book/Pages/default.aspx>.
- Mitchell, B., Ware, C., McGregor, A., Brown, S., Wells, A., Stuart, R.L., ... Mason, M. (2011). ASID (HICSIG)/AICA position statement: Preventing catheter-associated urinary tract infections in patients. *Healthcare Infection*, 16(2), 45-52.
- Mukakamanzi, J. (2017). *Knowledge, attitude and practices of nurses towards the prevention of catheter-associated urinary tract infection in selected Referral Hospitals in Rwanda*. (Doctoral dissertation). Retrieved from <http://dr.ur.ac.rw/bitstream/handle/123456789/324/MUKAKAMANZI%20Jacqueline.pdf?sequence=1&isAllowed=y>
- Nicolle, L.E. (2014). Catheter associated urinary tract infections. *Antimicrobial resistance and infection control*, 3(1), 23.
- Niederhauser, A., Züllig, S., Marschall, J., & Schwappach, D. (2018). Nurses' and physicians' perceptions of indwelling urinary catheter practices and culture in their institutions. *Journal of patient safety*, 0(0), 1-8. <http://doi.org/10.1097/PTS.0000000000000502>
- Opina, M.L.F., & Oducado, R.M.F. (2014). Infection control in the use of urethral catheters :

- Knowledge and practices of nurses in a private hospital in Iloilo city, *Asia Pacific Journal of Education, Arts and Sciences*, 1(5), 93–100.
- Parker, V., Giles, M., Graham, L., Suthers, B., Watts, W., O'Brien, T., & Searles, A. (2017). Avoiding inappropriate urinary catheter use and catheter-associated urinary tract infection (CAUTI): A pre-post control intervention study. *BMC Health Services Research*, 17(1), 314. <http://doi.org/10.1186/s12913-017-2268-2>
- Pieper, B., & Zulkowski, K. (2014). The pieper-zulkowski pressure ulcer knowledge test. *Advances in Skin & Wound Care*, 27(9), 413-9. doi: 10.1097/01.ASW.0000453210.21330.00.
- Prasanna, K., & Radhika, M. (2015). Knowledge regarding catheter care among staff nurses. *International Journal of Applied Research*, 1(8), 182–186.
- Selim, S.M., El-Seoud, A.R.A., Mohamed, A.A.H., & Ibrahim, S.A.A.R. (2018). Effect of infection control program on catheter-associated urinary tract infection in intensive care units at Zagazig University Hospital. *Zagazig University Medical Journal*, 24(5). 420–436.
- Shah, M., Wahab, F., Ullah, F., Gul, U., Aziz, A., & Ullah, Z. (2017). Infection control in the use of urethral catheter: Knowledge and practices of nurses. *American Journal of Advanced Drug Delivery*, 5(1), 1-8.
- Shehab, M.S. (2017). Impact of protocol of care of patients undergoing urinary catheterization. *International Journal of Caring Sciences*, 10(2), 1013–1021.
- Shehzadi, A., Ali, A., Bhatti, R., & yaseen, I. (2018). Knowledge and attitude of nurses towards the prevention of catheter-associated urinary Tract Infection in ICU, S of A Public Hospital Lahore. *Saudi Journal of Nursing and Health Care*, 7921, 119–124.
- Sobeih, H.S., & Nasr, M.H. (2015). Indwelling urinary catheter management: Effect of an interactive workshop on nurses' practice and perception. *New York Science Journal*, 8(5), 117–126.
- Talaat, M., El-Shokry, M., El-Kholy, J., Ismail, G., Kotb, S., Hafez, S., ... Lessa, F. C. (2016). National surveillance of health care-associated infections in Egypt: Developing a sustainable program in a resource-limited country. *American Journal of Infection Control*, 44(11), 1296–1301. <http://doi.org/10.1016/j.ajic.2016.04.212>
- Tenke, P., Mezei, T., Böde, I., & Köves, B. (2017). Catheter-associated urinary tract infections. *European Urology, Supplements*, 16(4), 138–143. <http://doi.org/10.1016/j.eursup.2016.10.001>
- Zachariah, C.A. (2016). Effectiveness of SIM on knowledge and practice among nurses regarding prevention of UTI in patients with indwelling catheter, 5(8), 2013–2016.