# Effect of Implementing Educational programs on Reducing Urinary Tract Infections among Patients with Urinary Catheterization

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**Abstract**

**Background:** Urinary tract infection (UTI) is the most frequent and serious issue with urinary catheters. **Aim:** was to evaluate the effect of implementing educational programs on reducing urinary tract infections among patients with urinary catheterization. **Methods:** Quasi-experimental design was used. **Setting:** the study was conducted at the urology department at Benha University Hospitals. **subjects:** all available nurses (30) working in the urology department and a purposive sample of 60 adult patients in need of urethral catheterization for more than seven days, Equally divided randomly into (30) a study group and (30) control group. **Three tools** were used for data collection including nurses' knowledge assessment questionnaire, nurses' practice observational checklist regarding the care of long-term urinary catheters, and patients' social and biomedical data. **The results:** The control group's positive urine culture rate (86%) was greater than the study group's rate (6.6 percent ). The outcomes also showed that nurses' understanding and practice of catheter patient care considerably increased following the implementation of the nursing education program. **Conclusion:** The implementation of the nursing training program reduces the incidence of urinary tract infections in catheterized patients, and there are notable variations in the knowledge and performance of nurses before and after its implementation. **The study recommended** that to avoid catheter-related urinary tract infections, establish treatment guidelines. A written training program on catheter use, insertion, removal, and maintenance should be provided and put into practice. Ensure you have the tools needed for sterile catheterization on hand. Make sure there are enough skilled nurses and technical resources available to reduce catheter-related UTI occurrence and promote outcomes.

**Keywords**: Nursing educational programs, Urinary catheter, urinary tract infection

## Introduction

Nosocomial infections may be endemic or epidemic. The most frequent infections are endemic ones. A specific virus or infecting organism may experience an aberrant rise from its baseline during outbreaks, which are known as epidemic infections. Nosocomial infections can be brought about by a wide variety of pathogens. Different patient demographics, healthcare settings, and institutions have different infecting microorganisms (Bernard et al., 2020).

Due to complications and frequent recurrences, catheter-associated urinary tract infection (CAUTI) is the most prevalent type of nosocomial infection and a significant public health issue. Gram-negative bacteria that cause CAUTIs and these infections frequently express a variety of virulence factors linked to biofilm development as well as factors that harm the host (Sorbye et al., 2018).

In hospitals and nursing homes, indwelling catheters are a common medical device used to treat urine retention and incontinence. The Foley indwelling catheter, a closed sterile system that consists of a tube that is placed through the urethra and maintained in place by an inflating balloon to allow bladder voiding, is the most often used catheter ( Wald et al., 2018).

The nursing team is trained to properly treat patients as needed and to perform catheterization in a sterile manner. They are also taught to wash their hands because they are aware that this practice is a key contributor to UTI outbreaks and cross-infection. antiseptic treatment. Caretakers must address the requirements, need for, and length of catheterization with the medical team since the longer the catheter is left in place, the higher the risk that the patient will acquire a UTI ( Sorbye et al., 2018).

By implementing the proper preventative and therapeutic measures for the risks and advantages of catheterization, caregivers must assist carers in adjusting care. For caregivers to prevent the development of urinary tract infections, it can also be highlighted that preventive actions are equally vital as alternatives to utilizing a urinary catheter. With the use of these techniques, nursing teams may provide more individualized and effective care (Healthcare Infection Control Practice Advisory Committee. 2019)

***Significance of the study:***

A urinary catheter is thought to be present in 10–12 percent of hospitalized patients and 4 percent of outpatients at any given time. Risk factors for CAUTI include female gender, aging, extended hospital stays, immunocompromised patients, open-closed systems, illness comorbidities and management (such as diabetes, kidney disease, and use of systemic antibiotics), and inadequate aseptic technique (Letica et al., 2019)

The prevalence of CAUTI is high, according to the European Centre for Disease Control and Prevention's 2016 annual epidemiological study. The fact that medical staff in the ICUs under study did not follow infection prevention packages when placing and holding catheters is probably to blame for the high occurrence of CAUTI. The infection control team should concentrate their efforts on educating the public and disseminating information regarding bundles to encourage caution when inserting and holding the catheter. In this study, the most frequently isolated species in intensive care units were Klebsiella, Staphylococcus, and Escherichia coli. This might be caused by healthcare professionals not practicing proper hand hygiene, and environmental contamination might also play a role. This is similar to several surveillance studies that have been conducted in Europe, the United States, Egypt, and Saudi Arabia (Talaat et al (2016).

**Aim of the study:**

This study aimed to evaluate the effect of implementing nursing educational programs on reducing urinary tract infections among patients with urinary catheterization.

**Research hypotheses:-**

1. Compared to the pre-nursing education program, the nursing education program significantly enhanced nurses' understanding of long-term catheters and urinary tract infections.
2. Compared to the pre-nursing education course, the nursing education course had a substantial positive impact on the practical value of nurses caring for catheterization patients.
3. The study group experienced fewer urinary tract infections than the control group did.

**Material & Method**

**Research design:**

A quasi-experimental design was used in this study.

**Research Setting:**

The current study was applied in the urology department at Benha University Hospitals.

**Materials:**

***1- Nurses:***

A convenience sample of all available nurses (30) working at the urology unit at Benha university hospitals and who deliver direct care to patients with a urinary catheter.

***2- Patients:***

A purposive sample of 60 pre-operative adult patients with the recent indwelling urethral catheter was assigned and divided equally into two homogenous groups; 30 patients study and 30 patients control group selected according to the following:-

**Inclusion criteria:**

- Both sex with ages ranging from 21- 60 years old

- Long-term catheterization (for one week or more).

- On closed urinary drainage system.

- No local urinary antiseptics therapy recieved.

**Exclusion criteria:**

- Infected patient with; tonsillitis, chest infection, or bowel infection.

- Patient with urinary tract infection as proved by urine culture.

-Comorbid diseases e.g, DM, malignancy, anemia, or infection.

**Tools of the study:**

**1-Nurses' knowledge assessment questionnaire regarding long-term urinary catheters:**

This tool was developed by the researcher and adapted from previous studies after reviewing related literature (**Saint, et al ., 2020, Gokula. et al.. 2017 Fakih, et al., 2019)** to assess nurses' knowledge regarding long urinary catheterization and urinary tract infection. It is composed of two parts.

**Part (A): Sociodemographic characteristics of nurses:** included age, marital status, educational level, and years of experience.

**Part (B): Nurses' knowledge regarding long-term urinary catheters:** It included (74) closed questions. It included the following items; (4) questions related to the anatomical parts of the urinary system,(3) medical expressions concerning the urinary system,(3) investigations related to the urinary system,(3) The common urinary system diseases,(3) intake and output, (2) urine characteristics,(3) indications and contraindications of a urinary catheter, (9) complications of urinary catheter,(18) procedure of urinary catheter, (13) infection control for the patient with urinary catheter infections and (13) nursing management for patients use a urinary catheter.

***Knowledge scoring system:***

The component of each accurate response determines the importance of each knowledge variable. The knowledge exam has a score of 148 after computations based on the test data, with the following scores: Completed (2), Not Completed (1), and Incorrect (0). Here are the results of the knowledge test, calculated as a percentage out of a potential 148 points: **Good**: 148- 89 score
**Moderate**: from 88- 45 score
**Poor:** 0- 44 score

**2- Nurses practice observational checklist regarding the care of long-term urinary catheters**

It was developed by the researchers according to the review of the literature **(Christine, 2016 Allegranzi, et al ., 2017).** It was utilized to assess nurses' practice regarding care of long-term urinary catheter insertion and subsequent care for study groups. It included (57) steps divided as (2) steps related to pre-catheterization preparation, (13) steps for patient preparation, (14) steps for catheterization procedure, (17) steps for continuing care, (11) steps for a sterile method for obtaining a urine sample.

**Practice scoring system:**

The number of sub-items is used to grade reviews of the observation checklist. There are (2) points for completed exercises, (1) for incomplete exercises, and (0) for not done. The total score was 114 points when the scoring system for the list of tools was calculated.

The score of nurses' practice expressed as percent from a maximum of 114 points as follows:
**Good:** 114- 86 score
**Moderate:** 85- 57 score
**Poor:** 56- 0 score

***3- Patients' social and biomedical data:***

**Biomedical and bacteriological data**

(1) Sociodemographic characteristics of the patient involved: age, gender, marital status, educational level, occupation, and residence.

(2) Past medical history for Duration of the previous hospitalization, reasons for the previous catheterization if any type of catheter material, catheter design, and size, numbers of catheters & urine bag change. Previous medication, and investigations.

(3) Current medical history: Length of hospital stay, mobility status, catheterization duration, type of catheter material, catheter design, and size, the problem associated with urine flow,

frequency of drainage bag emptying, usage of separated collection jug,

**Bacteriological studies and culture:**

When there were more than 10 colonies of variable bacteria per milliliter of urine, an infection of the urinary tract was present. Bacterial counts between 10,000 and 100,000 colonies/mL are regarded as latent infections, while counts of less than 10,000 colonies are termed "contaminated" or normal flora (Department of Health, Esclarin, 2016).

To evaluate the morphology of the organism, Gram staining was used to create films from newly formed colonies (appearance and color of the colonies). Additionally, a microscopic analysis of the urine samples that were taken was done to look for pus cells and red blood cells (Fink et al., 2012).

***Content validity and reliability:***

A group of five medical and nursing specialists reviewed the data collection tools for comprehensiveness, applicability, and legibility to assess the face and contentvalidity. The educational program's goals and content are approved by the same professionals. The modification was made following the panel's assessment of the content's appropriateness, completeness, and sentence clarity. The reliability of the tools (I, II) was verified using Cranach's Alpha coefficient test, which showed that each item was made up of the most similar items. The scores for the nurses' knowledge evaluation questionnaire and practice observational checklist were 0.943 and 0.972, respectively.

**Pilot study:**

Three nurses and six patients participated in pilot research to determine the produced tool's clarity and usefulness in providing the relevant data after making the necessary improvements.

**Fieldwork :**

The six-month data collection period began in September 2019 and ended in March 2020.

The investigation was done in four stages (preparation and evaluation, planning, implementation, and evaluation). Reviewing research and theoretical knowledge of current literature and research topics through textbooks, evidence-based articles, Internet journals, and journals is a part of the preparation and assessment phase.

For nurses: Three days a week, in the morning and afternoon, researchers came to the urology department to gather data. The researchers interviewed four to five nurses every day on average from among the available nurses. Before collecting any data, the researchers verbally got the urology nurses' agreement to participate in the study at the beginning of the interview after introducing themselves and outlining the study's goals and anticipated outcomes. The Nurse Knowledge Assessment Questionnaire and the Nurse Practice Observation Checklist were then used by the researchers to evaluate nurses' understanding and practice of caring for catheterized patients (Tools I and II). The conversation lasted between 25 and 35 minutes. This month-long stage is known as the pre-implementation phase of creating an educational plan (pre-testing).

For the benefit of the patients: Sociodemographic and medical history questionnaires were completed by patients in a control group who underwent a pre-educational program implementation and were frequently admitted to the hospital (Tool III). One month passed during this time.

The planning phase was established to solve the knowledge and practice gaps in urological catheterization care among registered nurses. It was based on the findings of pre-planning assessments utilizing questionnaires, observation lists, and literature studies (Stephan et al, 2016).

It includes the formulation of training initiatives designed by researchers to advance nurses' skills and knowledge in providing long-term catheterized patients with care. The instructional program is divided into four lessons. The first lesson covers the goal of the training educational program, a review of the fundamental components and physiology of the lower urinary system (meaning of catheter terms, indications, and contraindications for catheterization, Understanding the types of

catheters, demonstrating catheter length and size ranges, explain catheter materials and their suitability, balloon size ranges, catheter complications, definitions and causes of urinary tract infections, symptoms of urinary tract infections, urinary tract infections diagnosis, drug treatment of urinary tract infections), Preparation for catheterization, information patients should know about bladder catheterization, safety measures to take before to catheterization, actions necessary for catheterization, justification for each phase of the procedure, and Chapter 1 are all included in the third portion. (Fourth part) Sessions (Applying infection control precautions, nursing steps to reduce infection in long-term catheterized patients, how to obtain a urine sample, the role of care for each complication).

Each subgroup of nurses participated in a 2-week session to complete the implementation phase. Five months passed during this phase. Each session starts with an overview of the previous session and a discussion of the objectives for the upcoming session, taking into mind the appropriateness of Arabic usage for the level of nurse education. In this study, the motivation to share was raised via in-session reinforcement and motivation.

There were six meetings in all. divided into two classes on knowledge and four lessons on application. The length of knowledge classes ranges from 45 to 60 minutes. Nurses were separated into various groupings. To gather relevant information, each group had 4-5 nurses. A leaflet is supplied with each nurse. Researchers keep improving the data they've collected, responding to any queries and offering suggestions. The length of the practical sessions, which lasted 45 to 60 minutes, varied, and there were four sessions for each group (4-5 nurses). Group discussions, lectures, demonstrations, and re-demonstrations are all examples of teaching techniques. Handouts, movies, and data presentations made up the media used.

Nurse Assessment Phase: Researchers compared nurses' knowledge and practice levels before and after the educational program (Tool II) in the education program to assess the effectiveness of the educational program's implementation. These learning tools included the Nurse Knowledge Assessment (Tool I) and Nurse Practice Observation. used three times before, right away, and three months after the program's start. It lasted for one month. For patients: The researcher interviewed the study group of patients post-educational program implementation who received care based on the educational program to complete thesocio-demographic and medical history sheet (Tool III). This phase took three months.

**Administrative design:**

The administrator has only formally approved one setting. The study's nature, goal, and anticipated outcomes are all expressed in straightforward terms. The nurses gave their informed consent to perform this study.

**Ethical consideration:**

Before the study's start and with the cooperation of patients and nurses, scientific research at the Benha University School of Nursing accepted the research plan. Data confidentiality and patient and caregiver privacy.

**Statistical analysis**

Version 25 of the statistics package SPSS (SPSS). Statistics were considered significant for P values under 0.05. Categorical variables were reported as absolute values, and the Fisher's exact test or the 2 test, as appropriate, was used to compare percentages. The mean and standard error is used to express continuous variables. To compare continuous variables, the Student's F-test was used. The Pearson correlation analysis was used to evaluate the relationships between the variables ***( Ansari et al., 2003).***

**Result:**

**Part I: Sociodemographic characteristics of study nurses**

Table 1 shows the distribution of study care together with sociodemographic data.

With a mean age of 32.95 and 8.57 years, the nurses' ages ranged from 20 to 45. All of them were married, 80% of the trained nurses had degrees, and 50% of them had between five and ten years of urological experience.

Table (2) demonstrates that there were highly statistically significant differences in all student nurses' understanding of urinary system anatomy and physiology, urinary system-related medical terminology, and knowledge of examinations between the items before training, after training, and three months after training. Except medical terms related to the urinary system (p=0.002), the urinary system, common diseases associated with the urinary system, intake and excretion, urine characteristics, indications and contraindications for catheterization, kinds, and characteristics of catheters, infection control, catheterization procedures, complications, and care management (p=0.0001).

Table 3 showed The completion times of the three training programs related to pre-catheterization, preparation, catheterization procedures, and methods of obtaining sterile samples in registered nurse practice revealed statistically highly significant differences (0.0001) between them. Permanent Care Representation (0.0002).

Table (4) showed a highly significant correlation between student nurses' knowledge and practice before, right away, and three months after the start of the training program is shown in the table with the correlation coefficient P = (0.001, 0.001, 0.002).

Table (5) shows that there is a highly significant correlation coefficient between the study nurses' practice and the frequency of urinary tract infections, P = 0.001. (0.001, 0.001 at 3rd post-catheterization, 4th day after catheterization, and before extubation, respectively, and 0.002). (0.0001, 0.0001 and 0.002).

Table (6) Comparison of the study group's and the control group's sociodemographic data on catheter use In both the research and control groups, more than half of the patients were between the ages of 50 and 60. (56.7 percent and 60 percent, respectively). The two groups did not statistically differ from one another. According to the distribution, the study group (80%) and the control group (80%) had more male patients than female patients (76.5 percent ). In both the research and control groups, married patients made up the majority of the sample (100 percent and 90%, respectively).

In terms of education, just 16.7% of those in the study group had both secondary education and a university degree, while only 13.3% of those in the control group had both secondary education and a university degree. The chart also demonstrates that both the research and control groups included employees (73.3 and 80 percent, respectively). Two groups were discovered to reside in rural areas, with 66.7 percent and 46.7 percent, respectively.

Table (7) shows the distribution of the catheter study and control groups by an underlying disease. Hospital stays might last anywhere from 7 days to more than 15 days. Compared to the control group, approximately 60.6% of the study group's patients spent 8–15 days in the hospital (46.7 percent ). Regarding the indications or causes for catheterization, it was found that only 30% of the sample in the control group had a catheterization to treat urinary retention, compared to less than half of the sample (46.7%) in the study group. Urinary flushing was the second reason for catheterization, accounting for 20% in the study group and 40% in the control group. Postoperative care was the third justification for catheterization in both groups (33.3 percent and 30 percent, respectively)

Additionally, it can be noted that 46.7 percent of the study group had intubations lasting 5 days or longer, whereas 46.7 percent of the control group had intubations lasting 3 days or less. Intubation time, catheter material, and catheter design did not significantly differ between the two groups.

It is also obvious that 18ch and 20ch conduits are the most widely used conduit sizes. In terms of the size of the 18-channel catheter, the study group made up 43.3 percent and the control group made up 50%, while the size of the 20-channel catheter made up 40% of the study group and 20%) to represent the

control group. Otherwise, both the control group and the study group (16.7%) employed 16-channel catheters (30 percent ).

The majority of individuals in both the study and control groups did not change their catheters, which was the same for both groups in terms of the number of catheter changes (83.3 percent and 70 percent, respectively). The bulk of the urine bags in the two groups, or 70% and 80% of the study and control groups, respectively, can also be seen to be unchanged. If pee bags were changed, it was because the outlets in both groups were contaminated (66.7 percent and 50 percent, respectively).

Figure(1) illustrates the distribution of study and control groups with a urinary catheter according to their previous taking of medication.
The figure shows that more than half of the study group (53%) take medication, and less than half (47%) in the control group.

Figure 2 illustrates the distribution of the catheter-use study and control groups following the initial investigation. Both the control group and the study group submitted 100% of their samples for urinalysis (92 percent ). Additionally, the majority of them (94%) in both the study group and the control group had blood testing done (88 percent ).

Table (8) shows both groups according to their prior medical histories, the distribution of catheters in the study, and the control groups. The hospital stay lasted somewhere between 7 and 15 days. Within 8 to 15 days, hospitals admitted more than half of both the study group (53.3%) and the control group (30.3%). Only the study group (13.3%) and the control group (13.2%) experienced the 7-day length (43.3 percent ). Most samples were found to be mobile in both groups, with 76.7 percent in the study group and 60 percent in the control group, according to mobility status.

Regarding the length of catheterization, the majority of samples revealed that both the study (76.7%) and the control group's catheters were worn for between 7 and 15 days (66.6 percent ). In terms of catheter type, insertion time, and design, there were no notable variations between the two groups. It is also obvious that 18ch and 20ch conduits are the most widely used conduit sizes. In the research (63.4%) and control group (66.6%), the 18-channel catheter size was represented, although the 20-channel catheter size was present in both groups (30 percent ). The size of the catheter did not significantly differ between the two groups (p = 1.470).

Constipation, irritability, and soreness were reported to be prevalent issues with urinary flow issues. Block in the study (66.6%) and control group (73.3%), irritability and pain in the study (13.3%), and block in the control group (16.7 percent ). The table demonstrates that both groups' samples featured an open-closed drainage system for emptying the bag and gathering the urine sample during the whole sample. Additionally, fewer than half of the participants in the research and control groups had a mechanism for open drainage to take the place of the drainage bag (43.3 percent, 36.7 percent ).

It was discovered that most samples in both groups urinated three times daily on average, which was the same in the study and control groups (76.7 percent and 66.6 percent, respectively). It is important to note that whereas all samples in the control group used the same jar for collection, all samples in the study group used separate collection jars.

**Figure 3** illustrates the distribution of study patients according to their diagnosis, benign prostatic hyperplasia was the main diagnosis; represented( 60%), while ureter stone and urethral stricture were the initial diagnoses for ( 20%) and (10%), respectively.

Table (9) shows the distribution of manifestations of urinary tract infections among both groups. The main manifestations among the study group were back pain and suprapubic pain which represent (20.3% and 16.7%) respectively. While the main manifestation in the control group was fever and bladder cramps which represent (26.7% and 20%) respectively. There were no statistically significant differences in both groups where the p-value ═ 0.064 and X2 ═ 10.427

**Table (10)** displays the results of urine culture, and demonstrates that the majority of the control group immediately before catheter removal (73.3%) had positive culture,

compared to less than half (43.3%) of those in the study group; this difference was statistically significant (p = 0.001).

Table (11) shows the pus cell counts ⁄ HPF as estimated on the 1st, 4th , and before removal of urinary catheter in relation to different pathogenic organisms. For the study group, it was found that the most common pathogenic organism isolated on the 1st, 4th day of catheterization and before removal of the catheter was Klebcills spp. with 23.3%, 26.7%, and 10% respectively, followed by Pseudomonas spp. with 13.3%, 6.7% and6.7% then E.coli with 13.3%, 3.3% and6.7% respectively with a pus cell count of more than 5⁄ HPF. The majority of patients on the 1st, 4th day of catheterization and before removal of catheter showed (a total of 76.6%, 56.7%, and 50% respectively) pus cell count of more than 5⁄ HPF, while (a total of 23.3%, 43.3% and50% respectively) showed pus cell count of less than 5⁄ HPF. There was a statistically significant variance among the three times where P-value = 0.047.

The same result was found in the control group were the most common pathogenic the organism was isolated on the first, and fourth day of catheterization and before the removal of the catheter was Klebcills spp with a total of 26%, 16.7%, and 30% respectively, followed by Pseudomonas spp. with a total of 20%, 13.3% and7.5% respectively then E.coli with a total of 10%, 10%, and 6.7% respectively with a pus cell count of more than 5⁄HPF.

**Table (1):** Socio-demographic characteristics of the studied nurses (N=30)

| **Items** | **Nursing staff (n=30)** | |
|---|---|---|
| | **N** | **%** |
| **Age:** | | |
| 20-25 | 14 | 46.7 |
| 25-35 | 13 | 43.3 |
| 35- 45 | 3 | 10.0 |
| **Range** | **21-45** | |
| **Mean±SD** | **32.95±8.57** | |
| **Marital status** | | |
| Single | 0 | 0.0 |
| Married | 30 | 100.0 |
| **Educational level** | | |
| BScN | 1 | 3.3 |
| Technical institute with a specialty in nursing science | 5 | 16.7 |
| Diplom | 24 | 80.0 |
| **Range** | **1-16** | |
| **Mean±SD** | **10.50±9.26** | |
| **Years of experience in the urology department** | | |
| 1-5 | 9 | 30.0 |
| 5-10 | 15 | 50.0 |
| 10+ | 6 | 20.0 |
| **Range** | **1-13** | |
| **Mean±SD** | **6.77±4.79** | |

**Table (2):** Mean score of nurses` knowledge regarding the care of the patient with urinary catheter .

| Knowledge items | Pre educational programs | Post-educational programs | 3 months post-educational programs | F | P |
|---|---|---|---|---|---|
| | Mean±SD | Mean±SD | Mean±SD | | |
| Anatomy and physiology of the urinary system | 2.91±1.91 | 6.57±1.69 | 4.91±1.95 | 160.23* | 0.0001* |
| Medical terminology related to the urinary system | 2.55±1.72 | 4.55±0.73 | 3.41±1.48 | 110.02* | 0.0002* |
| The investigation related to the urinary system | 1.18±1.45 | 4.73±0.87 | 2.45±1.17 | 200.52* | 0.0001* |
| Common diseases related to the urinary system | 0.89±0.57 | 4.73±0.87 | 2.45±1.17 | 158.72* | 0.0001* |
| Intake and output | 1.24±0.58 | 4.49±0.87 | 2.47±0.48 | 226.05* | 0.0001* |
| Urine characteristics | 1.12±2.0 | 3.11±0.81 | 2.0±0.94 | 217.75* | 0.0001* |
| Indication and contraindication of catheterization | 2.15±0.45 | 5.57±1.76 | 4.77±1.80 | 215.23* | 0.0001* |
| Types and characteristics of urinary catheter | 4.28±1.75 | 12.67±2.72 | 10.39±1.64 | 285.28* | 0.0001* |
| Infection control | 8.79±2.67 | 23.46±4.57 | 20.36±2.49 | 167.24* | 0.0001* |
| Procedure for catheterization | 18.34±4.67 | 33±15.49 | 28.67±12.68 | 197.25* | 0.0001* |
| Complications of urinary catheter | 8.37±4.28 | 18.73±6.57 | 16.47±6.43 | 156.84 | 0.0001* |
| Nursing management | 9.55±6.19 | 23.84±2.52 | 20.57±4.18 | 187.14* | 0.0001* |

***Significant P<0.05**

**Table (3):** Mean score of nurses` practices in the care of the patient with urinary catheter pre, and post-educational programs, and 3 months post-educational programs.

| Practices items (Ideal range) | Our educational programs | Post-educational programs | 3 months post-educational programs | F | P |
|---|---|---|---|---|---|
| | Range Mean±SD | Range Mean±SD | Range Mean±SD | | |
| Pre-catheterization | 1.12±2.0 | 3.11±0.81 | 2.0±0.94 | 217.75* | 0.0001* |
| Preparation with urinary catheter | 9.55±6.19 | 23.84±2.52 | 20.57±4.18 | 187.14* | 0.0001* |
| Catheterization | 10.12±3.42 | 24.21±4.12 | 19.50±3.28 | 167.24* | 0.0001* |
| Continuing care | 13±5.49 | 28.67±12.68 | 23.84±8.52 | 120.02* | 0.0002* |
| Sterile method of obtaining the sample | 10.39±1.64 | 18.73±6.57 | 16.47±6.43 | 128.51* | 0.0001* |

***Significant P<0.05**

**Table (4):** Correlation among nurses' knowledge and practices in nursing care of patients with urinary catheter.

| Variables | Pre- educational programs | | Post-educational programs | | 3 months post- educational programs | |
|---|---|---|---|---|---|---|
| | r | P | r | P | r | P |
| **Knowledge & Practices** | 28.5 | 0.001* | 97.5 | 0.001* | 82.5 | 0.002* |

***Significant P<0.05**

**Table (5):** Correlation among nurses' practices regarding nursing care of patients with urinary catheters and frequency of urinary tract infection.

| Variables | On insertion | | At fourth days | | Before removal | |
|---|---|---|---|---|---|---|
| | r | P | r | P | r | P |
| **Practices** | 28.5 | 0.001* | 97.5 | 0.001* | 82.5 | 0.002* |
| **Incidence of infection** | 55.8 | 0.0001* | 20.4 | 0.0001* | 8.5 | 0.002* |

***Significant P<0.05**

**Table (6):** Comparison between study and control groups with urinary catheters regarding their socio-demographic characteristics.

| Socio-demographic characteristics | Study group (N=30) | | Control group (N=30) | | X2 | P |
|---|---|---|---|---|---|---|
| | No | % | No | % | | |
| Age: | | | | | | |
| < 30 | 2 | 6.7 | 4 | 13.3 | | |
| 30-50 | 11 | 36.7 | 8 | 26.7 | | |
| > 50 | 17 | 56.7 | 18 | 60.0 | 0.4057 | 0.524 |
| Mean±SD | 45.50±11.33 | | 43.40±11.10 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Sex: | | | | | | |
| Male | 24 | 80.0 | 23 | 76.5 | 0.111 | 0.738 |
| Female | 6 | 20.0 | 7 | 23.3 | | |
| Marital status: | | | | | | |
| Single | 0 | 0.0 | 3 | 10.0 90.0 | - | - |
| Married | 30 | 100.0 | 27 | | | |
| Education level: | | | | | | |
| 1-Illiterate - Read & write | 10 | 33.3 | 11 | 36.7 | | |
| 2- Preparatory | 10 | 33.3 | 9 | 30.0 | | |
| 3-Secondary education | 5 | 16.7 | 4 | 13.3 | 0.000 | 1.000 |
| 4-High education | 5 | 16.7 | 6 | 20.0 | | |
| Occupation: | | | | | | |
| Not work | 8 | 26.7 | 6 | 20.0 | 0.400 | 0.527 |
| Work | 22 | 73.3 | 24 | 80.0 | | |
| Residence: | | | | | | |
| Urban | 10 | 33.3 | 16 | 53.3 | 3.600 | 0.057 |
| Rural | 20 | 66.7 | 14 | 46.7 | | |

**Table (7):** Distribution of study and control groups with a urinary catheter according to their past medicalhistory.

| Past medical history | Study group (N=30) | | Control group (N=30) | | X2 | P |
|---|---|---|---|---|---|---|
| | No | % | No | % | | |
| Duration of hospitalization: | | | | | | |
| 7 days | 4 | 13.3 | 12 | 40.0 | | |
| 8-15 days | 18 | 60.6 | 14 | 46.7 | 6.000 | 0.143 |
| > 15 days | 8 | 26.7 | 4 | 13.3 | | |
| Reasons for catheterization: | | | | | | |
| Postoperative | 10 | 33.3 | 9 | 30.0 | | |
| Retention | 14 | 46.7 | 9 | 30.0 | 1.742 | 0.186 |
| Irrigation | 6 | 20.0 | 12 | 40.0 | | |
| Duration of catheterization: | | | | | | |
| 3-5 days | 11 | 36.7 | 14 | 46.7 | | |
| 5-10 days | 14 | 46.7 | 14 | 40.0 | 0.888 | 0.345 |
| > 10 days | 5 | 16.7 | 4 | 13.3 | | |
| Type of catheter material: | | | | | | |
| Latex | 25 | 83.3 | 21 | 70.0 | 4.000 | 0.145 |
| Silicone | 5 | 16.7 | 9 | 30.0 | | |
| Design of catheter: | | | | | | |
| Double lumen | 28 | 93.3 | 27 | 90.0 | 0.333 | 0.563 |
| Triple lumen | 2 | 6.7 | 3 | 10.0 | | |
| Size of catheter: | | | | | | |
| 16 ch | 5 | 16.7 | 9 | 30.0 | | |
| 18 ch | 13 | 43.3 | 15 | 50.0 | 2.777 | 0.095 |
| 20 ch | 12 | 40.0 | 6 | 20.0 | | |
| Numbers of catheter changes: | | | | | | |
| None | 25 | 83.3 | 21 | 70.0 | | |
| Once | 5 | 16.7 | 9 | 30.0 | 2.666 | 0.102 |
| More than one time/ month | 0 | 0.0 | 0 | 0.0 | | |
| Change of Urine bag: | | | | | | |
| Yes | 9 | 30.0 | 6 | 20.0 | | |
| No | 21 | 70.0 | 24 | 80.0 | | |
| In case of yes, due to:- | | | | | 1.000 | 0.317 |
| Damaged outlet | 1 | 11.1 | 1 | 16.7 | | |
| Contamination to outlet | 6 | 66.7 | 3 | 50.0 | | |
| Leakage from outlet | 2 | 22.2 | 2 | 33.3 | | |

**Figure (1):** Distribution of study and control groups with a urinary catheter according to their previous taking of medication.

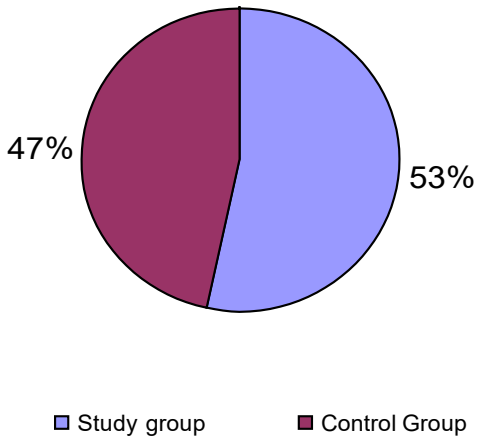


**Figure (2):** Distribution of study and control groups with a urinary catheter according to their previous investigations.

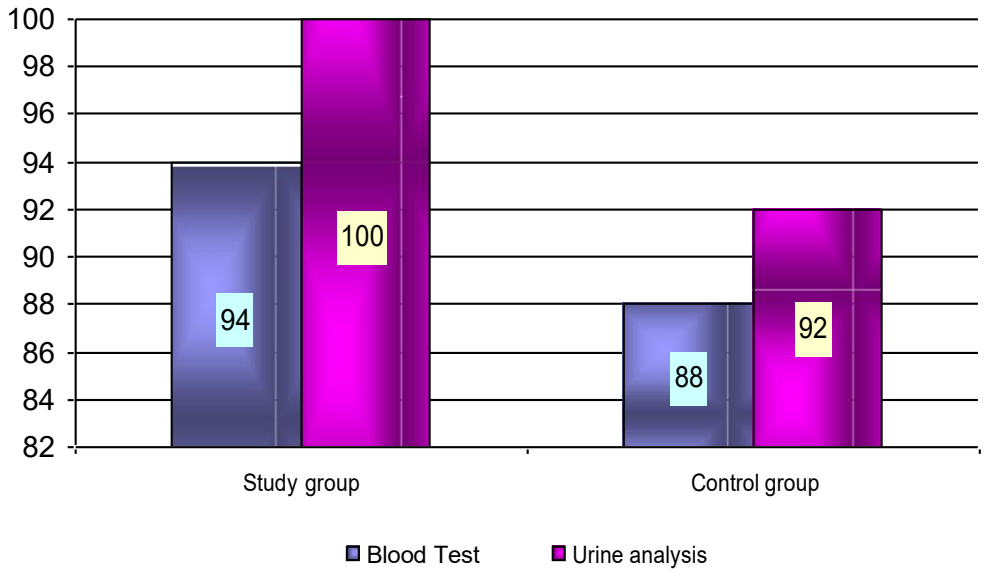

**Table (8):** Present medical history of study and control groups with a urinary catheter.

| Present medical history | Study group (N=30) | | Control group (N=30) | | X2 | P |
|---|---|---|---|---|---|---|
| | No | % | No | % | | |
| Duration of hospitalization: | | | | | | |
| 7 days | 4 | 13.3 | 13 | 43.3 | | |
| 8-15 days | 16 | 53.3 | 9 | 30.3 | 5.140 | 0.122 |
| > 15 days | 10 | 33.3 | 8 | 26.7 | | |
| Mobility state: | | | | | | |
| Mobile | 23 | 76.7 | 18 | 60.0 | | |
| Mobile with assistance | 5 | 16.7 | 9 | 30.0 | 4.130 | 0.157 |
| Immobile | 2 | 6.6 | 3 | 10.0 | | |
| Duration of catheterization: | | | | | | |
| 7 days | 3 | 10.0 | 5 | 16.7 | | |
| 7-15 days | 23 | 76.7 | 20 | 66.6 | 3.547 | 0.241 |
| > 15 days | 4 | 13.3 | 5 | 16.7 | | |
| Type of catheter material: | | | | | | |
| Latex | 3 | 10.0 90.0 | 5 | 16.7 | 4.789 | 1.050 |
| Silicone | 27 | | 25 | 83.3 | | |
| Design of catheter: | | | | | | |
| Double lumen | 28 | 93.4 | 26 | 86.7 | 3.457 | 0.147 |
| Triple lumen | 2 | 6.6 | 4 | 13.3 | | |
| Size of catheter: | | | | | | |
| 16 ch | 2 | 6.6 | 1 | 3.4 | | |
| 18 ch | 19 | 63.4 | 20 | 66.6 | 2.781 | 1.470 |
| 20 ch | 9 | 30.0 | 9 | 30.0 | | |
| Causes of problems associated with urine flow: | | | | | | |
| Leakage | 3 | 10.0 | 3 | 10.0 | | |
| Blockage | 20 | 66.6 | 22 | 73.3 | 4.258 | 0.0958 |
| Pulled out | 1 | 3.4 | 2 | 6.6 | | |
| Irritation and pain | 4 | 13.3 | 5 | 16.7 | | |
| *Causes of open closed drainage system: | | | | | | |
| For emptying bag | 30 | 100.0 | 30 | 100.0 | | |
| Take a specimen of urine | 30 | 100.0 | 30 | 100.0 | 5.247 | 1.028 |
| Changing urine drainage bag | 13 | 43.3 | 11 | 36.7 | | |
| Frequency of urine drainage bag emptying: | | | | | | |
| Once | 3 | 10.0 | 6 | 20.0 | | |
| Twice | 4 | 13.3 | 4 | 13.3 | 3.555 | 1.021 |
| Thrice | 23 | 76.7 | 20 | 66.6 | | |
| Use of separated collection bags: | | | | | | |
| Yes | 30 | 100.0 | 0 | 0.0 | - | - |
| No | 0 | 0 | 30 | 100.0 | | |

*More than one answer

**Figure (3):** Distribution of study patients according to their diagnosis.

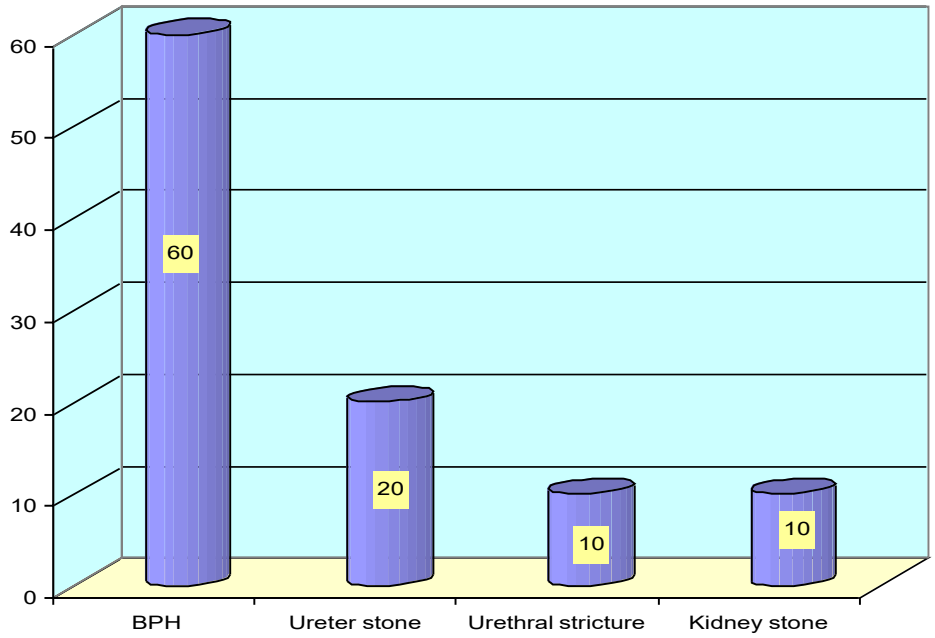


**Table (9)**: Distribution of manifestations of urinary tract infection among study and control groups.

| Manifestations | | Study (n=30) | | Control (n=30) | |
|---|---|---|---|---|---|
| | | № | % | № | % |
| Back pain | | 7 | 20.3 | 3 | 10.2 |
| Suprapubic pain | | 5 | 16.7 | 2 | 7.8 |
| Slight gross hematuria | | 3 | 10.2 | 3 | 10.2 |
| Turbid urine | | 2 | 7.8 | 2 | 7.8 |
| Fever | | 2 | 6.7 | 8 | 26.7 |
| Bladder cramp | | 1 | 4.3 | 6 | 20 |
| Chi-square | X2 | 10.427 | | | |
| | P-value | 0.064 | | | |

(*) Statistically significant at p<0.05

**Table (10): Urine culture result of the both groups during the first day after catheter Insertion, the fourth day, and before removal.**

| **Bacterial culture** | | **Stud group** | | | | **Control group** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **- ve** | | **+ ve** | | **- ve** | | **+ ve** | |
| | | **№** | **%** | **№** | **%** | **№** | **%** | **№** | **%** |
| First day | | 11 | 36.7 | 19 | 63.3 | 9 | 30 | 21 | 70 |
| Fourth day bacterial count | | 11 | 36.7 | 19 | 63.3 | 8 | 26.7 | 22 | 73.3 |
| Immediately before removal of catheter | | 17 | 56.7 | 13 | 43.3 | 8 | 26.7 | 22 | 3.3 |
| Chi-square | $X^2$ | 12.38 | | | | | | | |
| | P-value | 0.001* | | | | | | | |

(*) Statistically significant at p<0.0

**Table (11): P**us cell counts/HPF concerning different pathogenic organisms(№ = 30)

| Types of microorganism | Pus cell count on the first day | | | | Pus cell count on the fourth day | | | | Pus cell count before removal of the catheter | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | < 5 Pus cells/HPF | | > 5 pus cells/HPF | | < 5 Pus cells/HPF | | > 5 pus cells/HPF | | < 5 Pus cells/HPF | | > 5 pus cells/HPF | |
| | study % | control % | study % | control % | study % | control % | study % | control % | study % | control % | study % | control % |
| **Sterile** | 20 | 16.7 | 16.7 | 13.3 | 23.3 | 13.3 | 13.3 | 13.3 | 36.7 | 16.7 | 23.3 | 10 |
| **Klebsiella spp.** | - | - | 23.3 | 26 | 3.3 | 3.3 | 26.7 | 16.7 | - | 3.3 | 10 | 30 |
| **Pseudomonas spp.** | - | - | 13.3 | 20 | 6.7 | 3.3 | 6.7 | 13.3 | 3.3 | 3.3 | 6.7 | 7.5 |
| **E. coli** | - | - | 13.3 | 10 | 6.7 | 3.3 | 3.3 | 10 | 6.7 | | 6.7 | 6.7 |
| **Staphylococcus aureus** | - | - | 3.3 | 3.3 | - | - | - | 10 | - | - | - | 10 |
| **Proteus mirabilis** | - | - | 3.3 | 3.3 | 3.3 | 3.3 | - | 3.3 | - | - | - | 3.3 |
| **Candida albicans** | 3.3 | 6.7 | 3.3 | 3.3 | - | 3.3 | 6.7 | 3.3 | 3.3 | | 3.3 | 3.3 |
| **Total** | 23.3 | 23.3 | 76.7 | 76.7 | 43.3 | 30 | 56.7 | 70 | 50 | 23.3 | 50 | 76.7 |
| **Study group** | $X^2$ | | 4.862 | | | | | | | | | |
| | P-value | | 0.047 | | | | | | | | | |
| **Control group** | $X^2$ | | 0.467 | | | | | | | | | |
| | P-value | | 0.791 | | | | | | | | | |

## Discussion:

### *Nurses sociodemographic characteristics*

This result shows how the research nurses were distributed based on their sociodemographic traits, with ages ranging from 20 to 45. Half of the sample had ages ranging from 25 to 35. According to (Elpern et al., 2018), 40% of nurses were between the ages of 20 and 35, these findings are in line with their findings.

Regarding marital status, it was discovered that all nurses were married. This finding contrasts sharply with that of (El-Jardali, 2018), who discovered that more than half (57.1%) of the nurses who took part in his study were single. Only five nurses had technical colleges with nursing sciences concentrations, even though the whole sample's average educational level showed nursing diplomas to be higher.

This result contrasts with that of (Elpern et al., 2018), who discovered that while 92 percent of the nurses in his study had high school diplomas, only 8% of them were nurses. The findings also revealed that just a minority of the samples—50%—had more than ten years of experience, while the majority had five to ten years or less. This finding contrast with (Elpern et al., 2018), who discovered that 36% of RNs had 3-5 years of experience and 20% had 11-20 years. Only six nurses out of the sample had more than 10 years of urological expertise, while the majority of the sample had between 5 and 10 years.

The majority of the samples, it was discovered, had not participated in a general training program. This conclusion is corroborated by (Saleh, 2018), which discovered that less than 25 percent of nurses lacked a training course, and (Rawlins, 2020), which discussed the establishment of mentoring, educational programs, and training for nurses and new nurses. Important will aid in defining the laws and obligations. As a result, failing to give nurses a chance to adjust to the new work environment can result in major issues.

### *Nurses' knowledge and practice regarding pre, immediate, and post-educational programs:*

The current study discovered statistically significant differences in nurses' knowledge of the urinary system, the kidney, and kidney hormones, and differences between men and women before, immediately after, and after training. This finding supports the assertion made by Tortora and Grabowski (2020), who suggested that nursing staff should be knowledgable about the anatomy and

physiology before learning catheter-related skills.

Additionally, the findings revealed a statistically significant difference between nurses' knowledge of medical terms, surveys, and typical abnormalities of the urinary system between the first and third months following training. This is consistent with (Walsh, 2020), who emphasizes the need of having a solid theoretical understanding of the underlying principles of action before practice. He continued by saying that practice makes information effective.

This study demonstrated statistically significant variations in nurses' understanding of intake and inquiries before, following, and three months after the implementation of guidelines. Patients should get enough oral fluids to maintain an output of more than 50 to 100 mL/h, and adequate urine flow must be maintained. (Neil-Weise and van den Broek, 2018).

Foxley and Addison's (2018) reported that drinking water can help prevent the formation of bacteria in the urine by diluting it. Additionally, it offers a continuous flushing and downward draining effect. Constipation brought on by a lack of fluid intake might obstruct the passage of urine via the catheter by creating pressure, obstructions, and kinks.

According to recommendations for catheter care, cranberry juice's impact on the acidity of urine was evaluated by (Monroy-Torres and Macias, 2015). When habitually promoting this advice, nurses should use caution because the evidence suggests that cranberries must be consumed in large quantities to have adequate bacteriostatic effects.

In terms of nurses' knowledge of urine characteristics, results demonstrated a statistically significant difference between pre-educational programs both immediately and three months after teaching. This result is consistent with the findings of (Margaret and Colleges, 2019), who investigated the efficacy of a training program composed of educational sessions centered on understanding urine qualities that will identify the necessity for catheter replacement. Compared to pre-intervention recommendations, 15% of individuals who changed catheters had fewer infections after the program.

This study showed a statistically significant difference between pre-education programs in terms of knowledge of the indications and contraindications for urinary catheters. The results of (Crouzet et al, 2017), who standardized the indications for catheter insertion and/or removal training sessions, are consistent with this conclusion. After executing the instructional campaign, they discovered that the incidence of CAUTI reduced from 12.3 UTIs per intubation day to 1.8.

According to the findings (Margaret and Colleges, 2019), multifaceted catheters should be taken into account for the best CAUTI prevention education programs because there were statistically significant differences in knowledge of catheter types and characteristics before, after, and three months after the guideline. designed to support the use of silicone catheters impregnated with antibiotics, silver alloy hydrogel catheters, or other antimicrobial catheters.

This practice change program's main goal is to inform nursing staff about the effects of certain indwelling catheter procedures on preventing urinary tract infection issues in catheterized patients. This is in line with research by Newhous et al. (2017), which found that training greatly increased nurses' capacity to respond appropriately to test questions. Results revealed a highly significant difference in nurses' knowledge of the catheterization process, specific components of the described insertion technique, and the term "sterile," particularly nurses washing hands, opening sterile packaging for catheterization, and using sterile gowns and gloves.

The findings demonstrated that there were significant statistical differences in the understanding of infection control among catheter patients before, after, and three months after implementation. This outcome is consistent with (Apisarthanarak and colleagues, 2017), who discovered that more than three teams per indwelling catheter reviewed the days remaining and site of indwelling, appropriate and inappropriate catheterization indications, and reasons for initial catheterization were revised, and nurses monitored patients for CAUTI

manifestations. The intervention dramatically decreased the incidence of CAUTI, the number of unnecessary catheterizations, and the average length of catheterization.

According to Melissa and Schneider (2016), nurses adhere to the ethical rule of "do no harm." Patients may have issues if catheters are used carelessly or unnecessarily. It is an ethical obligation to research strategies to lower the incidence of UTIs and safeguard patients if these infections may be avoided by meticulous adherence to specified evidence-based regimens. The project intends to protect patients from preventable infections, decrease death from complications, and save significant amounts of money on medical treatment by reformulating practices and training nurses.

The most fundamental protocol is contained in indwelling catheter bundles. A closed system is maintained by limiting catheter connection disconnections, keeping the drainage bag below the level of the bladder, and ensuring that the individuals doing catheter insertion, maintenance, and weaning are adequately trained ( Lowry, 2020). When aiming to manage urinary tract infections in intubated patients, basic control procedures are crucial to increase safety and cut expenses (Harris, 2020). Furthermore, (Cornia et al., 2016) revealed that ensuring gravity-dependent urine flow and adhering strictly to infection control methods can both lower the risk of infection.

The study's findings revealed statistically significant variations in the nursing staff's understanding of nursing management of urinary catheter patients before, right away, and three months after the publication of the guideline. This result is comparable with that of (Rosenthal and colleagues, 2018), who looked at the impact of educational initiatives that included employee development and performance evaluation on the prevalence of CAUTI. An instructional program that covered hand hygiene and catheter care concepts was one of the interventions. Following the education/feedback intervention, there was a statistically significant and clinically important difference in the incidence of CAUTI.

explains the degree to which registered nurses have been practicing before, after, and three months following the guideline in preparing catheterized patients. The difference is statistically significant. (Margaret and Colleges, 2019) concerning catheterization under strict conditions for caretakers utilizing sterile or clean methods (eg, 4-minute hand washing or washing with soap and water, wearing sterile or non-sterile gloves and gowns, and catheters) Introduction to the training/feedback for insertion preparation Using a povidone-iodine solution to clean kites and dams helps to lower the prevalence of CAUTI.

The study's findings also showed that trained nurses' levels of practice in preparing catheters for patients before, after, and three months after the guideline varied significantly. This result is in line with (Kamdar et al., 2019), who state that nursing staff should be knowledgable prior aquiring skills to prepare patients for surgery. Examples of this preparation include talking to patients about procedures that lessen anxiety and patient embarrassment and making sure they understand so that informed consent was given.

The findings revealed statistically significant variations in registered nurses' level of practice for catheterizing patients before, immediately after, and three months after the introduction of the guidelines. To improve patient outcomes, professionals performing catheterization procedures need to be trained in aseptic techniques and have experience inserting and operating catheter systems (Ribby, 2016). To prevent CAUTI, those who insert the catheter must be well trained, and regression testing should be done to assure appropriate insertion (CDC, 2019).

The usage or practice of the aseptic approach during catheterization and upkeep of closure systems are stressed by (Gould et al., 2020). The ideal Foley catheter system is occluded and equipped with an indicator that verifies this fact. Willson et al. (2019) stated that their hospital's protocol requires that nurses wash the patient's perineal area with soap and water before opening the catheter introducer kit, even though further study is required to evaluate whether the aseptic approach lowers CAUTI incidence. (Caregivers must wash their hands before and after cleaning the perineal area, among other infection control procedures.) The perineum can be cleaned with an iodine swab, however, iodine is less effective as an antiseptic

than many caregivers may think. the presence of bodily proteins and blood.

To analyze indwelling urinary catheter (IUC) nursing practice to avoid CAUTI, Fink et al. (2012) identified three areas: (1) personnel, policy, training, and education; (2) documentation, monitoring, and relocation reminders. Wearing gloves, cleaning your hands, maintaining a sterile barrier, and employing contactless insertion procedures are some of the often practiced CAUTI measures. Give out enough urethral meat each day. The majority of reported IUC inserters were nurses. Upon hiring, nurses received instruction in aseptic technique and CAUTI prevention.

Results suggested that nurses should learn how to sample urine using an aseptic technique because their use of aseptic sampling from catheterized patients was very low before the publication of the guideline but rapidly improved after three months (Christine 2016). Gather samples from locations that gather samples. A urinary tract infection (UTI) is described by Paket (National Healthcare Safety Network, 2020) as developing during the insertion of the Foley catheter or within 48 hours of its removal. This definition must be followed when shipping samples to laboratories by medical personnel.

According to (Joyce and Wenger, 2020), both patients and caregivers need to use proper sample methods. The caregiver should spend an extra 15 to 20 seconds "scrubbing" the collection port hub with alcohol and letting it air dry before taking a sample from the Foley catheter. Urine can be moved directly from the Foley catheter to the culture tube using the direct transfer device, lowering the chance of contamination. Samples should be delivered to the lab as soon as they are collected.

According to Kashefi et al. (2018), a nurse's job is to instruct patients on how to care for themselves after having their catheters removed to find urinary tract infections as soon as possible. Dipsticks are the quickest and least expensive test, therefore patients should understand how to use them and how to interpret unusual urine dipstick results. No additional testing is necessary if this demonstrates a strong possibility of a urinary tract infection, and treatment can begin. Urine cultures should be performed on patients regularly, beginning every one to two months and reducing as the patient gets better. About two weeks after treatment, a second urine culture is typically performed to confirm that the urine is clear. When bladder infections reoccur frequently (Colgan et al, 2016).

Correlation between nurses' total knowledge and practice and their demographic characteristics.

The findings revealed that there was no significant association between nurses' knowledge and age before the introduction of the guidelines and within three months of it, however, there was a highly strong correlation between nurses' knowledge and education. level, extensive professional experience in urology, and years of experience. These findings go against Simms' (2017) findings that job happiness is positively correlated with age, education, and career experience.

The findings reveal a highly significant correlation between the nurses' knowledge and their practice before, immediately following, and three months after the implementation of the guidelines (Joyce and Wenger, 2020), noting that at the start of our era, there was no one approach that CAUTI would eliminate; we would need to adopt a multifaceted approach. Over two years, we began training, identified, and tested product upgrades. The nurse-driven Foley catheter removal policy, which gives nurses the power to remove Foley catheters when necessary and daily documentation of their medical necessity, was then included.

***Correlation between nurses' practices and incidence of urinary tract infection on three scheduled periods.***

The incidence of urinary tract infections with three catheterizations—on the first and fourth days following catheterization and before catheter removal—was highly correlated with the practice behavior of the nurses under study. Similar to Gokula et al. (2017), who stated that nurses should play a part in implementing measures to lower the prevalence of these illnesses, particularly urinary tract infections (UTIs) linked to catheterization since this is a job that nurses typically handle. The foundation of nursing team training is teaching certified nursing assistants and technicians to catheterize

patients in a sterile manner, teaching them to wash their hands, and letting them know that these are the main sources of cross-infection and UTI outbreaks and must be properly embalmed for patients (Gould, 2020).

Because patients are more likely to develop UTIs with residual catheterization the longer they are catheterized, Harris (2020) suggested that nurses and medical teams should discuss the requirements for catheterization, the need for catheterization, and the duration of catheterization.

The age and gender distributions between the study and control groups were different in this investigation. This is significant because the patient's age and gender have an impact on UTIs (Talaat et al, 2020; Wilde et al, 2020). Both groups' majority of patients were male. This conclusion is in line with Nirmanmoh et al. He discovered in 2019 that 80 males and 45 women made up the 125 individuals with urinary catheters who were a part of the study. Obstructive uropathy is recognized to be more common in men, notably benign prostatic hyperplasia (BPH), prostate cancer, and age-related strictures. This result is in line with earlier research (Oni et al., 2015), which discovered that men were primarily affected in this study.

Due to prostatitis, which affects men of all ages, the majority of the patients in the control group were between the ages of 30 and 50. According to (Doluoglu et al., 2020), prostate inflammation after transurethral resection of the prostate was an independent variable determining the development of urethral stricture (US) or bladder neck contracture. This finding is in line with their findings (BNC).

The study and control groups both had a low percentage of patients with higher education, and both had significant rates of illiteracy. This characteristic is significant because it may increase the risk of urinary tract infections (Coyne et al, 2019; Scott, 2020). The results also indicate that blue-collar employees make up the majority of both groups. This outcome is consistent with (Oni, et al. 2015), who discovered that around three-quarters or more of the study group members were married and illiterate and that more than half of the control group members worked as opposed to half of the study group members. There were extremely few smokers in the group—fewer than half.

The current study discovered that from the first day of catheter placement to the fourth day and before the catheter was removed, the number of patients in the study group acquiring urinary tract infections reduced even more. This study in the control group showed that the number of patients getting urinary tract infections grew more before removal and was greater on the fourth day of catheterization than on the first day. This finding is consistent with the Wu et al. match. 2015 found that if bacteriuria >= 105 colony forming units (CFU)/mL (gram-negative) or bacteriuria >= 104 colony forming units (CFU), patients with negative urine cultures during surgery and before catheterization Diagnosed with CAUTI were. /ml (gram-positive). On day 3, no catheter-related bacteriuria was found in either the control or treatment groups. By day 5, 5 of 30 control patients and 1 of treated patients developed bacteriuria. On the 7th day, seven patients in the control group had bacteriuria, but still one in the treated group.

This is expected because it is a component of the intervention, which is thought to lower the rate of CAUTI. This result is consistent with Abd Elatty's findings from 2020, who discovered that the research intervention had a positive impact on the number of UTIs experienced by the study group of patients.

According to the results, Escherichia coli, Pseudomonas, and Klebsiella were the most frequently isolated organisms in both groups. These findings concur with those of (Nicolle, 2015), who discovered that Escherichia coli was the most frequently isolated Gram-negative bacterium and were frequently the first infectious organism. The findings agree with those of Klebsiella spp. researchers Aly et al. (2018). The most often found cultured bacteria in confirmed nosocomial infections include Escherichia coli and Escherichia coli.

## Conclusion

The study's findings demonstrate that registered nurses' practical skills and knowledge were inadequate before the program's implementation, but that these skills significantly improved post-intervention. According to the

study's findings, a nursing education program can help decrease the prevalence of urinary tract infections in catheterized patients.

The two groups' most frequent isolates were Klebsiella and Escherichia coli, and bacteriuria was evident. The primary mechanical issues that both groups encountered were blockage and irritation. Before extubation, the control group had a greater positive urine culture rate than the study group; this difference was statistically significant. Improved clinical symptoms and test findings support this.

Even though using educational programs was linked to faster healing and shorter hospital stays. The results showed that there were notable disparities in the nurses' knowledge and performance both before and after the educational program was put into place.

## Recommendations:

**Based on the findings of the current, the following suggestions are recommended:**

1. To avoid catheter-related urinary tract infections, set treatment guidelines.
2. Add the following details to the patient's medical file: The reason a catheter was inserted, the date and time it was inserted, the nurse who did it, and the day and time it was removed.

a. Include documentation in the nursing flow sheet or nursing notes.

I. Documentation should be accessible in patient records and documented in a standard format for data collection and quality improvement.

b. If possible, searchable electronic material should be used.

3. A written training program on catheter use, insertion, removal, and maintenance should be provided and put into practice.
4. Ascertain that the tools needed for sterile catheterization are on hand.
5. Ensure there is sufficient skilled nursingstaff and technological support to reduce the frequency of UTIs associated with catheters and support outcomes.
6. Provide caregivers involved in the insertion, maintenance, and care of catheters with information on CAUTI prevention, including guidelines for the insertion, handling, and removal of catheters as well as alternatives to indwelling catheters.
7. Nursing personnel should avoid placing patients with catheters in the same room or adjacent beds, especially those with bacteriuria; they should be dispersed across the station to prevent or lessen the risk of cross-infection.

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