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Nurses' Performance regarding Catheter Associated Urinary Tract Infection Bundle in Intensive Care Unit

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ABSTRACT

Background: Catheter-associated urinary tract infection represents the predominant form of hospital-acquired infection, frequently arising as a complication in patients with urinary catheters or up to 48 hours following catheter removal. This condition notably increases morbidity and mortality rates. **Aim:** This study aimed to assess nurses' performance regarding bundle of care for catheter associated urinary tract infection. **Research design:** A descriptive design was utilized for conducting the study. **Setting:** The study was carried out in General Intensive Care Unit at Beni-Suef University Hospital. **Subjects:** Convenience sample of all available nurses were included in the study in the previously mentioned settings. **Data Collection Tools:** Data were gathered through two tools, **I** -Nurses' knowledge Questionnaire, it included nurses' demographic characteristics and nurses' knowledge, **II** - CAUTI Bundle Observation Checklist. **Results:** The mean total knowledge score was 20.06±2.98 out of 26, with (52%) of studied nurses had a satisfactory level regarding their total of knowledge. In relation to practice, the mean total knowledge score was 21.94±3.54 out of 30, with (60%) of nurses had a moderate level of practice. There was a positive significant statistical correlation between studied nurses' knowledge and their practice. **Conclusion:** Approximately half of the studied nurses had a satisfactory knowledge and more than half of the studied nurses had a moderate level of practice regarding catheter associated urinary tract infection bundle bundle. **Recommendations:** Educational and in-service training programs should be designed and implemented to enhance ICU nurses' knowledge and practice regarding catheter associated urinary tract infection bundle.

Key words: Nurses' performance, Catheter, urinary tract, infection, bundle

INTRODUCTION

Healthcare-associated infections (HAIs) represent a critical public health issue and pose considerable challenges for healthcare professionals and policymakers. Healthcare-associated infections (HAIs) represent a significant risk across all healthcare environments, particularly among patients in intensive care units (ICUs), where their prevalence is markedly higher than in other hospital wards. The European Centre for Disease Prevention and Control (ECDC) indicates that approximately eight percent of cases hospitalized in an ICU for over than two days experienced several healthcare-associated infections (HAIs) ***(Barchitta et al., 2021).***

The National Healthcare Safety Network (NHSN) indicates that over 75% of urinary tract infection (UTI) incidents are linked to the utilization of indwelling urinary catheters (IUC), rendering UTIs the predominant condition related with healthcare. A prior study indicates that many healthcare practitioners do not comply with established standards for the identification and therapy of catheter-associated urinary tract infections (CAUTI) ***(Arifin et al., 2022).***

Approximately 150 million individuals globally are affected by urinary tract infections, with CAUTI being the most prominent kind of hospital-acquired infection, impacting approximately 15–20%

of patients being hospitalized having prolonged catheterization. Catheter-associated urinary tract infections constitute almost 80% of the 40% of nosocomial urinary tract infections. Urinary tract infection (UTI) is a prevalent concern in world health, and defined by microbial infection ***(Chakrabarty et al., 2022).***

Urinary catheters are commonly utilized in perioperative environments for particular procedures, for cases with acute urinary obstruction or retention, and for assessing urine flow in critically ill patients. These operations frequently result in CAUTI, leading to heightened morbidity and death, particularly in cases with extended catheterization or substantial underlying health conditions ***(Mazi et al., 2024).***

A catheter-associated urinary tract infection (CAUTI) can be described as an infection in the urinary system that occurs within 48 hours of the insertion or removal of a urinary catheter. The Centers for Disease Control and Prevention (CDC) has revised its diagnostic criteria for catheter-associated urinary tract infections (CAUTIs) ***(Huang et al., 2023).***

A catheter-associated urinary tract infection is characterized by the presence of an indwelling urine catheter in a patient for more than two consecutive days, as per CDC standards. The patient must have at least one of the following clinical pictures: suprapubic discomfort, temperature over 38.0°C, urinary urgency, costovertebral angle pain or tenderness, increased urinary frequency, or dysuria. The urine culture of the patient should exhibit up to two species of organisms, with a colony count exceeding 105/ml ***(Van Decker et al., 2021).***

Urinary tract infections result from a variety of microorganisms. There are two types of bacteria that can cause UTIs: Gram-positive and Gram-negative, in addition to certain fungi ***(Tama et al., 2024)***. Urinary tract infections predominantly arise from bacterial sources, with approximately 80% linked to gram-negative organisms, particularly E. coli ***(Miah & Islam, 2023).***

Catheter-Associated Urinary Tract Infections (CAUTIs) can arise when aseptic technique is compromised or when catheters are used for longer periods of time than necessary. These infections correlate with elevated mortality rates, extended hospitalizations, and increased vulnerability to CAUTIs in particular patient demographics, such as women, the elderly, individuals with diabetes, and those with neurological disorders. CAUTIs raise the mortality rate by 11% and lengthen hospital stays by an average of 19.2 days. Approximately 100,000 people die every year in the US due to CAUTIs ***(Zewdie et al., 2023).***

Pathogens commonly associated with catheter-related urinary tract infections include Escherichia coli (24%), Pseudomonas (10%), Candida (24%), Enterococcus (14%), and Klebsiella (10%), while the rest instances are due to other species. Typical symptoms comprised a continual urge to urinate accompanied by a painful burning sensation during the act of urination. Additional symptoms may include nausea, vomiting, back pain, fever, fatigue or malaise, cloudy or dark urine, and cramping ***(Jena et al., 2020).***

The pathogen responsible for the infection may arise from endogenous sources, particularly the natural flora found in the urethra, rectum, or vagina. Contamination during Foley catheter insertion can arise from external sources, such as the hands of healthcare professionals and the use of contaminated equipment. Bacteria have the capability to invade the bladder and establish colonization within the urinary tract upon introduction. The onset of CAUTI is affected by multiple factors, such as catheter tip contamination, substandard hand hygiene among healthcare workers, improper insertion methods, inadequate catheter maintenance, microbial biofilm formation, catheter material, and residual urine in the bladder ***(Haque et al., 2022).***

Potential severe outcomes of CAUTIs consist of meningitis, septic arthritis, osteomyelitis, endocarditis,

bacteremia, and osteomyelitis. Factors such as advanced age, female gender, diabetes, and a compromised immune system increase the likelihood of CAUTIs ***(Shweta & Milan, 2024).***

The Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), and the Centers for Disease Control and Prevention (CDC), have collaborated to provide evidence-based practice guidelines to mitigate CAUTIs. The guidelines encompass recommendations for indications for IUC use, aseptic insertion techniques, appropriate catheter maintenance, and timely removal, collectively referred to as CAUTI prevention bundles ***(Chong, 2021).***

A care bundle is a collection of practices employed to standardize care and treatment within healthcare settings. A care bundle can be defined as a series of evidence-based practices, typically comprising three to five components that collectively aim to improve the patient's healing process and enhance the quality of care. The care bundle philosophy emphasizes the provision of optimal care rather than defining the specific nature of that care ***(Bulut, 2022).***

Nurses are essential in healthcare, responsible for the placement and maintenance of urinary catheters and ensuring desired outcomes through adherence to established protocols, regulations, and standards ***(Majid et al., 2023).***

The nurse's comprehension of catheter care and the CAUTI prevention bundle is crucial, as it directly impacts patient outcomes and the quality of care provided. When nurses possess adequate knowledge, patient outcomes improve, complications decrease, and hospital discharge is expedited. Nurses must possess adequate and up-to-date expertise to provide high-quality patient care. As higher morbidity and longer hospital stays can result from inappropriate treatment of urinary catheters, their practice is essential in reducing CAUTIs ***(Mohamed & Abused 2024).***

Understanding and implementing essential preventive measures can significantly decrease the frequency of catheter-associated urinary tract infections. These measures encompass the implementation of proper hand hygiene, the replacement of gloves prior to and following patient interaction, and the maintenance of a sterile and closed urine drainage system ***(Nure et al., 2024).***

SIGNIFICANCE OF THE STUDY

Urinary tract infections (UTIs) constitute the second most prevalent illness overall and the fifth most prevalent infection linked to hospital settings. Approximately fifty percent of infections contracted in hospitals are urinary tract infections (UTIs), with catheter-associated urinary tract infections (CAUTI) being the predominant kind ***(NATIONAL HEALTH CARE SAFETY NETWORK, 2023; Hinkle, Cheever & Overbaugh, 2022).***

Catheter-associated urinary tract infections are prevalent in critical care units, constituting 23% of healthcare-associated infections in the ICU. An increased risk of catheter-associated urinary tract infections (CAUTIs) of 3-7% per day of catheter retention is connected with the use of urinary catheters, which are present in 12-16% of adult inpatients. It is estimated that urinary tract infections are related with over 13,000 fatalities in the United States. A substantial percentage of CAUTI cases is considered avoidable, with estimates between 65% and 70% ***(CDC, 2024).***

The rate of CAUTI is 1.3 per 1,000 catheter-days, as stated by the National Health Care Safety Network (NHSN) and the Centers for Disease Control and Prevention (CDC). CAUTIs present a significant mortality risk in critical care units (ICUs), with reported fatality rates of 30.15% among ICU patients who suffer from CAUTI ***(Liu et al., 2023).***

The Ministry of Health and Population in Egypt has indicated that the prevalence of catheter-associated urinary tract infections (CAUTI) in intensive care units (ICUs) is 13.05 per 1000 catheter-days,

with a daily risk of CAUTI development ranging from 3% to 7%. The incidence of catheter-associated urinary tract infections (CAUTIs) rises with the duration of catheter use. Implementing infection control strategies and care bundles can decrease the incidence of CAUTI by as much as 69% ***(Abdelmoaty et al., 2020).***

Several factors from personal to organizational causes contribute to non-compliance with Standard Precautions among health care providers, based on the researcher's observation, there are lacking in the application of CAUTI bundle in the ICUs. Therefore, it is essential to evaluate the performance of nurses regarding bundle of care for catheter associated urinary tract infection.

AIM OF THE STUDY

This study aimed to assess the nurses' performance regarding bundle of care for catheter associated urinary tract infection at Beni-Suef University hospital through:

1. Assess level of nurses' knowledge regarding catheter associated urinary tract infection bundle.
2. Assess level of nurses' practice regarding catheter associated urinary tract infection bundle. .

Research questions

To fulfill the study purposes, the following research questions will be answered:

1. What are the nurses' level of knowledge regarding bundle of care for catheter associated urinary tract infection?
2. What are the nurses' level of practices regarding bundle of care for catheter associated urinary tract infection?
3. Is there any relationship between knowledge and practice?

Operational definition:

Nurses Performance: nurses' performance referred to nurses' knowledge and practice as measured

SUBJECTS AND METHODS

Technical design

The technical design included the research design, setting, subjects, and tools for data collection.

Research design.

A descriptive exploratory design was utilized to achieve the aim of the study.

Setting

The present study was conducted in Beni-Suef University Hospital's General Intensive Care Unit, the hospital consists of 16 main departments, and 11 units providing multi services. The hospital consists of seven-floor building. General Intensive Care Unit is located on the third floor of the hospital and has 19 beds, 12 ventilators, 19 monitors, and 3 emergency carts distributed among three rooms.

Subjects:

Sample type and size: Convenience sample of all available nurses (50 nurse male and female) used in current study, who are working in the previously mentioned settings and give direct nursing care and directly contact with critical ill patients regardless their age, education, sex, education and years of experience.

Tools of data collection:

Data were collected using the following two tools:

Tool (I): Nurses' Knowledge Questionnaire:

It was adapted from **(El-Rahman, 2022)** and minor modification was done by the researcher**,** the aim was to evaluate the nurses' knowledge of the CAUTI bundle incorporation and maintenance, comprising two components. This questionnaire was designed in Arabic to accommodate the proficiency level of the participants, who predominantly utilize the Arabic language. It consists of two parts as outlined below:

Part1-Nurses'demographic characteristics:

It was concerned with demographic characteristics of the nurses under study. It consisted of seven questions such as age, gender, marital status, level of education, years of experience in work, years of experience in ICU, training courses/ workshops and who conducted the training and how long it was lasting.

Part 2 - Nurses' knowledge regarding CAUTI bundle and infection control measures:

It was used to assess nurses' level of knowledge towards CAUTI bundle and infection control measures. It consisted of **(25)** questions; **(21)** of them were M.C.Q & **(4)** were true & false, this part comprised the following **four** main parts:

1. (A) Nurses' knowledge about Anatomy and function of the urinary system **(3 M.C.Q questions).**

2. (B) Nurses' knowledge regarding the urinary catheter **(5 M.C.Q questions).**

3. (C) Nurses' knowledge regarding the urinary tract infection **(8 M.C.Q questions).**

4. (D) Nurses' knowledge about the catheter associated urinary tract infection bundle **(4 True & false and 6 M.C.Q questions).**

Scoring system: The **correct answer** was scored "**1**", while the **incorrect** was scored **zero,** with total score of 25 grades, classified as the following:

- Unsatisfactory < 50% of total scores.
- Fair 50% to75% of total sores.
- Satisfactory > 75 % of total scores.

Tool II - CAUTI Bundle Observation Checklist:

It was adapted from **(sultan et al., 2022)** and minor modification was done by the researcher**.**

It aimed to assess the nurses' level of practice regarding CAUTI bundle insertion and maintenance it comprised the following two main sections:

- **Section 1:** Urinary catheter insertion observation checklist**: (18) steps.** This section comprised the following **(3)** parts.
  - **Part I:** Verification prior to insertion **(5) steps.**
  - **Part II**: Insertion of indwelling urinary catheter under aseptic technique **(9) steps.**
  - **Part III :** after IUC insertion completion **(4) steps.**
- **Section 2:** Urinary catheter maintenance observation checklist included **(7) steps.**

Scoring system:

- each step was scored by **competent = 1, not competent = zero** classified as the following
  - High competent ≥ 75 % of total scores
  - Moderate ≥ 50% to < 75 % of total sores.
  - Low competent < 50% of total scores

Operational design

The operational design contains preparatory phase, content validity, pilot study and field work.

Preparatory phase:

The process included a thorough examination of pertinent literature and theoretical frameworks related to different facets of the study, employing resources such as books, articles, online materials, periodicals, and magazines to create data collection instruments. Approval for data collection at Beni-Sueif University Hospital was obtained from the hospital administration by submitting a formal letter from the Faculty of Nursing at Beni-Suef University. The investigator and participating nurses will clarify the aims, nature, and objectives of the study.

Tools Validity and reliability

- **Content Validity:**

The content validity of the developed tools was assessed for clarity and applicability by five experts, all of whom are assistant professors in the medical surgical nursing department at the Faculty of Nursing,

Beni-Suef University. The expert evaluated the tool for sentence clarity, relevance, accuracy, comprehensive understanding, simplicity, applicability, and ease of administration, with minor modifications made. The final forms have been successfully completed. Certain questions were removed, others were revised, and some were refined.

- **Reliability:**

The reliability of the Nurses' Knowledge Questionnaire was assessed using **Cronbach's alpha** is utilized to assess internal consistency. A pilot test was carried out with a sample of nurses to assess the reliability of the questionnaire. The Cronbach's alpha coefficient was determined to be 0.84, exceeding the acceptable threshold of 0.70, which signifies strong internal consistency for the knowledge items. The reliability of the CAUTI Bundle Observation Checklist was assessed using **inter-rater reliability** to evaluate the consistency of observations between different raters. **Cohen's kappa** statistic was calculated to measure the level of agreement. The kappa value was [0.89], which exceeded the acceptable value of 0.75, indicating almost perfect agreement between raters. This confirmed the reliability of the checklist in evaluating nurses' performance regarding the CAUTI bundle.

Pilot study:

A pilot study was conducted involving five nurses from the participant group, representing 10%, to evaluate the clarity, applicability, feasibility, and relevance of the tools utilized, as well as to determine the time required for the application of these study tools. The nurses initially included in the pilot study were subsequently excluded from the sample and replaced with others.

Field Work

- An approval letter obtained from Beni-Suef university hospital directors and nursing directors.
- The purpose of the study was simply explained to all nurses that were included and agreed to participate in the study prior to any data collection.
- Data were collected within 6 months from December 2023 to June 2024. The data was collected from nurses at Beni-Suef University Hospital in general ICU. Two days per week at the beginning of morning shift, the researcher was attended the shifts that was scheduled in the morning, to collect data from nurses and to observe nurses practice due to routine patients' procedures begin at the beginning of the shift and stayed with them along day shift.
- The researcher observed each nurse while providing the care for catheterized patients in their work place to fulfil all items included in observational checklist. At maximum 3 nurses in morning and afternoon shifts.

Then, self-administered questionnaire was distributed to nurses to be filled by each one within 30 to 45 minutes. About 3 nurses in morning shift and afternoon shifts

Administrative design

Approval has been achieved from the Research and Ethics Committee at the Faculty of Medicine, Beni-Suef University. An official approval was obtained from the director of the Faculty of Nursing at Beni-Suef University, clarifying the purpose and setting of the study to be conducted. A formal letter detailing the title and objectives of the study was submitted to the director of Beni-Suef University Hospital for approval to proceed with the research. Complete confidentiality of all acquired information was guaranteed. The study maneuvers were designed to ensure the safety of the participants.

Ethical considerations:

- The Beni-Suef University Faculty of Medicine's Scientific Research Ethical Committee approved the study protocol.
- Written consent was acquired from each participant to engage in the study following a thorough clarification and discussion of the

aims, objectives, and anticipated outcomes of the research.

- The anonymity and confidentiality of participants were guaranteed, and they were provided with the option to choose whether to participate in the study. Additionally, participants had the right to withdraw from the study at any time without the need to provide an explanation. They were assured that all collected information would remain confidential and would be utilized solely for research purposes.
- The data collection process has commenced and is anticipated to conclude within a six-month timeframe, specifically from December 2023 to June 2024.

Statistical design

The gathered data was analyzed, encoded, and organized utilizing Statistical Package for Social Sciences (SPSS), version 12.0 (SPSS Inc., Chicago, Illinois, USA). The statistical presentation and analysis of this study utilized the mean and standard deviation (SD): The Chi-square test (χ^2) was employed to compare groups in qualitative data, Pearson's correlation coefficient (r) was utilized to evaluate the strength of association between two variable sets, and multiple linear regression was applied to analyze and estimate the dependence of a quantitative variable on one or more independent variables using version 12.0 (SPSS Inc., Chicago, Illinois, USA).

RESULTS

Table (1): summarized the distribution of studied nurses' demographic characteristics. Regarding their ages, (68%) were aged ≤25 years with mean age (23.5±3.1). In terms of educational background, (64%) of them hold technical nursing degree. Furthermore, regarding their experience, only (6%) have less than one year of experience with mean of experience (3.4 ±1.6). Also, (60%) of the studied nurses had attended training courses.

Table (2): Displayed the distribution of studied nurses' knowledge levels regarding Catheter Associated Urinary Tract Infection Bundle. Related to knowledge items, (96%, 94%, and 92%) of studied nurses answered correctly questions related to obtaining a urine sample, and assessing nurse's responsibility in prevention of catheter associated urinary infections, and nursing practices to prevent infection before catheter insertion respectively. On the other hand, (92%) of studied nurses answered incorrectly about maintaining a closed system.

Table (3): Displayed the distribution of overall mean score of studied nurses' knowledge regarding bundle of care for catheter associated urinary tract infection and infection control measures. Regarding overall mean score of studied nurses' knowledge was (20.06±2.98) with mean percent (77.2%) indicating a satisfactory level of knowledge.

Figure (1): Illustrated that, nurses' total level of Knowledge regarding bundle of care for Catheter associated urinary tract infection and infection control measures. Related to their total knowledge **(52%)** of studied nurses had a satisfactory level of knowledge.

Table (4): Illustrated the distribution of studied nurse' practices levels regarding *Insertion of indwelling urinary catheter*. Related to practice items, (100%) of the studied nurse had chosen the correct size of urinary catheter and inflated the indwelling urinary catheter (IUC) balloon and were removing gloves and performed hand hygiene. On the other hand, (94%) did not label a urine collection container. Moreover, (84%) of nurses did not use sterile gloves and personal protective equipment (PPE).

Table (5): Displayed the distribution of overall mean score of studied nurses' practices level regarding bundle of care for catheter associated urinary tract infection and infection control measures. Regarding overall mean score of studied nurses' practice was

(21.94±3.54) with mean percent (73.1%) indicating an average level of practice.

Figure (2): Showed that, (60%) of nurses had average level regarding to their total of practice regarding bundle of care for Catheter associated urinary tract infection and infection control measures, while (2%) of nurses were incompetent regarding to their total level of practice.

Table (6): displayed the relation between studied nurses' demographic characteristics and their total level of knowledge their total of practice regarding bundle of care for Catheter associated urinary tract infection and infection control measures. Using chi square test revealed non-significant statistical relation between studied nurses' knowledge levels and all demographic characteristics.

Table (7): revealed the relation between studied nurses 'demographic characteristics and their total level of practice regarding bundle of care for Catheter associated urinary tract infection and infection control measures. Using chi square test revealed non-significant statistical relation between studied nurses' practice levels and all demographic characteristics.

Figure (3): Summarized the correlation matrix between studied nurses' knowledge and their practice regarding bundle of care for Catheter associated urinary tract infection and infection control measures. Using Pearson's correlation coefficients, strong positive significant statistical correlation between studied nurses' knowledge and their practice (***r***=0.782, **P**=0.000)

Items		N	%
Age (Years)	– ≤25	34	68
	– >25	16	32
Mean ±SD		23.5±3.1	
Gender	• Male	22	44
	• Female	28	56
Marital status	• Married	22	44
	• Single	28	56
Education	• Diploma	1	2
	• Technical	32	64
	• Bachelor	16	32
	• Master	1	2
ICU experience (Years)	– < 1	5	10
	– 1-3	31	62
	– 4-6	14	28
Mean ±SD		3.4 ±1.6	
Training courses	– Yes	30	60
	– No	20	40
Number of courses	– One	14	28
	Two	12	24

	Three	4	8

Table (1): *Frequency Distribution of the Studied Nurses' Demographic Characteristics*

Table (2) *Frequency Distribution of Studied Nurses' Knowledge Regarding Catheter Associated Urinary Tract Infection Bundle (n =50).*

Item	Correct		Incorrect	
	N	%	N	%
1. The purpose or desired outcome of CAUTI bundle applications	42	84	8	16
2. Nursing Practices to Prevent Infection Before Catheter Insertion:	46	**92**	4	8
3. Catheter Principles to Prevent CAUTIs	32	64	18	36
4. Maintaining a closed system	4	**8**	46	**92**
5. Maintaining unobstructed urine flow	40	80	10	20
6. Causes of Sterile Field Breakage During Catheter Insertion	38	76	12	24
7. Urine drainage bag handling and rinse/store urine	35	70	15	30
8. During catheter care, gloves are required only when emptying the urine drainage bag	18	36	32	64
9. Obtaining a urine sample from an indwelling catheter requires sterile technique	48	**96**	2	**4**
10. Nurse's responsibility in prevention of catheter associated urinary infections	47	**94**	3	6

Table (3) *Overall mean score of studied nurses' knowledge regarding bundle of care for catheter associated urinary tract infection and infection control measures (n=50)*

Knowledge Dimensions	Min - Max	Mean±SD	Mean (%)	Rank
– Anatomy of the Urinary System	0 – 3	2.44±0.67	81.3	1
– Knowledge regarding Urinary Catheter	0 – 5	3.78±0.93	75.6	2
– Knowledge regarding UTI	0 – 8	5.84±1.25	73	3
– Knowledge regarding CAUTI Bundle	0 – 10	7.01±1.67	70.1	4
Overall Knowledge	0 – 26	20.06±2.98	77.2	

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Figure (1) *Percentage distribution of the studied nurses' total level of knowledge (n =50).*

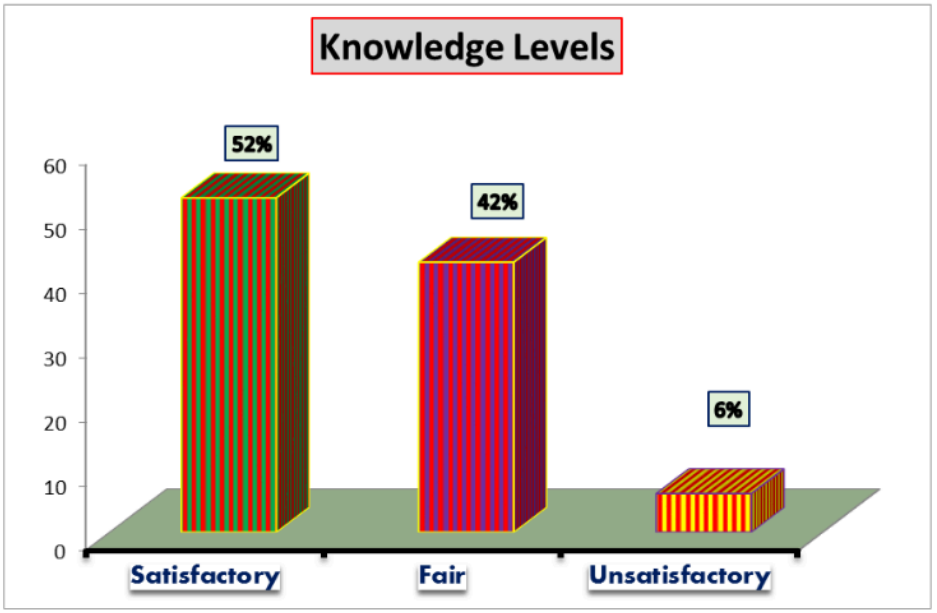


Table (4) *Frequency Distribution of Studied Nurses' Practice Regarding Insertion of indwelling urinary catheter (n=50)*

Item	Done		Not Done	
	N	%	N	%
1. Perform hand hygiene.	26	52	24	48
2. Use Standard Indwelling Urinary Catheter Kit	10	20	40	80
3. Organize supplies in each kit	28	56	22	44
4. Choose the Correct Size of Urinary Catheter	50	**100**	0	0
5. Do not per-inflate balloon to test	36	72	14	28
6. Maintain Strict Aseptic Technique	19	38	31	62
7. Use sterile gloves and personal protective equipment (PPE)	8	16	42	**84**
8. Use appropriate antiseptic or sterile solution	50	100	0	0
9. Apply sterile single use lubricant (gel)	16	32	34	68
10. Attach sterile urinary catheter to drainage bag	48	96	2	4
11. Insert IUC to appropriate length and check urine flow before balloon inflation	49	98	1	2
12. Inflate the indwelling urinary catheter (IUC) balloon	50	**100**	0	0
After insertion				
13. Secure catheter to the patient's thigh with adhesive Tape	43	86	7	14
14. Position drainage bag below level of bladder	45	90	5	10
15. Check System for Closed Connections	45	90	5	10
16. Remove gloves and perform hand hygiene	50	**100**	0	0
17. Discard used supplies in medical waste trash (red bag) and safety box if needed	46	**92**	4	8
18. Label a urine collection container	3	**6**	47	**94**

Table (5) *Overall mean score of studied nurses' practice regarding bundle of care for catheter associated urinary tract infection (n=50).*

Practice Dimensions	Min – Max	Mean±SD	Mean (%)	Rank
– Verification prior to insertion	0 – 5	3.94±1.09	78.8	1
– Insertion of indwelling catheter	0 – 12	9.18±1.69	76.5	2
– After IUC insertion completion	0 – 6	3.90±1.23	65	4
– Maintenance bundle	0 – 7	4.92±1.48	70.3	3
Overall Practice	0 – 30	21.94±3.54	73.1	

Figure (2) *Percentage distribution of the studied nurses' total level of practice (n =50)*

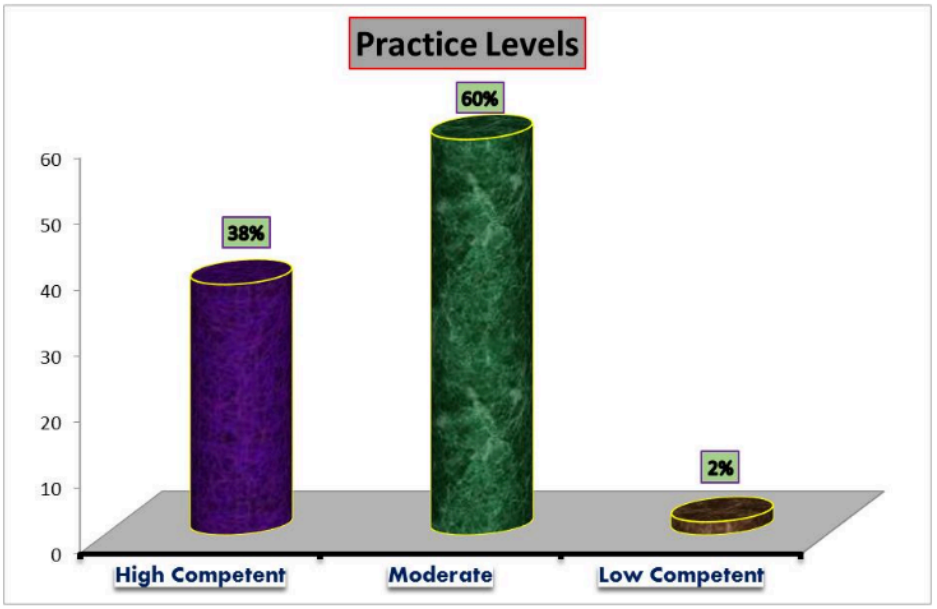


Table (6) *Relation between Demographic Characteristics and Total Level of Knowledge (n=50)*

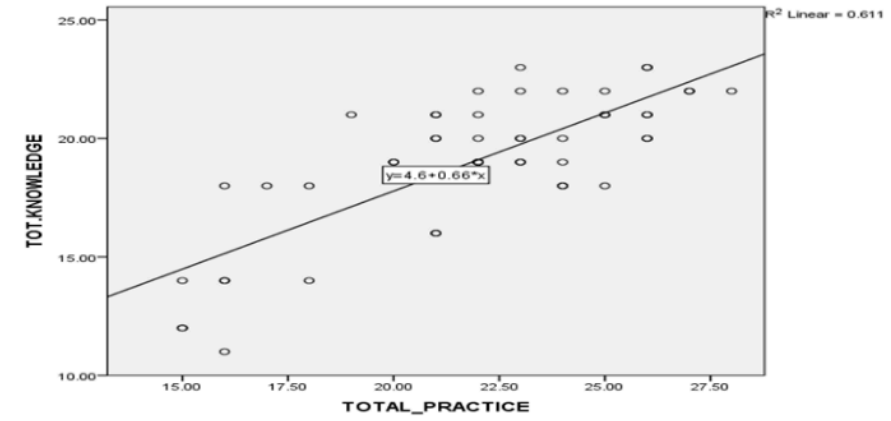
Items		Total Level of Knowledge						Chi-square	
		Unsatisfactory		Fair		Satisfactory		X^2	P
		No.	%	No.	%	No.	%		
Gender	– Male	2	4	11	22	9	18	2.1	**0.3**
	– Female	1	2	10	20	17	34		
Educational levels	– Diploma	0	0	1	2	0	0	4.8	0.5
	– Technical	1	2	14	28	17	34		
	– Bachelor	2	4	5	10	9	18		
	– Master	0	0	1	2	0	0		
ICU experience	– <1	0	0	1	2	4	8	3.9	0.4
	– 1-3	1	2	14	28	16	32		
	– >3	2	4	6	12	6	12		
Attending training	– Yes	1	2	8	16	11	22	**0.1**	0.9
	– No	2	4	13	26	15	30		

Table (7) *Relation between Demographic Characteristics and the Total Level of Practice (n=50)*

Items		Practice						Chi-square	
		Incompetent		Moderate		Competent		X^2	P
		No.	%	No.	%	No.	%		
Gender	– Male	0	0	13	26	9	18	0.87	0.6
	– Female	1	2	17	34	10	20		

Educational levels	– Diploma	0	0	1	2	0	0	6.1	0.4
	– Technical	1	2	22	44	9	18		
	– Bachelor	0	0	7	14	9	18		
	– Master	0	0	0	0	1	2		
ICU experience	– <1	0	0	4	8	1	2	1.5	0.8
	– 1-3	1	2	18	36	12	24		
	– >3	0	0	8	16	6	12		
Attending training	– Yes	1	2	11	22	8	16	1.4	0.4
	– No	0	0	10	20	11	22		

Figure (3) *Correlation between studied nurses' knowledge and their practice regarding bundle of care for catheter associated urinary tract infection (n=50).*



DISCUSSION

Urinary catheterization is an often executed treatment in health care centers as hospitals, particularly in intensive care units, and poses a significant risk of urinary tract infections. Over 70% of these infections are associated with catheter usage. Nurses have a pivotal function as the principal healthcare personnel tasked with the insertion and continuous management of urinary catheters (***Medina-Polo et al.,*** **2021).**

Inadequate urinary catheterization procedures elevate the risk of problems, including catheter-associated urinary tract infections, which are a primary source of infection. Urinary catheterization is a common nursing practice that should be employed only as a last resort after a comprehensive holistic assessment has indicated that no other appropriate choices are available (***Abinew et al., 2024).***

To optimize patient outcomes and improve safety, hospitals might employ a care bundle as a primary method. Minimizing catheter-related complications can be achieved by implementing standard infection control protocols, preventing unnecessary catheterization, shortening catheter usage duration, and adhering to sterile techniques during insertion and maintenance (Freund ***et al., 2020*; *Rashmi and Dhakal, 2021).***

The current study is a descriptive research study aimed at evaluating the nurses' performance regarding bundle of care for catheter associated urinary tract infection at Beni-Suef University hospital through assessing level of nurses' knowledge regarding catheter associated urinary tract infection bundle and assessment of level of nurses' practice regarding catheter associated urinary tract infection bundle.

Concerning demographic characteristic of the nurses, the result of the present study revealed more than two-thirds of the studied nurses their age≤25. This suggested that most of those nurses were recent graduated, young and tolerate the nature of the work in the critical care unit.

This finding in the same line with what was reported by ***Mong et al. (2021)*** who reported that the majority of their studied nurses between age 20-25.

Whenever this finding is contradicted with**, Sultan et al., (2022),** who included that one half of the study nurses were 26 to 35years of age.

Regarding to their gender, the current study results founded that more than half of the studied nurses were females. This finding near to what was reported by **Mohammad Abd Elbaky et al., (2023)** who stated that less than two thirds of respondents were female.

Conversely this finding disagreed with the finding that conducted by ***Rahimoon et al. (2024),*** which illustrated that less than two thirds of the studied sample were males.

In relation to their educational level, the results of this study showed that less than two thirds of the studied nurses were technical nursing institute while the rest were nursing bachelor. This aligned with **Kayem & Hassan (2022),** who reported that less than two thirds of their participants were graduated from the Technical Nursing Institute.

However, this different with the findings of **Alabeiat et al., (2022)** who clarified that more than two thirds of their sample population practiced with a bachelor's degree. It also displayed higher knowledge levels compared to those with a Diploma or technical institute

With regard to years of experience in the critical care unit, the current study indicated that less than two-thirds of the nurses examined had between one to three years of experience. This observation may be linked to their relatively young age. This finding is consistent with what was reported by **Al-jaradi et al., (2020)** which found more

than half of their studied nurse had from 1-3 years of experience in ICU.

Also, ***Rashmi & Dhakal*** **(2021)** in their study reported that more than two thirds of the studied nurses had experience less than five years of experience.

On the other hand, this finding different with **El Rhman et al., (2022)** who stated that more than two thirds of their studied nurses had more than five years of experience in ICU.

Concerning Training Courses, this study revealed that less than two thirds had training courses. This was closely matched with a study presented by ***Haza, (2021),*** which showed that more than one half of the studied nurses had training courses about CATUI prevention.

Different with this study, **Kayem & Hassan (2022)** who explained that less than two thirds of the studied nurses not participate at any training courses.

Concerning total knowledge **of the nurses about** bundle of care for catheter associated urinary tract infection, the findings of the present study demonstrated that just fifty percent of the examined nurses possessed an adequate degree of knowledge concerning the catheter-associated urinary tract infection bundle. From the researcher's perspective, this may be attributed to several factors, including the fact that over half of the surveyed nurses have only completed a technical nursing institute, which may restrict their exposure to pertinent information. Additional contributing factors include insufficient supervision of nurses, the absence of an orientation program prior to commencing work, a lack of care conferences during employment, the unavailability of a procedure manual specifically designed for critical care areas, and inadequate guidance, resulting in their unpreparedness and insufficient knowledge to deliver evidence-based or specialized care. A significant factor contributing to the deficiency of information concerning the CATUI bundle is the limited experience in the critical care unit, as over half of the study nurses possessed less than three years of experience.

These results are congruent with **Negm et al., (2021)** who stated that more than half (52%) of their studied nurses had satisfactory knowledge regarding catheter associated urinary tract infection bundle. In addition, **AL-Moutiwty & AL-Wily (2023)** stated that more than half (52%) of their studied nurses had satisfactory knowledge about catheter associated urinary tract infection and its prevention bundle.

On the other hand, this finding is contradicted with ***Zegeye et al. (2023***), who reported that, more than two thirds of their ICU nurses had poor level knowledge of the CAUTI and its prevention. Moreover, the study results interfered with the study finding of ***Bibi et al. (2023)*** mentioned that less than two thirds of the studied nurses had moderate level knowledge of the CAUTI and its prevention.

In investigating the total practices of nurses concerning the catheter-associated urinary tract infection bundle, the current study revealed that fewer than two-thirds of the participating nurses demonstrated a moderate level of practice in this area. This observation can be attributed to several factors, including the fact that more than half of the nurses involved had only completed their education at a Nursing Technical Institute and lacked access to ongoing effective training programs in ICU nursing. Additionally, many were newly graduated yet held full responsibility for the care of critically ill patients and the execution of critical procedures. Other contributing factors encompass the scarcity of infection control resources such as sterile equipment, a shortage of nursing personnel resulting in heightened workloads, insufficient closed nursing supervision, and a deficiency in motivation and financial incentives. Insufficient policies and protocols represent the most prevalent obstacles faced in clinical practice environments.

This finding agreed with, ***Veer and Biradar (2023),*** who reported during their study for assessing the knowledge and practices regarding CAUTI care bundle among the staff nurses in selected hospitals

of Maharashtra, stated that their nurses' practice on CATUI prevention was found to be average.

On the other hand, this finding is contradicted with, ***Teshager et al. (2022)*** reported that more than half of the respondents had competent level of practice Also, ***Zegeye et al. (2023)*** found that nearly more than half of the respondents had competent level of practice of CAUTI prevention.

The results of the current study revealed that there was no statistically significant relationship between the nurses' level of knowledge and practice and their demographic characteristics. This findings Congruent with **Kayem & Hassan (2022)** reported that there was no statistically significant relationship between the nurses' level of knowledge and practice and their demographic characteristics. Additionally, **Abo Elmay *et al. (2024)*** & **Algarni et al., (2019)** showed there was no statistically significant relationship between the nurses' level of knowledge and practice and their demographic characteristics.

In contrast to that, ***Benny et al. (2020)*** reported that study showed association of level of knowledge with age, educational qualification, and encounter with patients with CAUTI level of significance.

Based on the results of the current study, it was found that there was strong positive correlation between the nurses' level of knowledge and their practice. This result is similar ***Veer & Biradar, (2023)*** who stated that it was observed that there was a positive correlation identified between knowledge and practice regarding CAUTI Care bundle. Similarly, ***Zegeye et al. (2023)*** reported that good knowledge was found to have significant association with practice of nurses towards prevention of catheter associated UTI.

CONCLUSION

Based on the result of the current study it can be concluded that:

The average level of practice regarding catheter-associated urinary tract infection bundle was possessed by less than two-thirds of the nurses who were studied, while half of the nurses possessed satisfactory knowledge. There was a highly statistically significant relationship between the total level of knowledge of nurses regarding the catheter-associated urinary tract infection bundle and their overall level of practice. Furthermore, the analysis revealed no significant statistical relationship between the overall knowledge and practice levels of the nurses studied and their associated demographic characteristics.

RECOMMENDATIONS

Based on the current study's findings the following recommendations are suggested

- Regular and continuous in-service training should be included in the CATUI package.
- CAUTI bundle checklist must be developed to include the main components of insertion and maintenance bundle and appropriate indication for catheter use and removal protocol.
- It is recommended that the study be replicated with an expanded sample size and across diverse hospital environments to enhance the generalizability of the findings.

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