

Evaluating the Impact of Utilizing Urinary Catheter Care Bundle on Minimizing the Incidence of Catheter-associated Urinary Tract Infection (CAUTI) among Intensive Care Patients

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Received June 18, 2019; Revised August 04, 2019; Accepted August 09, 2019

Abstract Urinary tract infection (UTIs) is the most common type of hospital-acquired infection that is mostly linked with indwelling urinary catheter use, that is, catheter-associated UTIs (CAUTIs). **Aim:** The study evaluated the impact of utilizing urinary catheter care bundle on minimizing the incidence of Catheter-Associated Urinary Tract Infection (CAUTI) among surgical intensive care patients. **This study is a quasi-experimental** and was conducted in the Surgical Intensive Care Unit (SICU) at King Fahad Hospital in Madina Kingdom of Saudi Arabia. **The study subjects** are divided into two groups: Thirty (30) nurses who are providing nursing care for the patient during urinary catheter insertion and through on-going maintenance of the catheter, the other group are eighty (80) patients with a urinary catheter that are divided into a control and intervention group. **Tools of the study.** Three (3) different instruments were used in the study: The first tool was patient devolvement assessment sheet for reporting the symptoms of Catheter-associated Urinary Tract Infection (CAUTI); the Second tool was a structured observational checklist, and the Third tool was urinary catheter care bundle. **Findings:** The study findings concluded that implementation of catheter care bundle minimizes the incidence of (CAUTI) compared to routine care of urinary catheter. It also enhances positive changes in the nursing practice and patient outcome that was observed among the intervention group who received urinary catheter bundle.

Keywords: *minimizing –incidence, urinary catheter, care bundle, CAUTIs, ICU patients*

Cite This Article: Hala Ibrahim Zaiton, Joyce Toriente Relloso, and Jocelyn Magtalas Medinah, “Evaluating the Impact of Utilizing Urinary Catheter Care Bundle on Minimizing the Incidence of Catheter-associated Urinary Tract Infection (CAUTI) among Intensive Care Patients.” *American Journal of Nursing Research*, vol. 7, no. 5 (2019): 836-845. doi: 10.12691/ajnr-7-5-17.

1. Literature Review

Urinary tract infections (UTI) are the most common hospital derivative waste period affecting individuals today. A significant number of seventy-five percent of hospital-acquired UTIs are associated with the use of an indwelling urinary catheter (IDC), considering that there is a 15-25% chance of a hospitalized patient that requires catheter insertion during their stay. [1]

CAUTI occurrence can be associated with inoculating organisms in the catheter into the bladder that results in colonization and cause bacterial adhesion and mucosal irritation. [2] A bacterial infection is prone to those who have a urinary catheter. Once a catheter is placed, the daily incidence of bacteriuria is 3-10%. Between 10% and 30% of patients who undergo short-term catheterization usually 2-4 days corroborate bacteriuria

and are asymptomatic [3]. Nurses can have significant roles in the prevention of CAUTI.

[4] CAUTI prevention efforts have been implemented in healthcare facilities and ICUs globally, however standardization of interventions and protocols was lacking, otherwise the review of the literature has shown that some ICUs have implemented interventions and protocols that have been successful in decreasing CAUTI, yet others who have done so have not been as fortunate [5]. Accessary wide earlier for specific protocols is (bundling) care bundle sorrow gathering of scientifically guided elements that are necessary for safe and effective patients custody [6].

The 2009 Center for Disease Control and Prevention (CDC) bundle for barriers of catheter-associated urinary tract infections (UTIs) recommends the use of a catheter for appropriate indications only. Catheter use and duration should be minimized in all patients, especially those at higher risk for catheter-associated UTI (e.g., women, elderly persons, and patients with impaired immunity [7].

CAUTIs can be associated with encircling over contrasting fatal outcomes for the patient, and an associate to potentially aggravate an infection, the patient can also experience urethral strictures mechanical trauma, nonbacterial urethra inflammation, and impaired mobility. Prevention of CAUTIs relies on the application of appropriate nursing care. The care should ensure proper techniques for both the insertion and maintenance of the catheter.

[8] Prevalent prowl the interventions to cut CAUTI target on the give of evidence-based bundles for catheter insertion, and maintenance to condone keep away alien catheter insertion, reduction of length of catheterization and avoid cross-contamination. Resolutions measure of catheter use has been favourable to support clinical and beyond teams to recognize the onslaught of the variety they have made to tribulation processes.

1.1. Significant of the Study

According to CDC, seventy-five (75) percent of UTIs are attributed to the use of a urinary catheter, and ninety-five (95) percent of these occurred in ICUs [1,9]. There was a considerable number of clinical guidelines and studies; however, hospital-acquired catheter-associated urinary tract infections (CAUTI) occurrence is still rising. It needs to be re-evaluated to determine other incidences of CAUTI and develop a model to decide high-risk patient.

2. Subjects and Methods

2.1. Aims of the Study

The study aims to evaluate the impact of utilizing urinary catheter care bundle among intensive care patients in reducing the catheter associated infection incidence.

2.2. Primary Outcome

To reduce the rate of CAUTI regardless of patient illness severity.

2.3. Secondary Outcome

To evaluate the impact of catheter care bundle on nursing intervention.

2.4. Research Hypotheses

It was hypothesized that catheter care bundle would minimize the rate of catheter-associated urinary tract infection.

2.5. Research Design

A quasi-experimental design was utilized for this study to evaluate the impact of utilizing urinary catheter care bundle on minimizing catheter-associated Urinary Tract Infection (CAUTI) among Intensive Care Patients. The study was conducted for a period of 6 months from April 2018 - September 2018.

2.6. Study Setting

This study was conducted in the Surgical Intensive Care Unit at King Fahd Hospital –Almandine Kingdom of Saudi Arabia.

2.7. Sample Size

Epidemiological information system(EPI) was utilized to calculate the sample size of the study. The data collected shows a confidence level of 95% and a power of study of 80%. The estimated sample size was calculated as eighty (80) patients and thirty (30) nurses that are categorized as the following:

2.8. Study Subjects

Group I –Nurses Sample

The sample for this study consisted of RNs working in the Surgical Intensive Care Unit. All of the RNs employed in the units were asked to participate voluntarily, and all of the RNs had the option to decline without consequence. A total of 30 RNs were recruited and composed the final study sample.

Group II- Patients:

The selected patients are divided into two groups; the first was a control group that includes forty (40) patients who received routine nursing care during insertion and maintaining urinary catheter, while the second was intervention group that contains forty (40) patients who received urinary catheter care bundle.

The inclusion criteria for patients to be included in the study are:

1. All patients admitted to ICU that requires insertion of urinary catheter
2. The patient should be 20 years of age and above.
3. Free from any signs of urinary system infection during admission as documented in the file.

Exclusion criteria

- Exclusion from the study are the patients who:
- Underwent perennial, gynaecological, and urological surgeries.
 - Admitted with enlargement of prostate hyperplasia.

2.9. Data Collection Tools

Three (3) tools were developed by the researchers for the collection of the required data based on a review of relevant literature.

Tool (1): patient devolvement assessment form: This form is used for assessment of CAUTIs devolvement. It was developed by the researchers based on criteria for the diagnosis of CAUTIs depending on the evaluation of the patient's status regarding the determination of CAUTIs. The tool consists of two (2) parts: the first part includes information about demographic characteristics and medical condition, e.g., gender, age, clinical diagnosis, the purpose of urinary catheter insertion, length of urinary catheter insertion.

Second part: Assessment of symptoms of urinary tract infection based on criteria for diagnosis, which included the following criteria:

- (1) Temperature $>38.5^{\circ}\text{C}$.
- (2) Leukocyte count $> 12,000$ cells/uL or $< 3,000$ the cells/uL
- (3) Urine culture of ≥ 105 CFU/mL with \leq two species of microorganisms. (Positive).

Tool (2): A Structured observational checklist

It is performed while nurses perform routine care during insertion of urinary catheter and once during applied urinary catheter care bundle. The scoring system for the observational checklist consisted of given two points for the done step, while zero for the step not done. The higher scores indicated a higher level of practices. Those score classified as:

Unsatisfactory	($< 60\%$)
Satisfactory	(60%)
Good	($\geq 75\%$)

Tool (3): Urinary Catheter care bundle

Urinary catheter care bundle are groupings of best practices concerning a disease process that individually improve care, but when applied together, the result shows substantially greater improvement. Its compliance can be measured by simple assessment of the completion of each item. The approach has been most successful when all elements are executed together, an "all or none" strategy. It includes the following process; For the two months, the researcher introduced a bundle of four evidence-based interventions, according to the HICPAC: Guideline for the Prevention of Catheter-associated Urinary Tract Infections 2009 [13] document. These interventions were as follows.

- (1) The use of silver alloy catheters in the ICU is the first intervention to consider.
- (2) The second intervention was the use of securing devices to prevent the movement of the catheter after its insertion.
- (3) The third intervention consisted of having the nursing staff reposition the catheter tubing if it was found to be touching the floor, at any time during their work shift.
- (4) The fourth intervention: the requirement for documentation for most surgical patients for the catheter to remain in place on a postoperative day 1-**Methods of data collection.**

Implementation phase

- Members of the research team held meetings with the nursing administrative personnel at participating hospital to explain the objectives of the research, to answer any questions, and to seek professional facilitation and support during the implementation process. Nurses working in the selected units were approached individually and were invited to participate. After obtaining a completed consent form for participation, data collection began. A list of names for the nurses and their work schedules at the selected units were obtained to create a coding manual. To ensure the participants remained anonymous, each nurse who agreed to participate was assigned a unique, depersonalized code.

- Development of tool I & II after reviewing the recent relevant literature.

The validity of tools was established through a five [5] panel who are expert in this field who revised for understandability, diligence, quick-wittedness, comprehensiveness, and ease for implementation and

according to their opinions, minor modifications were done accordingly.

- In the control or study group the patients were randomly assigned; 40 in the control group, and 40 in the intervention group.

- The control group of patients who received routine nursing care during urinary catheter insertion, the data collected about two months retrospectively before urinary catheter care bundle is applied.

- Whereas the intervention group received urinary catheter care bundle based on Guideline for the Prevention of Catheter-associated Urinary Tract Infections 2009 [10].

- Urinary catheter in the ICU was placed by the nursing staff as ordered by the physician. The nurses document the selection and time when a Foley catheter is placed, and also when it is removed.

- Pilot study: Urinary catheter care bundle was applied to five nurses up ahead accurate details collection to evaluate the tentative effect on decreasing CAUIs.

- The bundle composed of four interventions: First, exclusive use of silver alloy catheters in the ICU was applied by the designing operation. The second intervention was the use of securing devices to prevent the movement of the catheter after its insertion; the third intervention is the repositioning of the catheter tubing by the nursing staff if the tube was found to be touching the floor any time at their work shift. Then the fourth intervention that is ensuring the seek and evidence for most surgical patients for the inserted catheter place on postoperative day 1-2.

- Recording the duration of the catheter after application by days for patients in intervention and control group applied by the researcher and by assisting the documentation in patient's files while patients among intervention group who approved with the first, second and third interventions were monitored. It was authorized by the Infection Control office in the hospital who justify the compliance of nurses for applying the bundle steps twice per week. For the quarter intervention, authorization was befitting of the nurses as part of their assessment for surgical patient who had an indwelling urinary catheter in placed.

- Axillary's set-up temperature and count of WBC was documented for encircling patients in control and intervention groups after 24 hours of catheter insertion.

- The General History lab reviewed all urine cultures obtained from patients admitted to the Surgical ICU at king Fahd University and all suspected CLA-BSI.

2.9. Ethical Consideration

The study was approved by the research and ethics committees of the university and the participating hospitals. The research team explained the aims of the study. Nurses were informed that participation was voluntary. After that, written consent was obtained from nurses who agreed to participate in the current study.

2.10. Statistical Analysis

Upon completion of data collection each sheet was manually scored. The background data sheet was coded

and listed into numbers for calculation. Data were validated by using SPSS (version 16) software computer packed (special package for social science). Data were expressed as number and percentage for categorical variables, range, and mean \pm standard deviation for continuous variables. Student t-test, Chi-square (χ^2), Mann-Whitney test, Fisher test are used for comparison between quantitative and qualitative variables at P -value < 0.05 shows a significant difference in the mean of body temperature on 1st, 2nd, 3rd, a 4th and 5th day among intervention and control group.

3. Results.

The results showed the personal characteristics of the studied nurses. In terms of age, sixty (60) percent are more than 30 years; the range is between 24-45 years with Mean \pm SD 31.94 ± 6.38 . (93.3%) were married, and (93.3%) had a diploma degree in nursing. (66.6%) Of the studied nurses had less than or equal ten years of experience in general nursing with Mean \pm SD 13.89 ± 5.87 , ranged between 6-27 years. Also, (46.6%) of them had less than ten years of experience in the ophthalmic department with Mean \pm SD 9.61 ± 6.025 , ranged between 1-27 years. (86.6%) of studied nurses did not have any previous training course related to nursing care of urinary catheter.

Table 1 illustrated that the intervention included 80 patients, 40 in the intervention, and 40 in the control group, 60 % of intervention, and 65% of the control group were more than 25 years old. More than half of the sample (65%) were females in the intervention group and (70%) in the control group. The differences were not proved to be statistically significant. It shows that, regarding patient medical diagnosis, Pulmonary diseases account for 50% and 42.5% in the intervention group control group. 25% of patients admitted to ICU with cardiovascular diseases

accounts for 25% among intervention group and 37.5% among the control group consequently. While cerebral cardiovascular disorders (25%) in the intervention group and (20%) in the control group.

Moreover, about Concerning Indication of maintenance urinary catheter in the intervention group was found that (77.5%) of patients Inserted urinary catheter to calculate the intake and output followed by (15%) for urinary incontinence while (7.5%) for mental status. The use of insertion urinary catheter among the control group was (60%) of patients' maintenance urinary catheter indicated for calculating the intake and output followed by (20%) for urinary incontinence while (5%) for metal status respectively. The difference between intervention and control groups with regards to, diagnosis, the purpose of insertion urinary catheter, and duration of urinary catheter insertion/days were statistically non-significant.

Table 2: Illustrated that the total means score of nurses practice regarding the use of maximum barrier precautions during preparation for urinary catheter insertion by routine care was 3.7 ± 2.4 compared to 5.2 ± 1.3 their practice during compliance the urinary catheter care it was found that there was a statistically significant difference among studied nurses. $P = 0.01$.

- According to the tables, the attributed significant difference between the routine care and urinary catheter care bundle as follows: For the practice of nurses regarding applying sterile drape, the p -value was a significant difference among routine care and bundled care.

- Compliance of wearing sterile gown is significantly higher in bundle care than in routine care with p -value (0.02*).

- Regarding the practice of nurses removing gloves and gown and performing hand hygiene again on procedure completion, is significantly higher among nurses practice compliance the bundle care with p -value (0.009*).

Table 1. Patients `s demographic and Clinical Characteristics among Intervention and Control group (n=80)

Items	Intervention Group (n=40)		Control Group (n=40)		χ^2	P-Value
	No	%	No	%		
Age (years):						
25 <	16	40	14	35	0.05 $t=0.38$	0.82 0.61
25 >	24	60	26	65		
Rang	18.0-79.0		18.0-80.0			
Mean \pm SD	45.9 \pm 18.3		44.5 \pm 18.2			
Sex :						
• Male	14	35	12	30	0.26	0.63
• Female	26	65	28	70		
Causes of ICU admission :						
• Pulmonary diseases.	20	50.0	17	42.5	2.11	0.35
• Cardiovascular diseases.	10	25.0	15	37.5		
• Intra-abdominal surgery.	10	25.0	8	20.0		
Indication of maintenance urinary catheter						
• Mental status	3	7.5	2	5.0	2.19	0.33
• Obtain accurate intake and out put in critically ill patient	31	77.5	24	60.0	Fisher	1.00
• Incontinence	6	15	8	20	2.11	0.35
Duration of urinary /days						
5 <	18	45.0	14	35.0	0.83	0.36
5 >	22	55.0	26	65.0		
Range	5.0-18.0		5.0-15.0		U=3.18	0.37
Mean \pm SD	7.2 \pm 2.6		8.6 \pm 3.3			

(*) statistically significant < 0.05 .

Table 2. Nurse's Practice regarding applying maximum barrier precautions during preparation for urinary catheter insertion and ongoing care control and intervention group number of (nurses 30)

Items	Routine nursing care (n=30)		(UC)Bundle care (n=30)		²X	P value
	No	%	No	%		
• Hand washing before and after inserting urinary catheter.	10	33.3	15	50.0	1.71	0.19
• Done sterile gloves before and after insertion the urinary catheter	18	60.0	20	66.7	0.29	0.59
• Apply sterile drape	0	0.0	18	60	12.0	0.001*
• Compliance of wearing sterile gown.	0	0.0	5	16.7	5.36	0.02*
• Perform hand hygiene and wear gloves and apron prior to each catheter care procedure on procedure completion	18	60	18	60.0	0.0	1.0
• Remove gloves and gown and perform hand hygiene again on procedure completion,	10	33.3	20	66.7	6.67	0.009*
Total Mean ± SD (range)	3.7±2.4 0-8		5.2±1.3 2-8		Paired-t 3.4	0.01*

Table 3. Nurse's Practice regarding nurses compliance with four interventions of urinary catheter care bundle among intervention and control group (total nurses numbers 30)

Items	Routine nursing care (n=30)		(UC)Bundle care (n=30)		²X	P value
	No	%	No	%		
• Check the clinical indication why the urinary catheter is in situ – is it still require.	2	6.7	5	16.7	0.65	0.42
• Check the catheter has been continuously connected to the drainage system..	12	40.0	20	66.7	4.29	0.03*
• Use of silver alloy catheters in ICU	0	0.0	20	66.7	0.0	1.0
• Use of securing devices to prevent the movement of the catheter after its insertion.	20	66.7	25	83.7	2.22	0.13
• Reposition the catheter tubing, if it was found to be touching the floor, at any time during their work shift.	10	33.3	15	50.0	1.71	0.19
• Involved and educate the patient about urinary catheter care and educated and how they can minimize complications	20	66.7	26	86.7	3.35	0.06
• Regularly empty urinary drainage bags as separate procedures, each into a clean container.	20	66.7	23	76.7	0.74	0.39
• Document for the urinary catheter every day for short-term and on a regular basis for long-term.	0	0.0	0	0.0	0.0	1.0
• Daily review comment on the continuing need for the UC.	30	100	30	100.0	0.0	1.0
• Maintaining the integrity of the closed urinary drainage system	12	40.	20	66.7	4.29	0.03*
• Documentation for most surgical patients for the catheter to remain in place on postoperative day 1-2.	4	13.4	9	30.0	2.45	0.11
Prompt removal of unnecessary Urinary catheter	10	33.3	17	16.7	3.3	0.069
Total Mean ± SD (range)	6.0±1.8 4-8		9.3±3.0 6-14		paired t 10.7	< 0.001**

P < 0.05 significant (S) * P < 0.01 highly significant (H.S) **.

Table 3: Portrays nurse's practice regarding compliance with four interventions of urinary catheter care bundle among intervention and control group. It was found that the total mean practice score was 6.0±1.8 among (control group) and increased to 9.3±3.0 among the intervention group. A statistically significant difference was found among studied nurses throughout the use of guidelines protocol. P< 0.001.

- According to the tables, the significant difference between the routine care and urinary catheter care bundle are as follows: For the practice of nurses regarding the first intervention of the Checking the catheter has been continuously connected to the drainage system, the p-value was a significant difference among routine care and bundled care.

- Compliance of other intervention of using of secured devices to prevent the movement of the catheter after its insertion is significantly higher in bundle care than in routine care with p-value (0.02*).

- Regarding the practice of nurses Remove gloves and gown and perform hand hygiene again on procedure completion, is significantly higher among nurses practice compliance the bundle care with p-value (0.009*).

Figure 1: Illustrated that there was no significant difference regarding body temperature after urinary catheter insertion on 1st, 2nd, 3rd, a 4th and 5th day among intervention and control group. It can also noted that, on 1st day the mean of body temperature was 37.3±0.5, 2nd was 37.5±0.2, 3rd day was 37.6±0.5, 4th day was 37.8±0.2, 5th day was 38.0±0.5 in intervention group compared to control group on 1st day was 37.5±0.6, 2nd was 37.5±0.8, 3rd day was 38 ±0.3, 4th day was 38.5±0.5, 5th day was 39.0±0.8.

Table 4: Illustrated that there was no significant difference in (WBCs) counts on 1st, 2nd, 3rd, 4th, and 5th day after urinary catheter insertion among intervention and control groups. It can also note that, on 1st day the mean (WBCs) count was 9.6±3.0, 2nd was 10.7±3.0, 3rd day was 11.4±3.0, 4th day was 12.5±5.0 and on 5th day was 12.8±5 compared to control group on 1st day was 10.0±4.8, 2nd was 11.2±5.9, 3rd day was 12.2±5.9, 4th day was 14.3±5.2 and on 5th day was 15.7±5.5. There was no significant difference in the mean (WBCs) count in 1st, 2nd, 3rd, 4th, and 5th day among intervention and control group.

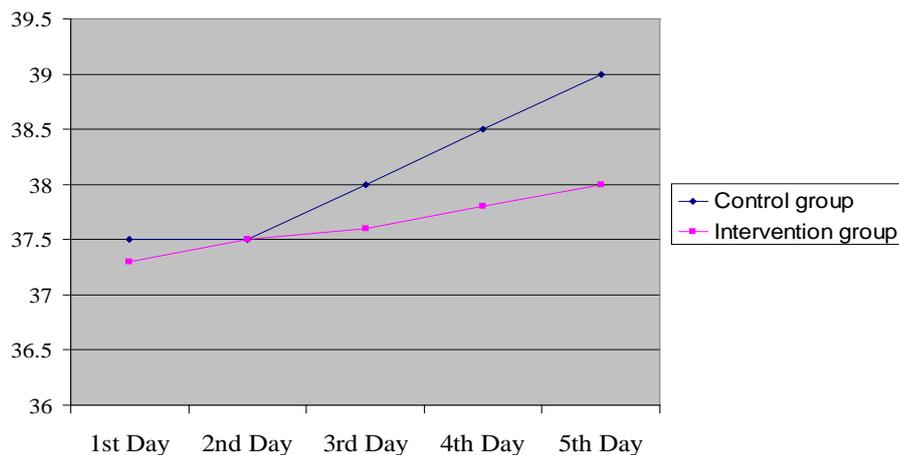


Figure 1. Mean of Body Temperature Follow-up after urinary catheter insertion among Patients in the Intervention and Control Group

Table 4. White Blood Cells (WBCs) Count throughout five Days Following urinary catheter insertion among Intervention and Control Group

(WBC) Count	Control Group (n=40)		Intervention Group (n=40)		X ² Test	p-value
	No.	%	No.	%		
First day of Urinary catheter insertion :						
<10	30	75.0	23	57.5	2.37	0.10
10>	10	25.0	17	42.5		
Range	5.0-19.0		3.0-21.0		U=1.95	0.19
Mean ±SD	9.6±3.0		10.0±4.8			
2 nd day :						
<10	28	70	22	55.0	1.92	0.42
10>	12	30	18	45.0		
Range	6.0-19.0		2.0-24.0		U=0.56	0.26
Mean ±SD	10.7±3.0		11.2±5.9			
3 rd day:						
<10	26	65.0	19	47.5	0.08	0.72
10>	14	35.0	21	52.5		
Range	6.0-19.0		2.0-24.0		U=0.89	0.34
Mean ±SD	11.4±3.0		12.2±5.9			
4 th day:						
<10	18	45.0	10	25.0	2.65	0.08
10>	22	55.0	30	75.0		
Range	4.0-26.0		1.0-33.0		U=1.76	54
Mean ±SD	12.5±5.0		14.3±5.2			
5 th day:						
<10	16	40.0	8	20.0	2.05	0.12
10>	24	60.0	32	80.0		
Range	4.0-32.0		1.0-41.0		U=2.67	0.16
Mean ±SD	12.8±5		15.7±5.5			

Figure 2 shows that urine culture microbial growth was Escherichiacoli. It is isolated in urine culture for three patients among the intervention group while detected among eight (8) urine cultures among the control group. Pseudomonas species follow it, but only one result among the intervention group compared to three among the control group. However, the number of urine culture detected Staphylococcus aureus completely disappeared in the intervention group and only appeared in one culture for the patient in the control group. Coagulase-negative staphylococci found in two urine

culture, equally among the intervention and the control group. Finally, the candida found in the intervention group is only one compared with the control group with five (5). The rest has no growth in 34 urine culture among the intervention compared to 25 among the control group.

The Table 5 illustrated that the percentage of positive microorganism which detected among the intervention group about 15% compared to 85% respectively, by conventional criteria, this difference is considered to be very statistically significant.

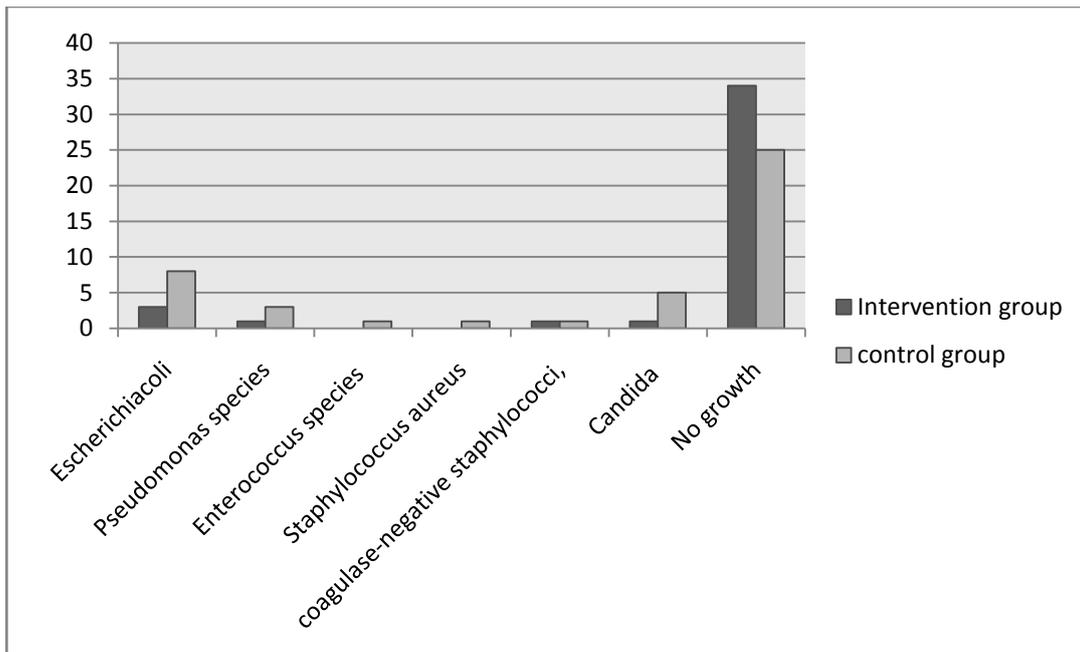


Figure 2. Frequency of Isolated Organisms from urine Culture among Study and Control group (n - 80 patients)

Table 5. Percentage Distribution of positive growth of Isolated Organisms from urine Culture among Study and Control group

	Intervention group		Control group		t- test	p-value
	n	%				
No growth	34	85%	25	62.5%	2.6629	0.0094
Positive growth	6	15%	15	37.5%		

4. Discussion

The incidence of CAUTI in the ICU setting was linked to the increased use of catheters in this area [11]. Bacteriuria develops at a rate of 3-10% per catheterization a day, and it has been shown that CAUTI rates rise in patients with urinary catheters more magnificant than seven days [12]. The present study designed to evaluate the impact of utilizing urinary catheter care bundle on minimizing the risk of CAUTI when caring for patients with indwelling urethral catheters in ICU.

The result of the present study reflected that the majority of nurses did not receive training courses on the care of the urinary catheter. This finding supports the significant of the present study that nurses' education improved the patient outcomes and nurses' satisfaction through evidence passed practice, this result supported by [13] who reported that practice change is possible when intervention is well designed and based on evidence. The goal of practice changes ultimately decreased the number of incidence of CAUTI among ICU patients. It demonstrates the perceived value of education for health care providers in this area.

The study revealed that on admission to ICU, there is no any significant difference between the intervention and control groups as to, age, gender, admission diagnosis, an indication of urinary catheter use, and maintenance. [4] It is mentioned that the critical tools for reducing urinary catheter use are lists of appropriate and inappropriate catheter indications, which restrict use to appropriate signs and prompt catheter removal when catheters are no longer necessary.

Concerning the duration of urinary catheter use, there was no significant difference detected among the control and intervention group. Despite the period of urinary catheter discussed by several studies [14] reported that the most significant risk factor for contracting a urinary tract infection has a urinary catheter; once inserted, the longer the duration of catheterization the higher the risk of disease. Therefore, using alternative urine collection strategies when appropriate and minimizing the length of catheterization are climacteric in the prevention of urinary tract infections.

Nurses who perform the intervention or procedure has the direct contact of putting the patients at risk of urinary catheter reinfection [15] stated that a valuable benefit of direct observation is the ability to provide immediate constructive feedback that improves practice [16]. In the present study, nurses practice through the implementation of the urinary catheter bundle components among patient in the intervention group, the nurses achieved excellent results in minimizing the rate of CAUTI, This comes online with [17] who reported that the best way to prevent healthcare-associated infections is by following best practices. Urinary tract infections (UTIs) is considered as the most common hospital-acquired infection, with most attributed to the use of an indwelling catheter. On the other hand, [18] added that the use of evidence-based guidelines, monitoring compliance with them, and action planning to improve quality, are essential to reducing CAUTI rates. Urinary catheters are sometimes misused because of ignorance of the recommendations, uncertainty about the course of the patient's illness, and for the

convenience of hospital staff. Sometimes its presence is often forgotten.

As to applying maximal barrier precautions during preparation for urinary catheter insertion and ongoing routine care, there was a significant difference among both groups related the following items (use sterile drape, compliance of wearing a sterile gown and remove gloves and gown and perform hand hygiene again on procedure completion). These results were supported by [19] who said that aseptic technique requires the use of various barriers, such as sterile gloves, sterile gowns, sterile drapes, and mask. This will prevent the transfer of microorganisms from health care personnel and the environment to the patient during a procedure. Even though hand hygiene is a vital component of any adequate patient safety and infection prevention program, only half of the nurses complied to hand washing technique before and after insertion of the catheter, may mean that nurses accustomed to using alcohol hand scrub as available hand scrub rather than hand washing by antiseptic and water. As mentioned by [20], hand hygiene is the single most important measure in preventing the spread of infection.

The implementation of the first intervention of urinary catheter care bundle explains that exclusive use of silver alloy catheters in ICU resulted in excellent compliance among nurses. This finding supported by multiple studies [21] stated that, Silver alloy-coated Foley catheters that dissuade bacterial adhesion may help to reduce this distressing event, and that further complications arise in some patients who are catheterized long term. Urease-producing bacteria (for example, *Proteus mirabilis*) colonizing the catheter system can cause a complex cascade of biochemical changes, resulting in deposition of crystals which will eventually block the catheter, on other hand [22], mentioned that monitoring the patient using a catheter diary is recommended and may avoid blockage by planning catheter changes in advance of habitual obstruction. Another study by [23,24] emphasized that the chance of reducing the risk of infection with the use of catheter coated with silver alloy is still in doubt. Though it is expensive, it may be reasonable to reserve these catheters for patients who are at the highest risk of developing a UTI.

As to nurses' practice of the second intervention, nurses achieved significant improvement though implementing the urinary catheter care bundle by minimizing the counts CAUTI infection this finding supported by [23,24] who mentioned that once the catheter has been inserted, maintaining the integrity of the closed urinary drainage system is essential to minimize the risk of infection. When the closed drainage system is open, for example, when emptying or changing urinary drainage bags, there is a potential risk of microbial contamination. Bacteria and other microorganisms can then ascend into the bladder resulting in bacteriuria and CAUTI. Aseptic indwelling catheter insertion is essential for the prevention of UTI because of its closed-drainage system. Though many of these infections occur in clusters, proper hand washing before and after catheter care is vital.

Regarding the third intervention of urinary catheter bundle which emphasized on the importance of nurses' compliance, the intervention step of reposition the catheter tubing was observed that there was no significant

difference detected among the nurses practice among both groups. The previous findings supported by, [25] this study applied about the auditing urinary catheter care in England, the researcher founded that, the majority of nurses' compliance of placing the Uri-bag in a proper position including being kink-free, secured well, no obstructions, and support of the Uri-bag below the level of the bladder.

The fourth intervention of urinary catheter care bundle stressed on the importance of the requirement for documentation for most surgical patients for the catheter to remain in place on a postoperative day 1-2. The finding of the present study revealed that no one of the studied nurses achieved in their practice among both groups any point regarding the documentation of the urinary catheter every day for short-term and regularly for long-term. While all nurses in both groups perform, daily review comment on the continuing need for the UC with no significant difference, this finding supported with Good catheter care is dependent on accurate documentation. This starts with core care plans and care pathways in acute and primary care, and relies on continuous recording of interventions, mainly when problems occur with encrustation, leakage, and blockage. This finding come in the same line with [26] who claimed that The use of a 'catheter diary,' recording the dates and reasons for catheter changes, can enable a planned program of interventions, which are preferable to crisis management of catheter-related problems. The finding of the present study comes on the same line with [27] who considers that the supply of consistent information, helpful documentation and reduction in inconsistencies through coordinated care will be beneficial, while [28] emphasizes the need for excellent communication when transferring catheterized patients between caring environments. There is no such designation as a 'legal' document-any document used in health care can be called as evidence in a court of law should it prove relevant [29].

Various strategies have been adopted to reduce the risk of catheterized patients developing urinary tract infections as well as the symptoms of catheter-related urinary tract infection (UTI) generally are nonspecific; most patients present with fever and leukocytosis. A more than 50 white blood cells (WBCs) per high-power field (HPF) indicate pyuria, and the colony counts on a urine culture range from 100-10,000/mL.

Regarding leukocytosis counts detected among both group from the day of insertion of a urinary catheter, there was no significant difference between patients in study and control groups on the first, second, third, fourth and fifth day. Presence of leukocytosis in patients that were not having Bactra urea might be related to another body infection. This agreement with [30], who reported that for suspected (CAUTI) followed the catheter care bundle includes the following criteria: (i) fever of $>38.3^{\circ}\text{C}$ (ii) leukocytosis of $>12 \times 10^9/\text{ml}$, and (iii) A positive urine culture. As regarding to body temperature there was no significant difference observed between patients in intervention and control groups on the first, second, third, fourth and fifth day after urinary catheter insertion this finding in line with [8] , stated that, generally symptoms of UTI are nonspecific, and most of the patient has fever and leukocytosis. The presence of more than 50 white

blood cells indicates pyuria, and the colony counts for a urine culture ranges from 100-10,00/ml.

As to the types of microorganisms isolated through urine culture taken from both intervention and control groups, it was detected among both groups, and the most frequent microorganisms' gram was Escherichiacoli. [31], who reported that Escherichiacoli are most commonly responsible, but Pseudomonas species, Enterococcus species, Staphylococcus aureus, coagulase-negative staphylococci, Enterobacter species, and yeast also are known to cause infection. Proteus and Pseudomonas species are the organisms most commonly associated with biofilm growth on catheters. Microorganisms most often associated with CAUTI in hospitals include Candida spp and Commensal enteric Gram-negative bacteria, especially Escherichia coli, Enterococcus spp., Pseudomonas aeruginosa, Klebsiella pneumoniae, Proteus and Enterobacter spp, [30]. The reduction in the number of positive growth in urine culture significantly different between the intervention and control group. For about six compared to 15 positive perceptions among the intervention group, this reduction in infection numbers support the finding that by the implementation of a catheter care bundle, provide best nurses practice, and allow for improvements in both care and measurements of effectiveness against the core elements of the bundle.

5. Conclusions and Recommendations

Nurses have a significant role in implementing evidence-based practice wherein change can be challenging, and success depends on a well-organized process. The most important result from the study was the positive changes in nurses practice and patients outcome among the intervention group who received the urinary catheter bundle. The similar bundle could be used for all patients that may need an indwelling catheter. Findings from this study may boost changes in clinical practice guidelines leading to a reduction in the urinary catheter utilization as well as the measured reduction in the incidence of urinary tract infection. A urinary catheter care bundle is a key component of urinary tract infection prevention program. Aseptic technique is a method use to prevent contamination of microorganism, is it necessary when preparing to insert urinary catheter, Nurses in ICU should be attentive to maximal sterile barrier precautions, compliance of urinary catheter care bundle can improve patients adherence to best practices and reduce error, Development of documentation system and multidisciplinary guidelines of care for urinary catheter insertion and maintenance. Finally, nurses' practice related to the care of urinary catheter needs to be supported by the policies, procedures, and practices of their ICU.

6. Limitations

This study provides an opportunity to evaluate short-term improvements that occurred in nurses practice as a result of providing education about catheter care bundle regarding minimizing the rate CAUTI. However, the researchers were unsure whether practice gains would

be sustained for a longer period. Longitudinal studies would be particularly useful for providing insight into how urinary catheter care bundle have influenced outcomes in the future.

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