

## Effect of Self-Care Practice Guidelines of Catheter-Associated Urinary Tract Infections among Patients with Benign Prostatic Hyperplasia

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### Abstract

**Background:** Difficulty in passing urine and increased frequency of urination are common symptoms of Benign prostatic hyperplasia (BPH), a prevalent condition among elderly males characterized by the enlargement of the prostate gland, and urinary tract infections. Patients with BPH who require catheterization are at higher risk for developing Catheter-associated urinary tract infections (CAUTIs), which makes such a group of patients in a crucial need to develop effective strategies to prevent and manage such conditions. **Aims:** This study aimed to evaluate the effect of self-care practice guidelines of Catheter-associated urinary tract infections (CAUTI) on patients with benign prostatic Hyperplasia (BPH). **Methods:** A quasi-experimental study was conducted in the urology departments at Alexandria Main University Hospital. A convenience sample of 60 adult patients with BPH was equally divided randomly into two groups: a study group (n=30) and a control group (n=30). Two tools were used for data collection: a (BPH) patients' knowledge assessment questionnaire and a (BPH) sign and symptom severity structured interview schedule. **Results:** The study showed a significant improvement among the study group's knowledge, international prostate symptom score (IPSS) symptom severity, quality of life, catheter care, and patients' practices for urinary tract infection-related signs and symptoms and catheter care, comparing to the control group. **Conclusion:** The provision of effective education had a profound impact on improving patients' knowledge and practice.

**Keywords:** Benign prostatic hyperplasia, Catheter Guidelines, Self-care.

### Introduction

Benign prostatic hyperplasia (BPH) is a urological condition among men causing prostatic tissue overgrowth around the urethra, leading to lower urinary tract symptoms. Ignoring it could result complications that require surgical intervention. (BPH) affects half of the adults' men over 50 years old, making males particularly susceptible to develop such condition. (Wen et al., 2017; Na et al., 2017).

Risk factors for benign prostatic hyperplasia (BPH) include age over 40 years old, family history of (BPH), and physical disorders such as obesity, heart disease, and

circulation problems. The causes of BPH include erectile dysfunction, type 2 diabetes, illness, and inactivity. Symptoms of (BPH) include frequent and urgent urination, difficulty urination, pain during urination or ejaculation, and blood in the urine (Yasser et al., 2017).

Benign prostatic hyperplasia increases the risk of urinary tract infections among individuals with bladder outlet obstruction (BOO), with (BPH) patients commonly experiencing bacteriuria. Urinary-source bacteremia had been linked to (BPH) among hospitalized male patients (Asafo-Adjei et al., 2018). (BPH) could had negative impact on a person's quality of life through symptoms such

as nocturia, frequent urination, psychological burden from urgency, unsatisfactory sex life, and fear of developing cancer prostate. Patients with urinary abnormalities are at an increased risk of infections caused by non-E. coli bacteria and prolonged antibiotic use which could lead to candida albicans superinfection or bacterial resistance. Bacteria could cause infections by colonizing the periurethral area and ascending the urethra to reach the bladder, especially during bladder outlets obstruction. Microbial adherence to epithelium and cellular internalization through Type 1 pili lead to the formation of intracellular bacterial colonies that resemble biofilms (BinLim, 2017).

Indwelling catheterization is a common medical management for acute urine retention, but it increases the risk of catheter-associated urinary tract infections (CAUTIs), which could lead to poorer patient outcomes (Meng et al., 2019). CAUTIs account for one-third of all healthcare-related infections, and 80% of them occur due to catheterization, resulting in financial penalties for hospitals (AACN Practice, 2016).

In US acute care hospitals, 40% of patients acquire at least one healthcare-associated infection (HAIs), with 70-80% of them being (CAUTIs). In 2016, acute care hospitals recorded 26,983 cases of (CAUTIs), which increased hospital stay, morbidity and mortality rate as well (Clarke et al., 2020). (UTIs) are a prevalent HAI in Egypt, which lead to increased hospital costs, morbidity, and mortality rate due to (CAUTIs) according to (Selim et al., 2018).

(CAUTIs) is a common hospital-acquired illness that could lead to catastrophic clinical and financial effects, with 10% of people with bacteriuria developing (CAUTIs), and 3% the condition progressing to bloodstream infection. So, patients at that time become at mechanical and physiological risk when indwelling urinary catheters are not used properly, so, nurses' adherence to infection prevention and control practices are crucial in order to prevent healthcare-associated infections (HAIs). Healthcare personnel who will be involved in catheter insertion should receive educational sessions, training and suggested

guidelines which should be followed by them to build appropriate preventative measures. Corrective measures could reduce the incidents of infection by 20-70%, according to a study done by (Hernandez et al., 2019).

Care protocol is essential to reduce catheterization time and the risk of (CAUTIs). regular education for the medical staff and high-quality nursing care provided for patients with urinary catheters are crucial, as demonstrated by a study done by (krocová et al., 2019). therefore, the study aims to evaluate the effect of applying self-care practice guidelines of catheter-associated urinary tract infections among patients with benign prostatic hyperplasia.

## Materials and methods

### Study Design and Setting:

The study was conducted in the urology departments of Alexandria Main University Hospital, utilizing a quasi-experimental design (pre-posttest) two groups (study and control).

### Study Sample:

The study included 60 adult patients diagnosed with BPH, admitted to the urology departments between June and October 2022. Using Epi info 7, the sample size was determined to be 60 (BPH) patients. Participants were randomly assigned to a study group (n=30) and a control group (n=30). The study group received self-care instructions, while the control group received the hospital routine care.

### Tools of the study:

The researchers created two tools for the study based on an analysis of the relevant related literature and translated it into Arabic.

### Tool I, knowledge Assessment Questionnaire

It includes two parts:

Part one; assessing the demographic and clinical data,

Part two; structured questionnaire assessing knowledge about (BPH).

**Tool II; Structured Interview Schedule.**

It includes three parts:

**Part I of the tool:**

It assesses (BPH)-related signs and symptoms.

**Scoring system:**

The severity of (BPH) signs and symptoms for each patient was calculated by summing up their scores and categorizing them as mild (<30%), moderate (30-70%), or severe (≥70%).

**Part II of the tool:**

It assesses catheter-associated urinary tract infection (UTI) signs and symptoms. The assessment tool utilized in this study called the (CAUTIs) Assessment Profile (CAP), which was developed to evaluate the existence of symptoms such as fever, suprapubic tenderness, flank tenderness, and delirium among such group of patients. The (CAP) instrument provides clear definitions for each clinical sign and symptom. **Scoring System:**

It involves assigning a score of one for the presence and zero for the absence of each sign and symptom in patients' responses.

**Part III of the tool:**

It assesses patients' practices for (UTI) -related signs and symptoms and catheter care. The researchers developed the tool to assess how (BPH) patients manage (UTI) -related signs and symptoms and catheter care. The tool consisted of 30 statements related to fever, tenderness, and delirium, and 53 statements covering areas such as catheter assessment, hygiene, infection surveillance, and troubleshooting.

**Scoring system**

The self-care practices of the patients were evaluated using a 3-point Likert scale (0=Never, 1=Sometimes, and 2=Always). The total score obtained was converted into a percentage and classified into three categories based on the level of health-promoting self-care

practices: poor (<50%), fair (50%-<75%), or good (≥75%).

**Ethical Consideration**

A written approval to carry out the study was obtained from the ethical committee of the faculty of nursing, Alexandria University. As well an official permission to conduct the study was obtained from the Dean of Faculty of Nursing, Alexandria University to the administrative authorities of the selected setting to obtain their approval to collect the data after explanation of the aim of the study. Before enrolling in the study, each patient was provided with detailed information about the purpose and benefits of the research, as well as the option to participate voluntarily. The study posed no risks to the participants, and their data was treated with strict confidentiality and anonymity. The study followed standard ethical principles in clinical research and ensured the privacy of all participants during the data collection process.

**Ethics Approval and Informed Consent**

The study obtained written approval from the ethical committee of the Faculty of Nursing at Alexandria University on March 13, 2022. (The ethical approval code is 1792022). Consent from participants was obtained after explaining research objectives.

**Validity and reliability of the tools**

To ensure the validity of the tools and booklet content, five experts in Medical-Surgical nursing were consulted, and their feedback was used to refine the tools. The reliability of the developed tools was assessed using Cronbach's Alpha test, and the reliability coefficients for Tool I and Tool II were found to be  $r=0.875$  and  $r=0.898$ , respectively.

**A pilot study:**

A pilot study was conducted on 10% of students' sample (six patients), who were excluded from the actual study sample from the previously mentioned settings to test the clarity, feasibility and applicability of the study tools, modifications needed were done. Researchers substituted the excluded sample with another

sample that is similar in characteristic to the original sample. Then data obtained from the pilot study were analyzed, and the final form of tools was reconstructed and ready for use.

### Data collection

Data collection started at the beginning of June 2022 and ended in October 2022.

Individual interviews were conducted with each patient using the structured tools to collect data needed for the study objective.

### Phases of the study

#### Phase I: Assessment

In phase I of the study, researchers built a therapeutic relationship, explained the study's purpose, and conducted an initial assessment using tools I and II. Subsequent assessments were conducted within 2 and 3 weeks after the self-care practices guidelines sessions to evaluate the teaching program's effectiveness and to assess patient progress.

#### Phase II: Planning

In phase II of the study, self-care practice guidelines were developed based on the patient's identified needs during the assessment, goals, priorities, contents, and expected outcomes. Guidelines for the prevention of (CAUTIs) were established and used with the European Association of Urology guidelines on urological infections. The content was organized in a feasible learning sequence, and teaching strategies included interactive lectures, discussions, demonstrations, and re-demonstrations. The self-care practice guidelines consisted of three (one-hour sessions) for each patient, and an illustrated colored booklet was developed and distributed to each patient in the study group during the implementation phase.

#### Phase III: Implementation

In phase III of the study, self-care practice guidelines were implemented for each patient in the urology department at the hospital setting. The guidelines were conveyed verbally and supported by a written booklet. Patients repeated the guidelines until the investigator

was confident that they are well understand the guidelines content.

### The self-care practice guidelines were divided into three sessions.

The teaching program for patients with (BPH) consisted of three sessions covering disease information, urinary catheters, (UTI), and self-care practices. Patients repeated the learned knowledge multiple times until it was successfully mastered. An illustrative booklet and post-session clarification were provided.

#### Phase IV: Evaluation phase

In phase IV of the study, the effect of education on self-care practices, as well on BPH and (UTI) symptoms among patients with (BPH) was evaluated after 2 weeks and after 3 weeks post the implementation of the teaching program using tools I and II.

#### Data analysis

After data collection, the data was coded and transformed into computer-friendly forms. The data that was entered underwent a verification process to identify and correct any errors, and statistical analyses were performed using SPSS Version 25 at a confidence level of 0.95, with a 0.05 probability of error. The statistical analyses included mean, standard deviation, t-tests for independent samples, repeated measures, chi-square, and significance (2-tailed).

### Results

Table 1 indicated that the majority of patients in both the study and control groups were married and aged between 50-60 years old. More than half of the patients in both groups resided in urban areas and had basic literacy skills. Manual labor was the primary occupation for 43.3% of patients in the study group and 26.7% in the control group. Both groups had a family income that was insufficient, among 100% of them. No notable differences were observed between the two groups concerning their demographic characteristics.

Figure 1 showed that the level of education of the participants in both the study and control groups was predominantly illiterate,

accounting for 56.7% of the total participants among the both groups. A small percentage of participants had received primary or secondary education, and approximately 13.3% of the study group and 10% of the control group had completed preparatory education. University-level education was attained by 16.7% of the total participants among both groups.

Table 2 showed that all patients were former smokers and quit smoking after diagnosis with BPH. Patients in both groups reported using over-the-counter medication. No significant differences were found between the two groups in relation to the risk behaviors. Table 3 showed, over two-thirds of patients in both the study and control groups had a family history of benign prostatic hyperplasia (BPH). Additionally, a higher percentage of patients in the study group had a history of chronic diseases compared to the control group. All patients in both groups had previous hospitalizations, with surgery being the primary reason for hospitalization for 40.3% and 36.7% of patients among the study and control groups, respectively. The remaining patients were hospitalized for chronic diseases such as diabetes, kidney disease, heart disease, arthritis, and cancer, and there were no significant differences between the two groups regarding prior hospitalization.

Table 4 indicated that there was no noteworthy difference regarding knowledge scores of patients with (BPH) between the study and control groups before the program implementation. However, a significant difference was observed between both groups after 2 and 3 weeks with ( $P=0.00$ ). The mean knowledge scores for the study group significantly improved after 2 and 3 weeks (F value of 270.70,  $P=0.00$ ). While the mean knowledge scores for the control group did not show significant differences between the first assessment, after 2 weeks, and after 3 weeks.

Table 5 revealed that the severity of symptoms associated with (BPH), such as the

International Prostatism Symptom Score (IPSS) and quality of life due to urinary symptoms, significantly improved for study group as compared to the control groups at 2 and 3 weeks after implementation of the guideline. Although no significant differences were observed between the two groups before the guideline was implemented, while significant differences were found between both groups at 2 and 3 weeks with ( $P=0.00$ ). The F values were 239.20 with ( $P=0.00$ ) and 18.71 ( $P=0.00$ ) for the study and control groups, respectively.

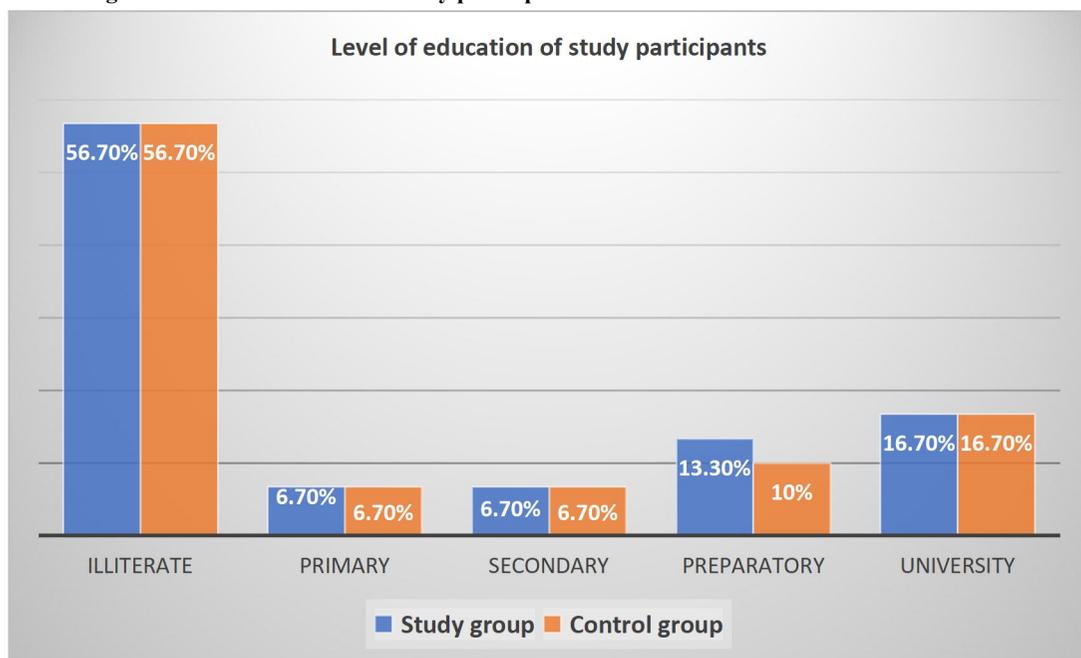
Table 6 showed the scores for assessing (CAUTIs) among the study and control groups, including fever, suprapubic tenderness, flank tenderness, and delirium. Significant improvement was observed regarding (CAUTIs) related to all items in both groups after 2 and 3 weeks. However, the total mean scores for the study group significantly improved with (F value of 116.00,  $P=0.00$ ) compared to the control group, with Mean  $\pm$  SD of ( $4.00\pm 0.00$ ,  $4.00\pm 0.00$ , and  $4.80\pm 0.41$ , respectively).

Table 7 showed that the results of applying self-care practice guidelines regarding (CAUTIs) among patients with (BPH) in the study and control groups before and after the sessions. The mean scores for all dimensions of catheter care practices significantly improved among the study group after 2 and 3 weeks of sessions with ( $P=0.01$ ). The improvement was maintained significantly at 3 weeks of evaluation. The control group also had significant improvement in both evaluations, but this improvement was not maintained significantly compared to the study group. There were no significant differences between the total mean scores of the self-care practice regarding urinary catheters care between the study and control groups. However, the discrepancies between the two groups were significant for both the total mean scores and all dimensions of catheter care at 2 and 3 weeks after the sessions were conducted, with P values below 0.05.

Table 1 Frequent distribution of participants in the studied

Demographic		Study group		Control group		Chi-square	P
		N= (30)	%	N= (30)	%		
Age	20 < 30	0	0.0	0	0.0	1.148	0.284
	30 < 40	0	0.0	0	0.0		
	40 < 50	9	30.0	13	43.3		
	50 <= 60	21	70.0	17	56.7		
	years						
Marital status	Single	0	0.0	0	0.0	3.158	0.206
	Married	30	100.0	27	90.0		
	Divorced	0	0.0	1	3.3		
	Widow	0	0.0	2	6.7		
Area of residence	Urban	16	53.3	18	60.0	0.271	0.602
	Rural	14	46.7	12	40.0		
Occupation	Manual work	13	43.3	8	26.7	3.719	0.293
	Office work	5	16.7	3	10.0		
	No work	3	10.0	7	23.3		
	Housewife	0	0.0	0	0.0		
	Retired	9	30.0	12	40.0		
Income	Enough	0	0.0	0	0.0		
	Not enough	30	100.0	30	100.0		

Figure 1 Level of education of study participants



**Table 2** Frequent distribution of the participants according to their risk behaviors in relation to (smoking habits and over-the-counter drugs)

Levels	Study group		Control group		Chi-square	P	
	N= (30)	%	N= (30)	%			
<b>Smoking habits</b>							
Did you smoke?	No	0	0.0	0	0.739	0.390	
	Yes	30	100.0	30			
Did you know at any age started smoking?	No	0	0.0	0			
	less than 18 years	23	76.7	20			66.7
	18-25 years	7	23.3	10			33.3
Did you still smoke after illness?	more than 25 years	0	0.0	0			0.0
	No	30	100.0	30	100.0		
Yes	0	0.0	0	0.0			
<b>Over-the-counter medication</b>							
Did you take medications without the doctor ordered?	No	0	0.0	0	0.0	1.720	0.886
	Yes (analgesic, common cold medication)	30	100.0	30	100.0		

**Table 3:** Frequent distribution of the participants' (family history and Present history)

Family history	Study group		Control group		Chi-square	P	
	N= (30)	%	N= (30)	%			
Is there is any family member suffer from BPH?	No	8	26.7	11	36.7	0.693	0.405
	Yes	22	73.3	19	63.3		
<b>Patient previous history</b>							
Do you suffer from any chronic diseases	No	0	0.0	6	20.0	6.667*	0.003
	Yes	30	100.0	24	80.0		
If yes	Heart disease	2	6.7	1	3.3	0.431	0.980
	Hypertension	7	23.3	7	23.3		
	Diabetes mellites	11	36.7	8	26.7		
	Kidney disease	8	26.66	6	20.0		
	Liver disease	0	0.0	0	0.0		
	Arthritis	2	6.7	2	6.7		
Do you enter the hospital before for any treatment?	No	0	0.0	0	0.0	1.515	0.911
	Yes	30	100.0	30	100.0		
If yes	Heart disease	2	6.7	2	6.7	1.515	0.911
	Cancer	5	16.7	5	16.7		
	Diabetes mellites	5	16.7	3	10.0		
	Liver disease	0	0.0	0	0.0		
	Kidney disease	6	20.0	4	13.3		
	Arthritis	1	3.3	1	3.3		
	Surgery	11	36.7	15	50.0		

\* Chi square test

**Table 4** Mean scores regarding benign prostatic hyperplasia patient knowledge that related to disease variables before, after 2 weeks, and after 3 weeks.

Benign prostatic hyperplasia	Study group				Control group				T	P
	Mean	SD	F	p	Mean	SD	F	P		
Pre	4.50	0.51	270.70*	0.00	4.50	0.51	18.81	0.114	0.00	1.00
after 2 weeks	7.50	1.41			5.17	0.91			7.62*	0.00
after 3 weeks	10.60	1.71			5.47	1.14			13.67*	0.00

\*P&lt;0.05

**Table 5 Mean scores of patients with benign prostatic hyperplasia assessment regarding the severity of sign and symptoms before implementation of the guideline, after 2 weeks, and after 3 weeks.**

Quality of life due to urinary symptoms	Study group				Control group				T	P
	Mean	SD	F	p	Mean	SD	F	P		
Pre	33.47	1.04			33.27	1.08			0.73	0.47
After two weeks	25.57	5.58	239.20*	0.00	32.17	2.18	18.71*	0.00	6.04*	0.00
Three weeks later	9.13	6.96			30.40	3.46			14.99*	0.00
Pre	5.00	0.00			5.00	0.00			0.00	1.00
After two weeks	3.00	1.44	71.87*	0.00	4.60	1.04	6.20*	0.00	4.94*	0.00
Three weeks later	1.90	1.32			4.30	1.29			7.11*	0.00

**Table 6 Mean scores of patients with benign prostatic hyperplasia assessment regarding catheter associated urinary tract infection sign and symptoms before, at 2 weeks after, and at 3 weeks after**

Variable		Study group				Control group				T	P
		Mean	SD	F	p	Mean	SD	F	P		
Fever	Pre	0.57	0.86	64.35*	0.00	0.47	0.73	16.10*	0.00	0.49	0.63
	After two weeks	3.83	2.04			0.97	1.10			6.79*	0.00
	Three weeks later	6.50	3.94			1.70	1.34			6.32*	0.00
Suprapubic Tenderness	Pre	0.87	0.86	63.23*	0.00	0.67	0.80	24.89*	0.00	0.93	0.36
	After two weeks	5.87	3.08			1.80	1.65			6.37*	0.00
	Three weeks later	10.53	6.40			2.67	2.15			6.38*	0.00
Flank Tenderness	Pre	0.57	0.77	87.41*	0.00	0.47	0.63	12.64*	0.00	0.55	0.58
	After two weeks	5.57	4.03			1.00	1.11			5.98*	0.00
	Three weeks later	13.30	5.63			1.87	2.08			10.44*	0.00
Delirium	Pre	0.40	0.62	140.58*	0.00	0.30	0.47	13.98*	0.00	0.71	0.48
	After two weeks	3.43	2.28			1.17	1.44			4.60*	0.00
	Three weeks later	8.83	2.52			1.57	1.61			13.30*	0.00
Total CAUTI	Pre	4.00	0.00	116.00*	0.00	4.00	0.00			0.00	1.00
	After two weeks	4.00	0.00			4.00	0.00			0.00	1.00
	Three weeks later	4.80	0.41			4.00	0.00			10.77*	0.00

\*P&lt;0.05

**Table 7 Mean scores of patients with benign prostatic hyperplasia practice regarding catheter care pre, after 2 weeks, and after 3 weeks**

Variable		Study group			Control group		
		Mean	SD	p	Mean	SD	P
Assessment of urinary catheter	Pre	0.47	0.57	0.01	0.40	0.62	0.00
	after 2 weeks	3.47	1.93		0.73	0.91	
	after 3 weeks	6.53	3.50		1.40	1.30	
Hygiene	Pre	0.40	0.56	0.00	0.40	0.56	0.01
	after 2 weeks	3.40	2.31		0.80	0.89	
	after 3 weeks	6.83	3.71		1.40	1.38	
Infection surveillance	Pre	0.43	0.57	0.01	0.30	0.47	0.00
	after 2 weeks	2.20	1.27		0.77	0.97	
	after 3 weeks	4.87	2.32		0.90	1.12	
Specimen collection	Pre	0.43	0.68	0.03	0.47	0.73	0.02
	after 2 weeks	3.40	2.31		0.67	0.96	
	after 3 weeks	8.03	4.00		0.93	1.20	
Catheter leaking	Pre	0.53	0.73	0.00	0.27	0.52	0.01
	after 2 weeks	4.47	1.36		0.70	0.70	
	after 3 weeks	11.77	1.28		1.23	1.61	
Fluids	Pre	0.30	0.47	0.03	0.20	0.41	0.00
	after 2 weeks	1.77	0.68		0.37	0.56	
	after 3 weeks	4.70	1.29		0.63	0.76	
Catheter falling out	Pre	0.00	0.00	0.02	0.00	0.00	0.00
	after 2 weeks	2.50	1.14		0.27	0.45	
	after 3 weeks	5.80	0.76		0.67	1.03	
Changing the urinary catheter bag	Pre	0.53	0.78	0.00	0.37	0.72	0.02
	after 2 weeks	6.90	3.87		0.87	0.86	
	after 3 weeks	17.20	1.94		2.40	1.92	
Total Self-care practice of catheter-associated urinary tract infection	Pre	2.40	1.67	0.01	1.90	1.45	0.00
	after 2 weeks	18.70	10.70		4.93	3.36	
	after 3 weeks	39.17	11.59		7.80	4.57	

## Discussion

Regarding the demographic characteristics of the study participants there were no significant differences between the control and study groups. The current study findings indicated that older age, chronic illness, immunocompromised status, low income, frequent hospitalization, and marital status were factors that increased the incidence of (CAUTIs) among patients with (BPH). This result aligns with a previous study done by (Onyebueke et al., 2020), who found a higher rate of (UTI) among greater age of patients with (BPH).

Similarly, a systematic review and meta-analysis of studies on risk factors for CAUTIs among patients with BPH done by (Wang et al., 2019), reported that age was a significant risk factor, while sociodemographic factors such as education and income were not consistently associated with increased risk.

While in a study done by (Dybowski et al., 2018), who found that men with urinary retention caused by (BPH) are more susceptible to genitourinary infections. As men age, hormone levels changes which can cause the prostate gland to enlarge, leading to an increase in (BPH). Poor dietary habits with a sedentary lifestyle which had also been linked to a rise in (BPH) among younger and middle-aged Men. Enlargement of the prostate gland could press against the urethra, leading to urinary retention and an increased risk of urinary infections.

Sociodemographic factors do not contribute to the increased risk of (CAUTIs) among patients with (BPH), but socioeconomic factors can affect health-seeking behavior. Proper catheter care and maintenance are crucial regarding the prevention of (CAUTIs), as bacteria could be colonizing the catheter surface and form biofilms and increasing the risk of infection. The current study's findings

support (Xu et al., 2020), conclusions regarding risk behaviors.

Healthcare professionals should provide educational programs to patients with (BPH) aiming to improve their understanding and management of the condition and its symptoms. Such programs could also reduce healthcare expenses by increasing patient knowledge and comprehension of (BPH) and its treatment regimens, according to a study done by (Li et al., 2022), who included symptom scores and quality of life. These findings are consistent with previous research suggesting the benefits of educational programs for patients with (BPH), as noted in a study done by (Clarke, 2013).

The study group's patients showed significant improvement regarding the intensity of symptoms as measured by the (IPSS) after following self-care practice guidelines, and this improvement persisted after two and three weeks. This finding is consistent with the finding of a study done by (De Nunzio et al., 2018), who reported that adopting a patient-centered approach resulted an improvement regarding drug adherence and addressed unmet needs, which may help to lower the likelihood of complications and the costs associated with treatment. (Liang et al., 2019), reported that patient with (BPH) counseling significantly improved their understanding level regarding management, treatment outcomes, and quality of life.

The current study revealed that patients had poor knowledge and self-management skills regarding (CAUTIs) signs and symptoms, which may be attributed to their low educational level and socioeconomic status. These findings align with a study done by (Johnson et al., 2020), who reported significant improvements regarding patients' knowledge, attitude, and practices.

The current study's findings revealed that, when comparing between the study and the control group, regarding the total scores of the (CAUTIs) and all of its constituent parts, which encompass fever, suprapubic tenderness, flank tenderness, and delirium, the study group showed considerably improved after the application of the self-care recommendations

sessions. This result supported by a study done by (Johnson et al., 2020), who notes that (CAUTIs) had a frequent side effect among patients with (BPH) who use indwelling urinary catheters. Similar results were reported by (Fasugba and Gardner, 2017), who discovered in their study a significant improvement regarding (CAUTIs) symptoms and came to the conclusion that the educational programs play a significant role in reducing the incidence of (CAUTIs) by enhancing patients' knowledge and understanding by the proper way of catheter insertion and maintenance. In a similar vein, (Schweiger et al., 2020), conducted a multi-center interventional study reported that an educational intervention package that involved providing concise indications about catheterization, with regular assessment of catheterization, and instruction with appropriate catheter insertion and upkeep, led to a significant reduction in (CAUTIs) complications, and came to the conclusion that educational programs could effectively reduce the incidence of (CAUTIs).

The current study found significant improvements among the study group's catheter care practices and self-care practices after implementing the (CAUTIs) guidelines among men with (BPH). These findings support the effectiveness of the educational program on catheter care, which reduce the incidence of (CAUTIs) in a study done by (Al Hasan et al., 2022), who reported that education and performance feedback on catheter care measures and handwashing compliance could reduce catheter-associated UTI rates. The study group's self-care practice scores showed no significant differences before implementing the guidelines, but significant improvements were observed after two- and three-weeks post sessions implementation. The dimensions of catheter care practices that improved included urinary catheter assessment, hygienic care, infection surveillance, specimen collection, troubleshooting, catheter leaking, diet, fluids, catheter falling out, infections, and changing the urinary catheter bag.

## Conclusion

This study highlights the significant burden of (CAUTIs) among patients with (BPH). The findings suggest that self-care educational guidelines could reduce (CAUTIs) and improve patient care. Patient-centered, self-care guidelines for (CAUTIs) resulted in significant improvements in patients' knowledge level and practices, which could help to prevent (CAUTIs) and improve patient outcomes while reducing healthcare costs.

## Recommendations

Since a patient-centered, self-care guideline for CAUTIs was associated with a significant improvement in patients' knowledge and practices needed to decrease and prevent CAUTIs among patients with BPH when compared with hospital prevention measures which in turn can have a significant impact on improving patient outcomes and reducing healthcare costs for patients with BPH. Therefore, health professionals and academic educators should:

- Ensure proper catheter selection and maintenance which are crucial to reducing the risk of infection.

- Using sterile techniques during catheter insertion and ensuring that the catheter is changed regularly.

- Conduct a needs assessment that should be conducted to identify the barriers and facilitators to adherence to self-care practice guidelines among patients with BPH.

- Enforce patient education on catheter care and self-care practices is essential to promoting adherence to treatment plans and reducing the severity of symptoms.

- Support educational initiatives that promote judicious use of urinary catheters and teach correct catheterization technique.

- Embrace the translation of urinary catheter design innovation into clinical practice and support researchers and medical device companies in their efforts to design safer urethral catheters to eliminate CAUI.

- Disseminate findings of the current study to healthcare providers, patients, and other stakeholders to inform practice and improve patient outcomes.

## Abbreviations

Benign Prostatic Hyperplasia (BPH)

Catheter-associated Urinary Tract Infections (CAUTIs)

International Prostate Symptom Score (IPSS)

Bladder Outlet Obstruction (BOO)

Healthcare-Associated Infections (HAIs)

Urinary Tract Infection (UTI)

International Prostatism Symptom Score (IPSS)

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## Conflict of interest

The authors declare that there is no conflict of interest.

## Data and materials availability

All data are available upon reasonable request from the corresponding author.

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