

## Effect of Applying Nursing Care Bundle about Urinary Catheter Infection on Nurses Knowledge, Practices and Children Outcomes



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### ABSTRACT

**Background:** infections of the urinary system associated with Catheterization (CAUTIs) are infection caused by constant use of renal catheters, as a result of an extended hospital stay. **Aim:** Evaluate the effect of applying nursing care bundle about urinary catheter infection on nurse's knowledge, practices and children outcomes. **Design:** A quasi-experimental design was adopted in one group (pre/posttest).The research was done out at Mansoura University Children's Hospital's pediatric intensive care unit. **Subjects:** 65 nurses of both were included as well as a convenience sample of 65 children in the PICU. **Tools:** 1: Structured Questionnaire Sheet (pre, posttest) II: Nurses' Practice about Urinary Catheter and CAUTI Care Bundle (pre, posttest). III: Child health assessment **Results:** The median ratings of nurses' has satisfactory knowledge and competent practice with a statistically significant distinction ( $P < 0.001$ ) in the post-intervention phase when compared to the pre-intervention phase; furthermore decrease incidence of UTI symptoms and signs in studied children in the post-intervention phase when compared to the pre-intervention phase **Conclusion:** According to the effect of applying the nursing care bundle about urinary catheters, there was an improvement in nurse's knowledge, and practice, and a decrease in the incidence of urinary catheter infection in children when compared to before it was implemented. **Recommendations:** Regular continued learning courses for nurses should emphasize the relevance of the CAUTI care bundle strategy and how it is implemented .

**Keywords:** Catheter-related urinary tract infections, Care bundle, Children outcomes, Nurse Knowledge, Practices.

### Introduction:

In the pediatric intensive care unit (PICU), urinary bladder catheterization is a routine operation. It is used in many contexts for both therapeutic and diagnostic objectives. During contrast-enhanced exams (empty cystography), diagnostic catheterization is required to obtain sterile urine samples for urine analysis and urine culture, as well as to collect urine for a full 24 hours, Proteinuria and metabolism assessment in newborn and young children using estimates of diuresis and urine output. Catheterization is utilized in medical settings as an alternative to relieve the stress caused by excessive urine retention (Kopač, 2013).

The presence of catheter is the greatest predictor for infections of the urinary system in the hospital setting, resulting in 70-80% of infections of the urinary tract. Infections of the urinary tract account for 32% of all HAIs and 13% of all HAI-related deaths, making it a significant contributor to hospital-associated morbidity (Siegel, et al, 2018).

According to Ravi and Joshi, (2018) CAUTI is diagnosed when one of the following criteria is met: When a patient with a urinary

catheter (UC) has any or all of these symptoms that do not occur by another known cause, the first criterion: The urine culture revealed 10 CFU per ml or higher, with only two bacteria detected, fever  $<38.8^{\circ}\text{C}$  and acute suprapubic discomfort. The second criterion was when a UC patient's urine sample produced the following results without any other known cause: Suppuration ( $>10$  leukocytes/mL) with a positive dipstick assay for leukocyte esterase or nitrate, The patient's first symptoms show 48 hours or more after being admitted to the hospital (El-Sahrigy et al, 2019).

The Institute of Healthcare Improvement, also known as IHI, developed the bundle concept to improve care quality. Care bundles are composed of numerous components that must be applied together and consistently to improve patient outcomes. The care bundle's strength is that all elements must be administered to all clients. The Urine Catheterization Caring Bundles (UCCB) is a set of accepted methods used during patient treatment to avoid CAUTI (Abdel-Hakeim, & Hamza, 2018).

According to **Abdelmoaty, et al, (2020)** The CAUTI care bundle includes both the insertion and maintenance bundles. Insertion Bundle which includes need verification before insertion, hand cleanliness, sterile catheter insertion, and urinary catheter management by authorized standards. The maintenance bundle includes avoiding unnecessary catheterization, bathing the perineum daily, removing catheters once not required, and keeping a closed system with unimpeded flow. Such evidence-based treatments are intended to improve patient outcomes when implemented in a systematic and consistent manner (**Lehane, et al 2022**).

According to the (CDC), the Urinary Catheter Care Bundle (UCCB) can prevent roughly 17-69% of CAUTIs, therefore health worker education and training, as well as the adoption of a preventative CAUTI bundle, all assist in dramatically minimizing the spread of CAUTI. The success of such a bundle would assist in lowering the CAUTI rate, length of stay, and economic burden (**Lavallée, et al, 2017**).

The nurses are the primary medical care providers responsible for installing and maintaining urinary catheters, and also for attaining the desired results by adhering to the relevant rules, protocols, and best practices during the placement of catheters and catheter maintenance **Teshager, et al (2022)** Education of nurses in research-based information can benefit patients because nurses play a vital role in patient outcomes. Because of this, organizations must update their policies and training materials, as well as inform nurses about how to take care of IUC procedures (**American Nurses Association, 2018**).

#### **Significance of the study:**

According to **Lachance and Grobelna (2019)** the summed total rates of CAUTI for adults and children were the same. On a national level the mean infection rate in pediatric intensive care units (PICUs) was 2.5 infections / 1000 a catheter day. In American hospitals, hospital acquired infections (HAIs) are a significant cause of morbidity as well as mortality in hospitalized patients. CAUTIs account for roughly 9% of all HAIs. According to (CDC) acute care hospitals indicated that 30-40% of all HAIs occurred in their facilities. CAUTIs increase patient mortality, morbidity, and length of hospital stays, as well as place a financial strain on the healthcare system (**Van Decker, et al, 2021; Galiczewski & Shurpin 2017**).

Device-associated infections (DAIs) occurred at a rate of 24.5 percent every 1000 ICU days in Egypt. In several underdeveloped nations, the prevalence of CAUTI is 6.3 for every 1,000 catheter use dates. These infections could be avoided or minimized by employing care bundles (**Hassan, et al, 2019**).

The most frequently occurring in intensive care units, CAUTIs represent the second most prevalent type of infection relating to healthcare. As stated by **Shade, et al, (2021)** these infections have a negative impact on both patient outcomes and healthcare expenses.

A nurse's knowledge of care with a urinary catheter and CAUTI care bundle is critical because it affects the child's condition and the care provided. When nurses have sufficient knowledge, the child's condition improves, complications are reduced, and discharge from the hospital is accelerated. The nurses must have sufficient and current expertise to give high-quality care to the children.

The practice of nurses is essential to preventing CAUTI because improper practice when dealing with urinary catheters results in an increase in morbidity and hospital stay time. Nurses must have the necessary experience and training to care for children with urinary catheters securely and professionally.

The current study sought to determine how the nursing care bundle for urinary catheter infection affects nurses' knowledge, practices, and pediatric outcomes. In the long term, this finding may attract interest and encourage more research in the field to provide up-to-date care and minimize risk of (CAUTI) among Intensive care unit for children

#### **Aim of the research**

Evaluating the effect of applying nursing care bundle about urinary catheter infection on nurse's knowledge, practice and children outcome.

#### **Research hypotheses:**

**H 1:** Applying nursing care bundle expected to improve nurses' knowledge about controlling urinary catheter infection .

**H 2:** Applying nursing care bundle expected to improve nurses' practice about controlling urinary catheter infection .

**H 3:** Applying nursing care bundle expected to reduce the incidence of urinary catheter infection among children's.

## Subjects and Method

The following designs will cover the study methodology:

- I. I. Technical design .
- II. II. Operational design .
- III. III. Administrative design .
- IV. IV. Statistical design.

### I. Technical design:

It refers to the research design, setting, subjects, as well as tools for data collection.

### Research design:

The present research employed a kind of quasi-experimental approach in a single group (pre-posttest). This refers to a research study that is employed to determine the impact of an intervention on the population it is designed for with using random selection. A one-group pre-posttest is a common quasi-experimental research method in which a single group of investigators or subjects is pretested, then given an alternate treatment or distinct variable influencing, and ultimately post-tested (Maciejewski, 2020).

### Setting of the study:

The research was done out at Mansoura University Children's Hospital's (MUCH) in pediatric intensive care unit. This was providing health care facilities for children with various health problems from Mansoura in and surrounding regions in Dakhliya County. It has 13 beds and approximately 60 nurses, with two nurses assigned to each patient, who provide full nursing care for children .

### Subjects:

The study included a convenient sample of 65 nurses of both genders who work in child critical care facilities, independent of age, identification, or years of experience, which provide nursing care to children with urinary catheters and consent to participate in this study, as well as a convenience sample of 65 children's in the PICU who has a urinary catheter were retracted according to the criteria of selection.

### Inclusion criteria of children :

- No warning signs of systemic infection, such as fever or increase number of white blood cells (WBCs) in the blood.
- No indicators of urinary tract infection (UTI), such as fever, leukocytosis and positive urine culture

### • Exclusion criteria of children :

- Child with UTI on admission
- Child had UTI before 48 hours of attachment with urine catheter.

### Tools of data collection:

The following three tools were used to collect data :

#### Tool 1: Structured Questionnaire Sheet (pre, posttest)

A researcher wrote it after evaluating the appropriate research for the study, which aimed to assess nurses' knowledge of urinary catheters and the CAUTI bundle in PICUs. It was split into two parts.

#### Part 1: Demographic characteristic of studied nurses

Such as their age, sex, degree of education, years of PICU experience, and previous training on preventive bundles.

#### Part 2: Nurses Knowledge about urinary catheter and CAUTI care bundle

It was adapted by (Abdel-Hakeim, & Hamza, 2018; Algarni, et al, 2019; Ibrahim, et al, 2021) and has been altered by the researcher. It composed of (20) questions to measure nurses' knowledge of the urinary catheter procedure and CAUTI-related to care bundle. It includes the following, definition of infection, urinary catheter, (CAUTI) and CAUTI care bundle.

### Scoring system:

The scoring system was utilized based on the questions of the interviewer questions, the nurses' responses were examined using an ideal key statement supplied by the investigator. The correct answer received (one grade), the inaccurate response received (zero), and the overall knowledge score of the investigated nurses was assessed based on the average score, which was divided into a satisfactory level of knowledge at 80% or higher and an unsatisfactory level of knowledge from less than 80%.

#### Tool II: Nurses' Practice about Urinary catheter and CAUTI Care Bundle (pre, posttest).

This tool was modified from (The Egyptian Ministry of Health and Population MOHP, 2020 and Hernandez, et al, 2019) to evaluate nurses' practice regarding CAUTI care bundle, it divided into two parts

**First part:** CAUTI insertion bundle it contained three parts which include confirm the need, insert the urine catheter aseptically and maintaining the catheter in placement.

**Second part:** CAUTI maintenance bundle such as daily recorded evaluations of need, maintaining a sterile environment, Continuous closed drainage system and catheter secured in place.

**Scoring system:** for each step performed properly (1 mark) and done incompletely or not performed (0 mark), The overall score of the investigated nurses' practices is going to be evaluated based on a median rating through a competent category level of performance 80% or more and incompetent level of performance less than 80% (**Abdel-Hakeim, & Hamza, 2018**).

**Tool (III): Child health assessment:**

This form was used for assessment of CAUTI development; it was developed by **Zaiton, Relloso, & Medinah, (2019)** based on criteria for the diagnosis of CAUTI the tool consists of two parts:

**Part (1):** Children characteristics and their medical data: the gender, age, diagnosis of children, the purpose of catheter placement, length of urinary catheter insertion .

**Part (2):** Clinical statistics of Urinary Tract Infection based on medical indicators, including the following items:

- Fever >38.5
- The percentage of leukocytes is < 5000 cells/ul.
- A urine culture of  $\geq 10^5$  CFU/ml of two microorganisms, (positive).

**II. Operational Design**

This includes the preparatory stage and exploratory stage.

1) The preparatory phase

These phases involved an evaluation of previous and present the associated research and studies, as well as the use of readily available texts, journals, and articles to become familiar with the many parts of the study as well as the study instruments. The content validity of the study tools was examined and amended by five nursing experts in the subject of the study. Cronbach's alpha coefficient was used to assess the internal consistency of the study tools. (Internal consistency) of the Nurses' knowledge was 0.903, and of the Nurses' practice was 0.897'

2) Exploratory phase: This includes pilot study and filed work.

This step comprised a review of relevant past and present research and literature.

**• pilot study:**

It was done on 10% of the total sample size (7nurses) drawn at random from the same environment to assess the clearness, feasibility, and application of the study tools, as well as to identify potential hurdles to collecting information and resolve methods.

**Filed work:**

- Data collection period:

Data collection lasted six months, beginning in September 2022 and ending in February 2023. The researcher initially introduces herself to the nurses and then provides them a brief overview of the research's goals and scope. The researcher came to their research site three days a week from 9.00 a.m. to 12.00 p.m.

**Study framework:** it was implemented in 5 phases as Follows:

**Phase 1:** Initial gather data (Assessment phase): Evaluation of current nurses' knowledge and practices in relation to CAUTIs and its care bundle

- Each nurse was questioned with a goal to acquire basic nurses' data using tool (I) part (A).
- Evaluation of nurses' knowledge regarding CAUTIs and the care bundle through tool (I) part (B).
- Evaluation of nurses' practice regarding CAUTIs and the care bundle without their awareness to avoid bias and to keep objectivity that was performed through using tool (II.)
- Assessment of child's data through using tool (III).

**Phase 2:** Setting goals and objectives: Based on the findings of the evaluation stage, goals, priorities, and anticipated outcomes were developed to address the needs of nurses for CAUTIs and its bundle of care.

**Phase 3:** Development of a learning bundle of care to improve nurses' CAUTI knowledge and practices as well as to prevent CAUTI:

- Considering the current a scientific basis research, essential knowledge, and practices, decide the appropriate time for each section, and choose the instructional technique. During this stage, the researcher was scheduled for four learning sessions concerning CAUTI and nursing care bundle to prevent CAUTI
- The sessions were composed of theoretical (educational), practical knowledge and practical sessions. The theoretical sessions was

conducted through lectures, questions, group discussions which aided by using booklets, electronic brain storming as (video) and PowerPoint presentation .

- The first learning session: It covers the following items: definition, size, indications, complications, contraindication of urinary catheter, It lasted 45-60 minutes to talk about its items while keeping the nurses' attentive.
- The second learning session: discussed child position during an insertion, removal, characteristic evaluation of UC, child 'assessment after insertion, role of the nurse for any complications as bleeding and infection for child. It took 45-60 minutes for discussing its items taking under consideration the nurses' attention
- The third learning session: discussed the nursing practices during CAUTI insertion bundle and it lasted 45-60 minutes to go through its items while keeping the nurses' focus in account.
- The fourth learning session: discussed the training of the members of the nursing staff CAUTI maintenance bundle. It lasted 45-60 minutes to explain its items while keeping the nurses' attention.

#### **Phase 4: Implementation phase :**

- The researcher employed concise, simple language , straight forward phrases and gave a quick summary at the end of every session
- The learning care bundle involved 65 nurses, with each nurse attending two sessions per week.
- Taking into account the nurses' time constraints, each session took between 45 and 60 minutes to debate its topics.
- Using a tool (II), the researcher monitors nurses' practices before and after the Implementation of the learning care bundle in both morning and afternoon shifts.
- Morning shifts began at 9 a.m., while afternoon hours began at 3 p.m.
- Throughout the session, the researcher employed several teaching approaches such as group discussions, questioning, and electronic to brainstorm such as (video), demonstration, and re-demonstration. A variety of tools for instruction, such as a brochure and a presentation in power point, were utilized.

- A guiding-colored book regarding the CAUTI care bundle was handed to each nurse following the assessment stage to pique her interest, encourage her, and assist her in investigating its material as necessary

#### **Phase 5: Evaluation phase:**

- After conducting the learning care bundle every nurse was reassessed to evaluate their knowledge and practice using a similar pre-test format.
- Evaluation of children through clinical data of UTI based on medical indicators (fever, leukocytosis and urine culture) pre and post intervention.

#### **III - Administrative design:**

An official permission from the Mansoura Faculty of Nursing's Research Ethics Committee was obtained authorization to perform the study , the researcher sent a written request to the Director of Mansoura University Children's Hospital (MUCH) was given permission to conduct this study. All participants completed a written formal consent form before to the examination after being informed about the nature and purpose of the study. Participation in the study is fully voluntary, and participants may withdraw at any time. Confidential security, private information, and confidentiality were scrupulously adhered to throughout the research procedure. The results were used as part of the research required for the Master's degree, as well as for review and instruction .

#### **IV. Statistical design:**

All statistical analyses were carried out through SPSS for the Windows version 20 (SPSS, Chicago, IL). Continuous data distributed in a normal manner and reported via the standard deviation (SD). The categories results were provided numerically and as a percentage. For categorical data, the Chi-square test was employed to examine variables. The internal consistency (reliability) testing for the forms used in the research was computed, the statistical significance of data was established at p0.05

#### **Results:**

Table (1) found that nearly half of the studied nurses (47.7%) under the age of 35, with an average age of 35. The bulk of the studied nurses were females, with nearly half of the studied nurses (44.6%) had a bachelor's degree. This table also showed that nearly half of the studied nurses (47.7%) had 10 - 15 years of expertise, with an average experience of 11.2 ±3.8 .

Furthermore, less than three quarters of them (70.8%) failed to take preceding training, and nearly half of the studied nurses (47.4%) only attended one training session.

Table (2) proved that, three fourths of the studied nurses (78.5%) had unsatisfactory Knowledge around urinary catheters infections Pre - Intervention which decreased to become lower than one fifth of the studied nurses (18.5%) Post - Intervention .Also more than three quarter of the studied nurses (83.1%) had unsatisfactory knowledge concerning CAUTI care bundle during Pre- Intervention, which decreased to become more than one quarter (27.7%) Post - Intervention.

Figure (1) presented that, more than three quarter of the studied nurses (81.5%) had unsatisfactory Knowledge around urinary catheters and `Urinary catheter care bundle Pre - Intervention, which decreased to become less than one fifth of the studied nurses 18.5% post intervention.

Table (3): Interpreted that, more than three quarter of studied nurses (80.0%) had incompetent practices during insertion which markedly decreased to (26.2%) post intervention, while three quarter of studied nurses (76.9%) had incompetent practices during maintenance of urinary catheter which decreased to become (16.9%) post intervention

Figure (2): Interpreted that, three fourth of studied nurses (78.5%) had incompetent practices

Table (1): percentage distribution of the demographic characteristics of the studied nurses

Nurses' characteristics	N	%
<b>Age (Years)</b>		
< 35	31	47.7
35 – 40	22	33.8
> 40	12	18.5
Mean ±SD	35.6 ±4.9	
<b>Gender</b>		
Male	11	16.9
Female	54	83.1
<b>Educational Level</b>		
Bachelor of Nursing	29	44.6
Nursing technical Institute	26	40.0
Masters' degree in children	10	15.4
<b>Years of Experience in PICU</b>		
< 10	26	40.0
10 – 15	31	47.7
> 15	8	12.3
Mean ±SD	11.2 ±3.8	
<b>Preceding training session</b>		
No	46	70.8
Yes	19	29.2
<b>Number of training session (n=19)</b>		
One	9	47.4
Two	3	15.8
Three or More	7	36.8

pre intervention, which markedly decreased to 21.5% post intervention, a statistically significant variations ( $p < 0.001$ ).

Table (4): showed that less than half of studied children (44.6%) were in the age range of one to less than five years. More than half of the 58.5% male children and, about half of the studied children (50.8%) had urinary catheters for Calculation of the inside and outside of the catheter and more than one third of the studied children (36.9%) had catheterizations lasting longer than 10 days. .

Table (5): Cleared the following, the most diagnosis of children (46.2 %) with leukemia while 23.1% of children with bone marrow depression

Figure (3): illustrated that more than half of children's (58.5%) had fever more than 38C at pre – intervention which markedly decreased to 38.5 post intervention.

Figure (4): Interpreted that, more than half of the children's (52.3%) having white blood cell count <5000 cells in the urine analysis at pre intervention which markedly decreased to (32.3%) post intervention.

Figure (5): Showed that during the pre-intervention period more than half of children (58.5%) having Positive Urine culture at pre – intervention which markedly decreased to (33.8%) after intervention

## Effect of Applying Nursing Care Bundle about ...

Table2: Percentage distribution of the nurses' knowledge domains Pre and Post – Intervention

	Pre – Intervention				Post – Intervention				Chi – Square	
	Unsatisfactory Knowledge		Satisfactory Knowledge		Unsatisfactory Knowledge		Satisfactory Knowledge			
	n	%	n	%	n	%	n	%	X <sup>2</sup>	P
Urinary atheter infection	51	78.5	14	21.5	12	18.5	53	81.5	46.844	<0.001**
CAUTI care bundle	54	83.1	11	16.9	18	27.7	47	72.3	40.344	<0.001**

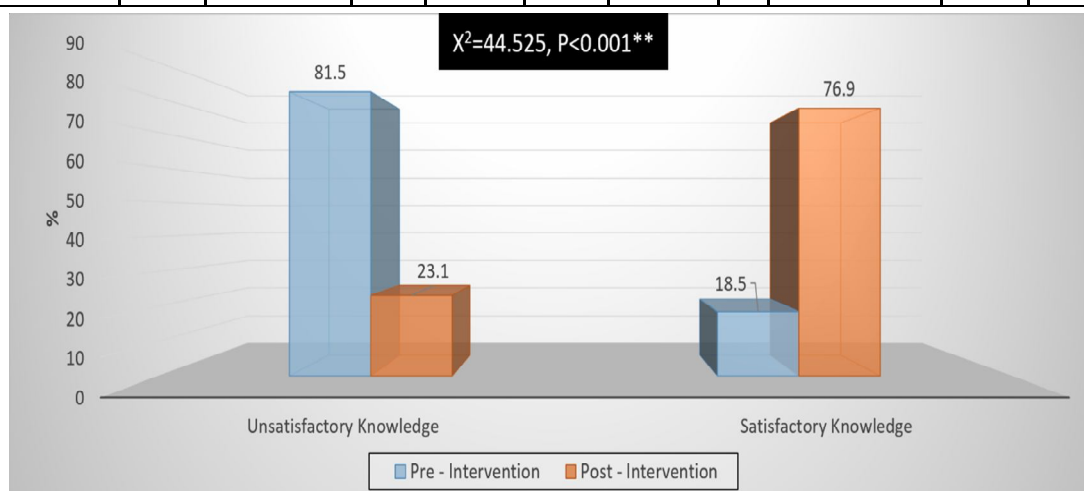


Figure (1) Percentage distribution of the nurses' total knowledge score at pre and post – intervention

Table (3): Percentage distribution of the nurses' practice level regarding insertion and Maintenance of urinary catheter Pre and Post Intervention

	Pre – Intervention				Post – Intervention				Chi – Square	
	Incompetent Practice		Competent Practice		Incompetent Practice		Competent Practice			
	N0	%	N0	%	N0	%	N0	%	X <sup>2</sup>	P
<b>Insertion</b>	52	80.0	13	20.0	17	26.2	48	73.8	37.835	<0.001**
<b>Maintenance</b>	50	76.9	15	23.1	11	16.9	54	83.1	46.977	<0.001**

Figure (2): Percentage distribution of the nurses' about total practice score at pre /post intervention

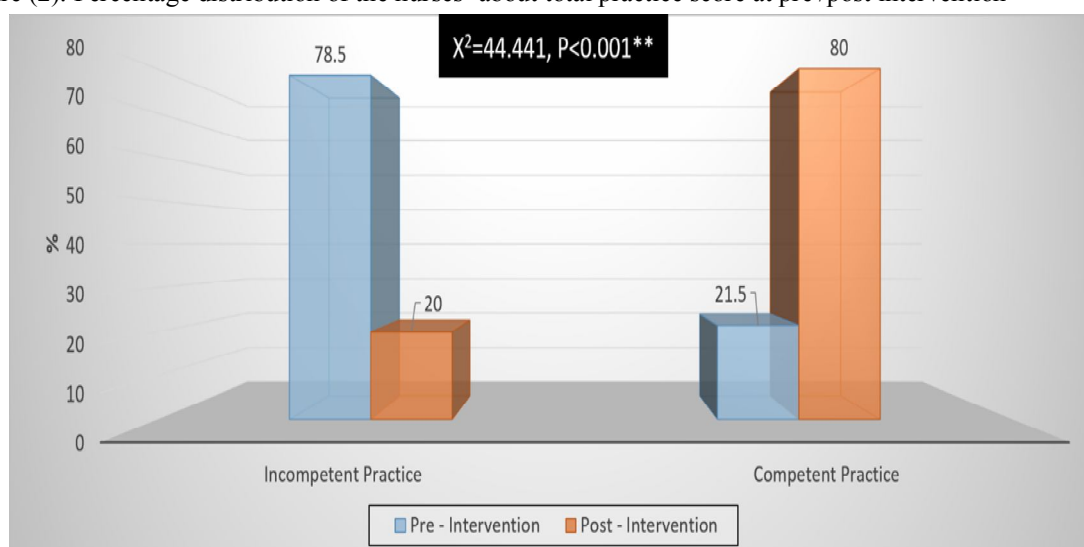


Table (4): Percentage distribution of demographic characteristics of the studied children (n=65)

	N0	%
<b>Age (Years)</b>		
1 – 5	29	44.6
6 – 12	27	41.5
> 12	9	13.8
<b>Gender</b>		
Male	38	58.5
Female	27	41.5
<b>The purpose of inserting a urinary catheter</b>		
Calculation of the inside and outside of the catheter	33	50.8
Urinary retention	22	33.8
Kidney disorder	6	9.2
Post operation	4	6.2
<b>Duration of urinary catheter (Days)</b>		
< 5	18	27.7
5 – 10	23	35.4
> 10	24	36.9

Table (5): Percentage distribution of the studied children according to their medical diagnosis

	Present		Absent		Chi – Square	
	n	%	n	%	X <sup>2</sup>	P
Nephrotic syndrome	22	33.8	43	66.2	7.159	0.007*
Meningitis	23	35.4	42	64.6	3.842	0.050*
Cerebral palsy	23	35.4	42	64.6	0.563	0.453
Pneumonia	26	40.0	39	60.0	0.295	0.587
Autoimmune hepatitis	18	27.7	47	72.3	2.175	0.140
Pulmonary edema	22	33.8	43	66.2	2.459	0.117
Encephalitis	24	36.9	41	63.1	4.571	0.033*
Bone marrow depression	15	23.1	50	76.9	0.182	0.670
Pulmonary fibrosis	23	35.4	42	64.6	6.863	0.009*
Under diagnosis	24	36.9	41	63.1	4.571	0.033*
Chronic heart disease	19	29.2	46	70.8	4.552	0.033*
Leukemia	30	46.2	35	53.8	6.594	0.010*
C H D	21	32.3	44	67.7	0.144	0.704

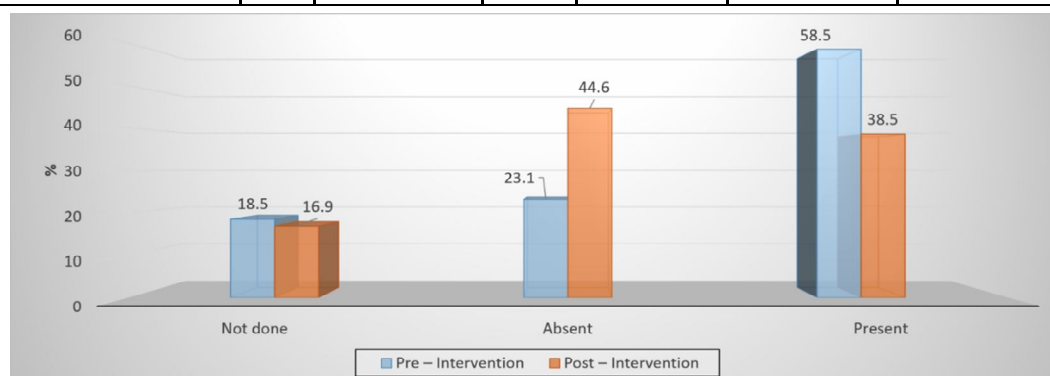


Figure (3): Percentage distribution of studied children presence of Urinary Tract Infection in the Shape of fever pre and post intervention.



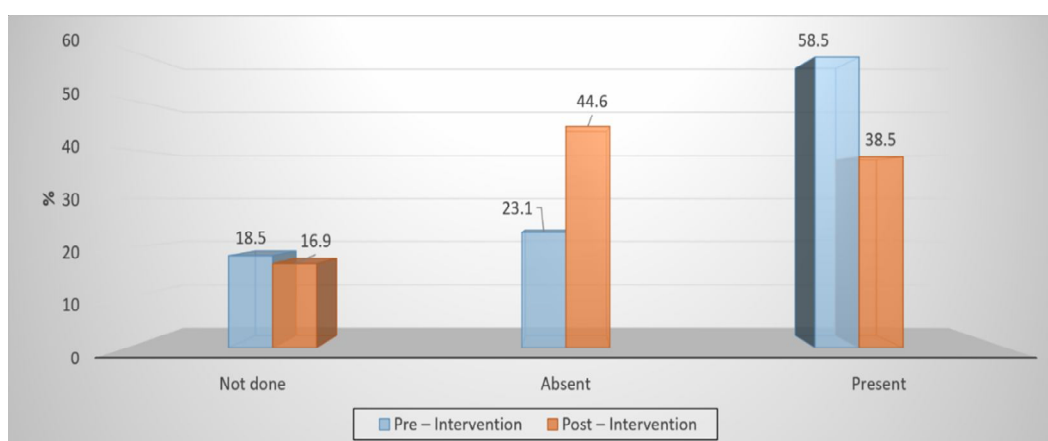


Figure (4): Percentage distribution of the evaluated children presence of Urinary Tract Infection in the Shape of White blood cell count pre and post intervention.

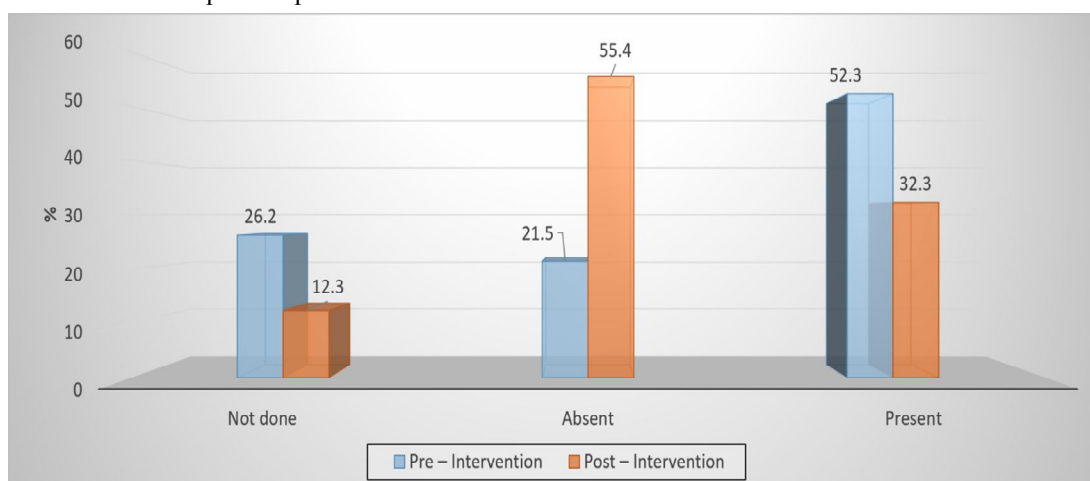


Figure (5): Percentage distribution of the evaluated children presence of Urinary Tract Infection in the Shape of Positive Urine culture pre/ post intervention.

**Discussion:**

Catheterization of the bladder is a necessary operation in hospitals, particularly in intensive care units. Around 70-80% of all obtained UTIs are caused by poor catheter use and failure to adhere to the (CDC) catheterization recommendation (Balu et al., 2021). Catheter-associated infections in the urinary tract develop within 48 hours of insertion as well as removal of a urinary catheter. As a frequent risk factor among inpatients with urinary catheters, it can raise the length of admission and expenditures or even induce urinary tract infection at worst, and must not be neglected (Cathy, 2019).

**Demographic characteristic of studied nursing:**

The results of the present study revealed that, nearly have of the studied nurses founded mostly in the fourth decade of age. This is congruent with the findings of a study undertaken by Niederhauser et al, (2020) who pointed out in their study titled "Nurses' and Physicians'

Perceptions of Indwelling Urinary Catheter Practices and Culture in their Institutions. Journal of Patient Safety" and who found the majority of his studied nurses in the same age group Our result was contradicted by a study that was carried out by Balu et al, (2021) who pointed in his study titled "Assessment of knowledge, attitude and practice on prevention of Catheter-associated Urinary Tract Infection (CAUTI) amongst health care professionals working in a tertiary care teaching hospital" who discovered that most of them of his studied nurses were between the ages of 25 and 30

According to the findings of the current study, the majority of the studied nurses were females and the rest were males. This might be related to the high ratio of female nurses comparing to male nurses, which supported by the results of Balu et al., (2021) and reported that, two thirds of the studied nurses were females.

According to the level of education, the present study revealed that, roughly half of them were bachelor degree which coincided with the studies by Algarni, Sofar, & Wazqar, (2019) who pointed in his study titled "Nurses' knowledge and practices toward prevention of catheter-associated urinary tract infection at King Abdul-Aziz University Hospital". And Anns et al., (2020) who pointed in his study titled "Nurses' knowledge on prevention of catheter associated urinary tract infection in a selected hospital of Mangaluru" that showed slightly more than sixty percent of his studied nurses had a bachelor's degree in nursing. The researcher relays this result due to highly educated nurses are usually distributed in intensive care units that provide critical care

The results of the current study clarified that the majority of our studied nurses were 10 to 15 years of experience with a mean experience of  $11.2 \pm 3.8$ , which is supported by the results of Algarni, Sofar, & Wazqar, (2019) and Niederhauser et al., (2020) who found that the majority of his studied nurses had years of experience above 10 years. Our results contradicted the results of the study by (Balu et al., (2021) reported that participants with more than 10 years of experience were ten percent of the total studied sample. The researcher possible explanation for this result might be due to nurses working in intensive care units should be experienced

According to the current study, the majority of our investigated nurses failed to participate any previous training programs and nearly half of the studied nurses attended one training session, which contradicted the results of another study conducted by Algarni, Sofar, & Wazqar, (2019) who said that a majority of nurses had participated in training course on bladder catheter operations. The study attributed this conclusion to the strain on nurses; a shortage of numbers may have hindered them from having time to take part in any programs, as they may believe that completing training courses has little or no significance for them and has no impact about their pay.

#### **Evaluation of the studied nurse's level of knowledge**

Our study results revealed that, majority of the studied nurses had unsatisfactory Knowledge about urinary catheters and Urinary catheter care bundle during Pre – Intervention, at post intervention the majority of studied nurses show Satisfactory level of knowledge with statistically significant difference. This may be attributed to; half of studied ICU nurses were graduated from secondary school, and technical institute of nursing

The results we found aligned with those of the study from **Abdelmoaty, et al, (2020)** who pointed in their study titled "Indwelling urinary catheter: Effect of training on nurse's knowledge and skills" applied in Egypt, stated that after undergoing CAUTI training program, nurses' knowledge improved.

These findings were consistent with those of **Algarni, Sofar, and Wazqar, (2019)** who discovered that nurses had low a level of knowledge toward prevention of catheter-associated urinary tract infection. A further study Anns et al., (2020) discovered that most of nurses having moderate level of satisfactory knowledge and few nurses had high level of knowledge regarding CAUTI, which improved through continuing nursing education. **Balu et al., (2021)** found in a further research after completing a training program on catheter-associated infections of the urinary tract (CAUTI) and its associated care nurses gained adequate knowledge level

Our results were also confirmed by **Abdelmoaty et al., (2022)** who pointed out in their research "Improving Nurses' Knowledge about Prevention of Catheter Acquired Urinary Tract Infections in Intensive Care Units "who reported a significant improvement in the total knowledge score among nurses in the intervention ICU compared to the control ICU. In the intervention ICU, the total knowledge and individual domain scores showed a statistically significant improvement between the baseline and follow-up. Furthermore, in correspondence to our findings, a study performed by **Yazici et al., (2018)**, who pointed in his study titled " Efficacy of a care bundle to prevent multiple infections in the Intensive Care Unit: A quasi-experimental pretest-posttest design study" who reported that the baseline knowledge score of nurses improved after implementing educational training regarding care bundle to prevent multiple infections in the Intensive Care Unit with a significant increase in knowledge

These findings were in agreement with **Jain, et al, (2018)** who pointed out in their research titled "Knowledge and attitude of doctors and nurses regarding indication for catheterization and prevention of catheter-associated urinary tract infection in a tertiary care hospital" Although nurses' knowledge of catheter-associated infections of the urinary tract preventive suggestions was inadequate before training instruction, it was a large statistically significant change in nurses' knowledge after the training program. Along the same line, **Banks and Willmann, (2018)** pointed

in their study "Nursing Interventions Aimed at Reducing the Incidence of Hospital Acquired Catheter-Associated Urinary Tract Infections" stated when there was a significant gap in nurses' CAUTI education due to a lack of knowledge about catheter care technique

These results contradicted as results of the research by **Ghuri et al., (2019)** carried out in Pakistan titled "Knowledge and attitude of health workers regarding catheter-associated urinary tract infection in tertiary care hospitals" who documented that nurses and doctors had adequate knowledge and attitudes about urine catheterization and precautions for catheter-associated urinary tract infection.

On the other side, **Mukakamanzi, (2018)** carried Rwanda's " Knowledge, attitude and practice of nurses towards the prevention of catheter-associated urinary tract infection in selected referral hospitals" demonstrated that somewhat under half of the nurses evaluated had adequate knowledge of infection prevention procedures for urethral catheters.

#### **Evaluation of the studied nurse's practices:**

The current study found that about three-fourths of studied nurses had incompetent practices pre intervention which markedly decreased post intervention with statistically significant difference. This results may attributed to that most of our studied nurses not attending any previous training programs and about nearly half of the studied nurse's attending only one training session.

These results were in line with the findings of **Algarni, Sofar, & Wazqar, (2019)** that showed revealed almost all nurses performed insufficient CAUTI prevention practices. **Niederhauser et al., (2020)** titled "Progress! Safe Urinary Catheterization Collaboration Group. Nurses' and Physicians' Perceptions of Indwelling Urinary Catheter Practices and Culture in Their Institutions." who emphasized that, Modifying the individual standards and behaviors of the participating healthcare professionals, as well as the culture within the setting, is required to improve practice in urinary catheter installation and removal. A well-planned training program is essential to effective catheter care enhancement.

These findings were likewise consistent with those of **Andrea et al., (2019)** who stated out in the study named "Change in staff perspectives on indwelling urinary catheter use after implementation of an intervention bundle in seven Swiss acute care hospitals: results of a before/after survey study" who confirmed that, changes in staff

knowledge and attitudes are needed to improve practice regarding appropriate catheter utilization and prevention of catheter-associated infections. Also, **Ivy et al., (2021)** titled " Knowledge, Attitude and Practice about catheter-associated urinary tract Infection (CAUTI) Prevention: A cross-sectional Study" noticed following the introduction of a multidisciplinary intervention bundle, who witnessed positive improvements in staff knowledge, practice, and attitudes towards catheter-associated urinary tract infections.

Another similar study carried out by **Algarni et al., (2019)** who noticed that, a new study conducted among medical and surgical intensive care nurses in Saudi Arabia discovered that the majority of the nurses had poor knowledge and practice with CAUTI prevention. The study cited a lack of effective CAUTI prevention guidelines in the clinical area as a possible reason for nurses' poor practice. **Mukakamanzi, (2018)** founded that only half of the studied sample had good practice toward infection control in the usage of catheter after application of an educational program.

According to **Ivy et al., (2021)** indicates that Knowledge was found to be considerably and beneficially influenced by nurses' attitudes and perceptions of CAUTI prevention practice, Knowledge and attitude have been revealed to understand the variation in observed preventive practice. The findings agreed with those of **Huang et al., (2023)** "Knowledge, attitudes and practices concerning catheter-associated urinary tract infection amongst healthcare workers: a mixed methods systematic review" which clarifies that The KAP model (knowledge, attitude, and practice) is the most often used model to describe how individual knowledge and attitudes influence achievements. These three components have a dialectical interaction .

Our results are also supported by the findings of the study conducted in Ethiopia by **Desta et al., (2018)** who pointed in the study titled "Knowledge, practice and Associated Factors of Infection Prevention among healthcare workers in Debre Markos Referral Hospital" which confirmed that, nurses' knowledge–practice gap in urinary catheter care is still observable in current practice. Also, CAUTI could be caused by a dearth of information, practice, and attitude among nurses concerning fundamental preventative practices. Poor knowledge among nurses is dangerous because it poses an obstacle to infection prevention and control practices, putting patients' health at risk. Educational intervention is necessary to

improve nurses' knowledge regarding infection control practices and narrow the knowledge-practice gap.

The World Health Organization **WHO**, (2023) stated that learning and training of healthcare workers is an essential component of avoiding infections. It has been proved that taking healthcare professional's education into CAUTI prevention programs contributes to reducing catheterization time. To meet demands of CAUTI's prevention and management, education and training of healthcare workers on catheterization indication, catheter insertion and care, early removal of urinary catheter is vital.

Another study by **Andrea et al., (2019)** reported that that minimizing incorrect urinary catheter usage reduces urinary catheter damage. The enactment of a multidisciplinary intervention bundle aimed at reducing unneeded catheter usage, proper insertion techniques, and appropriate catheter maintenance, in addition to educational activities that raise recognition between healthcare providers and assure safe catheter utilizing, is usual within these studies. All of these results were likewise consistent with those of **Balu et al., (2021)** who showed that CAUTI can cause a variety of medical problems in hospitalized patients, including fever, bodily pain, and extended antibiotic use, which can contribute to the creation of multidrug resistant microorganism.

Previous findings were accepted by **Jain et al (2020)**, who demonstrated that the majority of CAUTI may be avoided by complying with sufficient instructions and precautions such as hand hygiene when performing appropriate procedures, thorough maintenance of the catheter and the catheter removal. Inappropriate urinary catheterization and catheter for a prolonged time must be prevented. To enhance patient care, based on evidence practices must be adopted.

### **Children health assessment**

In terms of pediatrics patients' socio-demographic traits and clinical data, According to the study's findings, boys made up more than half of the children in both groups (pre and post intervention), and the median duration of a urinary catheter within the child's systems was greater than 10 days in both pre and post intervention groups.

This may be explained by the fact that the most of the pediatric patients who are in the current research required the placement of a urinary catheter for calculations involving intake and output lasting more than a week. These results were at odds with **Tweddell, et al (2019)**. "Health

care-associated infections are associated with increased length of stay and cost but not mortality in children undergoing cardiac surgery " In children undergoing heart surgery, health care associated infections are related with higher periods of stay and expenses, but not with fatality. Who revealed that almost all of pediatrics patients in PICU were girls with an average age of 11 months, but they additionally found that the typical time of urinary catheterization was 5 days, and that this prolonged catheterization may have increased CAUTI risk in the PICU by 5% per day .

According to the research of the present study, the most of pediatric patients having leukemia, and regarding the indication for urinary catheter placement, about half of them had catheters for calculating intake and output. This may be because the majority of pediatric children with kidney problems may require the placement of a urine catheter for the calculation of intake and output. These findings agreed with those of **Tweddell et al., (2019)**. They discovered that among pediatrics ICU patients, acute kidney impairment was the biggest risk independently linked to CAUTIs.

About half of children had urinary catheters for calculation of the fluid intake and output and more than one third of children had catheterizations lasting longer than 10 days which agreed with the results of the study by **Abu Samra & Elsayed, (2022)**, they researched " the effectiveness of evidence-based guidelines on catheter associated urinary tract infection rate among pediatric intensive care children".

In terms of fever and leukocytosis, there is significant variation detected among pediatric patients before and after intervention, which is consistent with previous finding **Zaiton, Relloso, &Medinah,( 2019)**. Who carried out research on "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" noted that most symptoms of UTI are not specific, and the majority of patients have fever and leukocytosis. This could be due to positive effect of applying nursing care bundle about urinary catheter which leads to reduce the rate from CAUTI in pediatric patients post intervention

Our findings demonstrated that more than half of the studied children had positive urine cultures pre intervention compared to one-third of the studied children post intervention, a substantial change. As the most common CAUTI criteria were

positive urine cultures, this could be a sign of the influence of proper intervention on the CAUTI rate in pediatrics patients post intervention. This result was consistent with that of the study by **Abu Samra & Elsayed, (2022)** who observed that one-third of the paediatric patients in the case group developed positive urine cultures, when compared to roughly two-thirds in the control group and These results were in the line with the findings of **Huang et al., (2023)** who suggested that HCWs play a critical role in implementing infection prevention and control measures and verified that 69% of infection can be averted if standards are closely adhered to. Only when HCWs convert their abundant information about CAUTI into believe can they adopt a constructive approach towards improving their CAUTI preventive and control practice. As a result, if nurses lack relevant information and ethical behavior practice, the possibility of bacteria colonization and infection spread increases.

#### Conclusion

According to the effect of applying the nursing care bundle about urinary catheters, there was an improvement in nurse's knowledge, and practice, and a decrease in the incidence of urinary catheter infection in children when compared to before it was implemented.

#### Recommendations:

Regular continued education courses for nurses should emphasize the relevance of the CAUTI care bundle strategy and how it is implemented.

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