Journal of Nursing Science

Journal homepage: www.jns.vn

Knowledge and attitudes regarding the prevention of catheter-associated urinary tract infections among nurses at Da Nang Hospital, Vietnam

Phan The Anh[1], Luu Thi Thuy[2], Vu Van Dau[3], Nguyen Thi Phuc[1]
[1]Da Nang Hospital; [2]Da Nang University of Medical Technology and Pharmacy;
[3]Nam Dinh University of Nursing;

ABSTRACT

***Objective**: To describe nurses' knowledge and attitudes regarding catheter-associated urinary tract infection prevention and to identify associated factors at Da Nang Hospital.* ***Methods**: A cross-sectional descriptive study was conducted from February to June 2025 among 223 nurses directly involved in caring for patients with urinary catheters at Da Nang Hospital. Data were collected using a questionnaire covering demographic characteristics, training and supervision, and knowledge and attitudes regarding catheter-associated urinary tract infection prevention. Data were analyzed using SPSS version 26.0, with descriptive statistics, the chi-square test, and Fisher's exact test. Statistical significance was set at $p < 0.05$.* ***Results**: Overall, 73.1% of nurses had satisfactory knowledge, while 77.1% demonstrated positive attitudes toward catheter-associated urinary tract infection prevention. The provision of educational materials on urinary tract infections was associated with nurses' knowledge. The frequency of hospital inspections and supervision, as well as nurses' knowledge levels regarding catheter-associated urinary tract infection prevention, was associated with their attitudes.* ***Conclusion**: Most nurses had satisfactory knowledge and positive attitudes toward catheter-associated urinary tract infection prevention. Improving access to educational materials, strengthening training, and enhancing internal supervision may help improve catheter-associated urinary tract infection prevention practices at the hospital.*

***Keywords**: Nurses; infection prevention and control; urinary tract infection; urinary catheter.*

INTRODUCTION

Urinary tract infection (UTI) occurs when microorganisms enter the urinary tract and cause an infection that may or may not present with clinical symptoms. UTI is one of the most common healthcare-associated infections, accounting for a substantial proportion of hospital-acquired infections, most of which are associated with urinary catheterization[1]. Prolonged urinary catheterization is considered a major risk factor for catheter-associated urinary tract infection (CAUTI). Approximately 15–25% of hospitalized patients are estimated to require urinary catheterization for periods ranging from several hours to several days[1,2]. In Vietnam, the reported prevalence of

Cor. author: Phan The Anh
Email: theanhbvdn84@gmail.com
DOI: 10.54436/jns.2026.05.1166

Received: Oct 21, 2025
Accepted: Oct 21, 2026
Published: Oct 22, 2026

CAUTI ranges from 15% to 25% [3]. CAUTI not only increases healthcare costs and prolongs hospital stays but may also lead to serious complications, directly affecting patients' health and quality of life [1, 2].

Nurses play a critical role in infection prevention and control and in ensuring patient safety, particularly during invasive procedures such as urinary catheterization[4]. Nurses' knowledge is an important factor influencing the effectiveness of catheter-associated urinary tract infection prevention. Limited nursing knowledge may be associated with an increased risk of CAUTI among patients with urinary catheters [5]. Previous studies have reported that the proportion of nurses with good knowledge of CAUTI prevention ranged from 16.25% to 72.2%, with most nurses achieving only a moderate level of knowledge [6-8]. In Vietnam, Le Thi Lien (2018) reported that only 29% of nurses met the required standard for knowledge of CAUTI prevention, whereas Dang Xuan Hung (2019) reported a corresponding proportion of 65.8% [9, 10].

In addition to knowledge, nurses' attitudes also play an important role in CAUTI prevention practices. Although most nurses demonstrate positive attitudes, a considerable proportion still hold less positive attitudes toward CAUTI prevention in patients with urinary catheters, particularly regarding proactively recommending catheter removal when it is no longer clinically indicated [4, 11, 12].

Previous studies have indicated that nurses' knowledge of CAUTI prevention is influenced by several factors, including age, professional qualifications, years of work experience, supervision of care, and the extent of contact with patients. Nurses' attitudes toward CAUTI prevention have also been closely associated with their knowledge and the supervision provided during the care of patients with urinary catheters [7-10].

At Da Nang Hospital, a substantial number of patients require ongoing urinary catheterization, increasing the risk of catheter-associated urinary tract infection (CAUTI). Although several studies have investigated CAUTI, they have primarily focused on its incidence and risk factors among patients, while the role of nurses in CAUTI prevention, particularly their knowledge and attitudes, has not been adequately assessed. Furthermore, no previous study has systematically examined this issue at Da Nang Hospital. Therefore, this study aimed to assess nurses' knowledge of and attitudes toward CAUTI prevention and identify factors associated with these outcomes at Da Nang Hospital.

STUDY PARTICIPANTS AND METHODS

Study participants: The study participants were nurses working at Da Nang Hospital.

Inclusion criteria: Nurses directly involved in the care of patients with urinary catheters at the time of the study.

Exclusion criteria: Nurses who had been working in their current unit for less than one month, were absent during data collection, or were undergoing an initial on-the-job training period.

Data collection period: February 2025 to June 2025.

Study setting: Eight surgical and intensive care departments at Da Nang Hospital.

Study design: A descriptive cross-sectional study.

Sample size: All nurses who met the inclusion criteria during the study period were invited to participate. A total of 223 nurses were included in the study.

Sampling method: Used a convenient sampling method.

Data collection instrument: Data were collected using a structured questionnaire consisting of four sections:

Part A: Demographic and professional characteristics. This section included questions on age, sex, professional qualifications, and years of work experience.

Part B: Training and supervision. This section covered training in CAUTI prevention, the annual frequency of training sessions related to urinary catheter care, the provision of educational materials on CAUTI, and hospital inspection and supervision.

Part C: Knowledge of CAUTI Prevention. Nurses' knowledge was assessed using a questionnaire developed by Nguyen Thi Thu Hien (2022), with modifications for the present study [11]. The original questionnaire comprised 18 items across four domains: (1) the definition of urinary tract infection (UTI), (2) UTI risk factors, (3) UTI prevention, and (4) care of patients with urinary catheters. In the original study, the questionnaire had a Cronbach's alpha coefficient of 0.55.

Before the main survey, the questionnaire was pilot-tested with 30 nurses to assess its reliability. The Kuder–Richardson Formula 20 (KR-20) coefficient was 0.51. After examining the item–total correlations, one item with a low correlation coefficient was removed. Following its removal, the KR-20 coefficient increased to 0.62. Therefore, the final questionnaire used in this study comprised 17 items. Each correct answer was assigned 1 point, and each incorrect answer was assigned 0 points. The total knowledge score ranged from 0 to 17, with higher scores indicating better knowledge of CAUTI prevention. Knowledge was classified as satisfactory if nurses answered at least 65% of the items correctly (equivalent to 12 or more correct answers) and unsatisfactory if they answered fewer than 12 items correctly [11].

Part D: Attitudes Toward CAUTI Prevention. Nurses' attitudes were assessed using the questionnaire developed by Nguyen Thi Thu Hien (2022) [11]. The questionnaire consisted of 12 items rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), with a total score ranging from 12 to 60. Attitudes were classified as positive if the total score was ≥ 48 and not positive if the total score was < 48. In the original study, the questionnaire had a Cronbach's alpha coefficient of 0.92 [11]. In our pilot study, the Cronbach's alpha coefficient was 0.70.

Data collection method: Before data collection, the researchers consulted the head nurses of the participating departments to coordinate the survey schedule for each department. At the agreed time, the researchers met with nurses in the departmental meeting room, explained the purpose and content of the study, and invited them to participate. Nurses who agreed to participate were asked to sign an informed consent form. The questionnaire was then distributed for self-administration, which took approximately 20 minutes. Completed questionnaires were collected immediately after participants had finished.

Data analysis methods: All collected data were checked, cleaned, entered,

and analyzed using SPSS version 26.0. Descriptive statistics were used to summarize the characteristics of the study participants as frequencies and percentages. The chi-square test was used to compare differences between groups for categorical variables. Fisher's exact test was used as an alternative when more than 20% of cells had expected frequencies of less than 5. Statistical significance was set at $p < 0.05$.

Ethical considerations: The study was approved by the Biomedical Research Ethics Committee of Nam Dinh University of Nursing (Approval No. 598/GCN-HDDD, dated March 5, 2025) and authorized by Da Nang Hospital (Approval No. 877/BVDN-HDDD, dated April 3, 2025). All participants were fully informed about the purpose and significance of the study, and participation was entirely voluntary.

RESULTS

Table 1. General characteristics of the study participants (n = 223)

Characteristic		Number	Percentage
Age	< 30 years	54	24.2
	≥ 30 years	169	75.8
Sex	Male	10	4.5
	Female	213	95.5
Professional qualifications	Intermediate level	2	0.9
	College degree	32	14.4
	Bachelor's degree	176	78.9
	Postgraduate degree	13	5.8
Work experience	< 5 years	38	17.0
	≥ 5 years	185	83.0
CAUTI prevention training	Yes	216	96.9
	No	7	3.1
Annual catheter care training frequency	0 sessions/year	4	1.8
	1–2 sessions/year	200	89.7
	> 2 sessions/year	19	8.5
Availability of CAUTI educational materials	Yes	145	65.0
	No	78	35.0
Frequency of hospital supervision	Occasionally (1-2 times/month)	78	35.0
	Frequent (weekly)	96	43.0
	Very frequent (several imes/ week)	49	22.0

Most nurses were female (95.5%) and aged 30 years or older (75.8%). Nurses with a bachelor's degree accounted for the largest proportion (78.9%). Most had at least five years of work experience (83.0%) and had received training/workshop in CAUTI prevention (96.9%). The majority (89.7%) reported attending one to two training sessions related to urinary catheter care per year. Educational materials on CAUTI had been provided to 65.0% of nurses. Approximately two-fifths of nurses (43.0%) reported that hospital inspections or supervision occurred weekly.

Table 2. Nurses' correct knowledge responses regarding the prevention of catheter-associated urinary tract infections (n = 223)

Content	Quantity	Percentage (%)
General knowledge of catheter-associated urinary tract infections (CAUTI)		
Definition of CAUTI	192	86.1
Causative agents of CAUTI	160	71.7
Routes of transmission leading to CAUTI	158	70.9
Definition of CAUTI associated with urinary catheterization	156	70.0
Signs and symptoms of CAUTI	120	53.8
Risk factors for CAUTI		
Risk factors from healthcare workers' practice	216	96.9
Risk factors from the patient	177	79.4
Risk factors associated with urinary catheters	169	75.8
CAUTI prevention		
Position of the urinary catheter after insertion	189	84.8
Preventive measures for patients with urinary catheters	175	78.5
Minimize urethral trauma during urinary catheter insertion	141	63.2
Caring for patients with urinary catheters.		
Monitoring urine volume in the drainage bag .	202	90.6
Aseptic care of patients with urinary catheters	201	90.1
Maintaining unobstructed urine flow	201	90.1
Positioning of the urine drainage bag relative to the bed surface	178	79.8
Antibiotic use for CAUTI prevention	141	63.2
Appropriate timing for urinary catheter replacement	97	43.5

Content	Quantity	Percentage (%)
Overall knowledge of CAUTI prevention		
Satisfactory	163	73.1
Unsatisfactory	60	26.9

Table 2 indicates that 73.1% of nurses had satisfactory overall knowledge of CAUTI prevention. The highest proportions of correct responses were recorded for risk factors related to healthcare personnel practices (96.9%), monitoring urine volume in the drainage bag (90.6%), and aseptic care of patients with urinary catheters (90.1%). In contrast, lower proportions of correct responses were observed for the appropriate timing of urinary catheter replacement (43.5%) and recognition of CAUTI signs and symptoms (53.8%).

Table 3. Nurses' attitudes regarding the prevention of catheter-associated urinary tract infections (n = 223)

Item	Mean ± SD	Min - Max
Importance of urinary catheter insertion and care	4.58 ± 0.53	2 – 5
Maintaining a closed urinary drainage system	4.50 ± 0.53	2 – 5
Ongoing CAUTI prevention training	4.41 ± 0.60	1 – 5
Minimizing catheterization duration	4.39 ± 0.48	3 – 5
Prioritizing CAUTI prevention	4.33 ± 0.64	1 – 5
Daily catheter monitoring and documentation	4.32 ± 0.60	1 – 5
Correcting improper catheter care practices	4.29 ± 0.57	2 – 5
Effectiveness of catheter care education	4.28 ± 0.74	2 – 5
Adequate time for guideline adherence	4.23 ± 0.49	2 – 5
Discussing timely catheter removal with physicians	4.21 ± 0.49	3 – 5
Reducing morbidity and mortality through proper catheter care	4.04 ± 0.53	1 – 5
Impact of workload on guideline adherence	3.04 ± 1.32	1 – 5
Overall attitude toward CAUTI prevention	**50.62 ± 3.78**	**37 - 60**

Note: SD = standard deviation; Min = minimum; Max = maximum.

The mean overall attitude score toward CAUTI prevention was 50.62 ± 3.78. The highest mean scores were recorded for the perceived importance of urinary catheter insertion and care as nursing skills (4.58 ± 0.53) and the role of maintaining a closed, one-way urinary drainage system in preventing CAUTIs (4.50 ± 0.53). In contrast, the item concerning the effect of workload on adherence to infection prevention guidelines had the lowest mean score (3.04 ± 1.32).

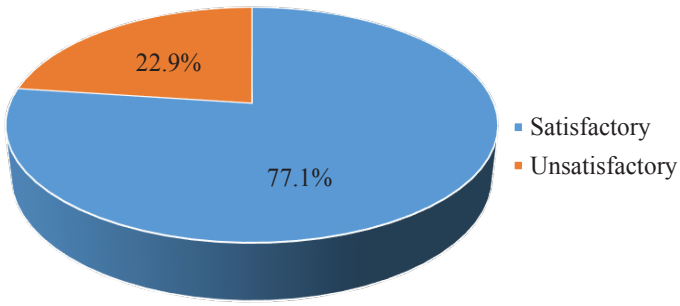


Figure 1. Classification of attitudes regarding the prevention of catheter-associated urinary tract infections (n = 223)

Most nurses (77.1%) demonstrated positive attitudes regarding the prevention of catheter-associated urinary tract infections.

Table 4. Factors associated with knowledge of catheter-associated urinary tract infection prevention (n = 223)

Factor		Satisfactory knowledge, n (%)	Unsatisfactory knowledge n (%)	p
Age	< 30 years	37 (68,7)	17 (31,3)	0.384[a]
	≥ 30 years old	126 (74.6)	43 (25,4)	
Sex	Male	7 (70,0)	3 (30,0)	0.731[b]
	Female	156 (73.2)	57 (26,8)	
Professional qualifications	Intermediate level	1 (50,0)	1 (50,0)	0.287[b]
	College degree	20 (62.5)	12 (37.5)	
	Bachelor's degree	133 (75,6)	43 (24,4)	
	Postgraduate degree	9 (69,2)	4 (30,8)	
Work experience	< 5 years	29 (76,3)	9 (23,7)	0.623[a]
	≥ 5 years	134 (72.4)	51 (27,6)	
CAUTI prevention training	Yes	158 (73,1)	58 (26,9)	0.920[b]
	No	5 (71,4)	2 (28.6)	
Annual catheter care training frequency	0 sessions/year	2 (50,0)	2 (50,0)	0.140[b]
	1–2 sessions/year	150 (75.0)	50 (25,0)	
	> 2 sessions/year	11 (57,9)	8 (42,1)	

Factor		Satisfactory knowledge, n (%)	Unsatisfactory knowledge n (%)	p
Availability of CAUTI educational materials	Yes	113 (77.9)	32 (22,1)	**0.026**[a]
	No	50 (64,1)	28 (35,9)	
Frequency of hospital supervision	Occasionally (1-2 times/month)	56 (71,8)	22 (28,2)	
	Frequent (weekly)	71 (74,0)	25 (26,0)	0.948[a]
	Very frequent (several imes/week)	36 (73.5)	13 (26.5)	

Note: a: Chi-square test; b: Fisher's exact test

The provision of educational materials on CAUTI was significantly associated with nurses' knowledge of CAUTI prevention (p = 0.026). Nurses who had received educational materials had a higher proportion of satisfactory knowledge than those who had not (77.9% vs. 64.1%). No statistically significant associations were identified between knowledge of CAUTI prevention and the other factors examined (p > 0.05).

Table 5. Factors associated with attitudes regarding catheter-associated urinary tract infection prevention (n = 223)

Factor		Positive n (%)	Not proactive n (%)	p
Age	< 30 years	38 (70,4)	16 (29,6)	0.174[a]
	≥ 30 years old	134 (79,3)	35 (20,7)	
Sex	Male	6 (60,0)	4 (40,0)	0.242[b]
	Female	166 (77.9)	47 (22,1)	
Professional qualifications	Intermediate level	2 (100,0)	0	0.441[b]
	College degree	24 (75.0)	8 (25,0)	
	Bachelor's degree	138 (78.4)	38 (21,6)	
	Postgraduate degree	8 (61.5)	5 (38.5)	
Work experience	< 5 years	31 (81.6)	7 (18,4)	0.473[a]
	≥ 5 years	141 (76,2)	44 (23,8)	
CAUTI prevention training	Yes	165 (76.4)	51 (23,6)	0.208[b]
	No	7 (100,0)	0	

Factor		Positive n (%)	Not proactive n (%)	p
Annual catheter care training frequency	0 sessions/year	3 (75.0)	1 (25,0)	
	1–2 sessions/year	158 (79.0)	42 (21.0)	0.115[b]
	> 2 sessions/year	11 (57,9)	8 (42,1)	
Availability of CAUTI educational materials	Yes	115 (79.3)	30 (20,7)	0.291[a]
	No	57 (73,1)	21 (26,9)	
Frequency of hospital supervision	Occasionally (1-2 times/month)	56 (71,8)	22 (28,2)	
	Frequent (weekly)	72 (75,0)	24 (25,0)	**0.05**[a]
	Very frequent (several imes/week)	44 (89.8)	5 (10,2)	
Knowledge of CAUTI prevention	Satisfactory	136 (79,1)	36 (20,9)	**0.000**[a]
	Unsatisfactory	27 (52,9)	24 (47,1)	

Note: a: Chi-square test; b: Fisher's exact test

The results in Table 5 indicate statistically significant associations between attitudes toward CAUTI prevention and hospital inspection/supervision frequency and knowledge of CAUTI prevention. The proportion of nurses with positive attitudes was highest among those reporting very frequent hospital inspections/supervision (89.8%). Nurses with satisfactory knowledge also had a higher proportion of positive attitudes than those with unsatisfactory knowledge (79.1% vs. 52.9%; $p < 0.001$).

DISCUSSION

Nurses' knowledge and attitudes regarding catheter-associated urinary tract infection prevention: The findings indicated that 73.1% of nurses had satisfactory knowledge of CAUTI prevention. This proportion was lower than that reported by Nguyen Thi Thuy (2024) at Hanoi Medical University Hospital, where 83.0% of nurses had satisfactory knowledge[13]. However, our findings were higher than those reported in several international studies, in which the proportions of nurses with satisfactory or good knowledge of CAUTI prevention ranged from approximately 16.7% to 69.1%[4,14-16]. These differences may be associated with variations in training and workshop on CAUTI prevention. In our study, most nurses had previously participated in training or workshop activities related to CAUTI prevention. In addition, differences in the criteria used to classify knowledge levels across studies may have affected the comparability of the findings.

Most nurses in this study correctly identified risk factors for catheter-associated urinary tract infection (CAUTI), particularly those related to healthcare personnel. This finding was consistent with

several international studies in which more than 95% of nurses correctly identified healthcare personnel-related risk factors [4, 14]. In addition, nurses demonstrated relatively high levels of knowledge regarding the care of patients with urinary catheters, particularly monitoring urine volume in the drainage bag, providing aseptic care, and maintaining unobstructed urine flow. These findings were comparable to those of a study conducted in Malaysia [4]. However, knowledge gaps remained in several areas. Fewer than half of the nurses correctly identified the appropriate timing for urinary catheter replacement. Although this proportion was higher than that reported by Nguyen Thi Thu Hien (2022) at Hanoi Medical University Hospital [11], the finding suggests that nurses' knowledge of certain specialized aspects of CAUTI prevention remains insufficient. This may be partly attributable to the limited emphasis placed on these topics in training and educational programs.

In this study, most nurses demonstrated positive attitudes toward CAUTI prevention. This proportion was higher than those reported in several studies conducted in Vietnam and other countries in the region, where the prevalence of positive attitudes among nurses ranged from 60% to 67.9% [9, 11, 17, 18]. This difference may be related to the fact that nurses in our study were regularly trained, educated, and monitored, especially in units with high numbers of catheterized patients. This demonstrates the importance of ongoing training programs and supervisory activities in improving nurses' knowledge and attitudes in infection control practices. However, when compared to international studies, the proportion of nurses with a positive attitude in our study is still lower, as a study in Malaysia recorded this figure at up to 85% [4]. This difference may be partly attributable to the high workload and predominantly manual supervision practices at the study hospital, which may contribute to variations in adherence to CAUTI prevention practices across departments.

In addition, nurses demonstrated the most positive attitude regarding the importance of catheter insertion and care techniques, with the highest average score. This finding is consistent with the study by Nguyen Thi Thu Hien (2022), in which 92.6% of nurses considered catheter insertion and care to be essential nursing skills [11]. In contrast, the item with the lowest mean score was "Workload affects the application of infection prevention guidelines". This finding was consistent with a previous study that identified workload pressure as a factor associated with reduced adherence to preventive guidelines among nurses[17]. The overload of catheterized patients may represent a barrier to full adherence to CAUTI prevention protocols. This highlights the need for appropriate solutions regarding workforce and work organization to alleviate pressure on nursing staff.

Factors associated with nurses' knowledge and attitudes regarding catheter-associated urinary tract infection prevention: The analysis identified a statistically significant association between the provision of educational materials and nurses' knowledge of CAUTI prevention. Specifically, the proportion of nurses with satisfactory knowledge was higher among those who had received educational materials than among those who had not (77.9% vs. 64.1%). This finding was consistent with a study by Veer and Biradar (2024) in India, which also reported an association between access to educational materials and nurses'

awareness of CAUTI prevention [14]. These findings suggest that access to professional guidelines and educational materials may help improve nurses' knowledge of CAUTI prevention in clinical practice.

In contrast, no statistically significant associations were found between nurses' knowledge of CAUTI prevention and age, sex, professional qualification, years of work experience, or participation in training activities. Similar findings were reported by Nguyen Thi Thu Hien (2022) [11]. However, other studies have reported different results. A study by Zegeye et al. (2023) in Ethiopia found that sex and participation in training were associated with nurses' knowledge levels [17]. Meanwhile, studies by Veer and Biradar (2024) [14] and Coutinho et al. (2018) [15] reported that nurses with higher educational qualifications had better knowledge of CAUTI prevention. These discrepancies may be related to differences in study populations and training contexts. In our study, most nurses were female and held college or bachelor's degrees. In addition, they received training based on the same nursing competency standards, which may have contributed to similar knowledge levels across groups.

Regarding attitudes toward catheter-associated urinary tract infection prevention, the frequency of hospital inspections and supervision was significantly associated with nurses' attitudes. The proportion of nurses with positive attitudes was notably higher among those reporting more frequent supervision. This finding was consistent with the study by Nguyen Thi Thu Hien (2022) and several international studies, which also reported associations between hospital supervision and nurses' attitudes toward CAUTI prevention [4, 10, 11, 15]. These findings suggest that hospital inspection and supervision may play an important role in fostering positive nursing attitudes toward CAUTI prevention in clinical practice.

In addition, a statistically significant association was identified between nurses' knowledge and attitudes toward catheter-associated urinary tract infection prevention. Nurses with satisfactory knowledge had a notably higher proportion of positive attitudes than those with unsatisfactory knowledge. This finding was consistent with a study conducted in Malaysia, which reported a positive correlation between knowledge and attitudes toward CAUTI prevention [4]. These findings suggest that improving nurses' knowledge, particularly regarding the care of patients with urinary catheters, may contribute to more positive attitudes toward CAUTI prevention in clinical practice.

In contrast, our study found no statistically significant associations between nurses' attitudes toward catheter-associated urinary tract infection prevention and demographic and professional characteristics, including age, sex, professional qualification, years of work experience, and participation in training activities. This finding was consistent with the study by Mong et al. (2022) conducted in Malaysia [4]. However, Zegeye et al. (2023) reported that access to educational materials may positively influence nurses' attitudes toward CAUTI prevention [17]. These discrepancies highlight the need for further research to clarify the roles of training, educational activities, and supervisory practices in shaping nurses' attitudes toward infection prevention and control.

This study has some limitations that should be considered. First, the cross-sectional descriptive design captures associations between variables at a single

point in time and does not allow causal relationships to be established. Second, data were collected using self-administered questionnaires, which may have introduced information bias. Third, the study was conducted at a single hospital; therefore, the findings may not fully reflect the situation in other healthcare settings. In addition, the internal consistency of the questionnaire used to assess nurses' knowledge was moderate, which may have affected the accuracy of the assessment of knowledge regarding the prevention of catheter-associated urinary tract infections. Finally, the study assessed nurses' knowledge and attitudes but did not comprehensively evaluate their actual clinical practices in CAUTI prevention.

CONCLUSION

Most nurses working in the clinical departments of Da Nang Hospital had satisfactory knowledge and positive attitudes toward catheter-associated urinary tract infection prevention. The provision of educational materials was significantly associated with nurses' knowledge, whereas the frequency of hospital inspections and supervision and nurses' knowledge levels were associated with their attitudes. These findings highlight the need to improve access to educational materials, strengthen specialized training programs, and enhance internal inspection and supervision to improve nurses' knowledge and attitudes toward catheter-associated urinary tract infection prevention.

REFERENCES

1. Werneburg GT. Catheter-associated urinary tract infections: current challenges and future prospects. Res Rep Urol. 2022;14:109-33. doi: 10.2147/RRU.S273663.

2. Centers for Disease Control and Prevention (CDC). Catheter-associated urinary tract infection (CAUTI) basics [Internet]. Atlanta (GA): CDC; 2025 [cited 2026 Mar 7]. Available from:https://www.cdc.gov/uti/about/cauti-basics.html

3. Ministry of Health. Decision No. 3916/QD-BYT dated August 28, 2017, on approving guidelines for infection control in medical examination and treatment facilities. Hanoi: Ministry of Health; 2017.

4. Mong I, Ramoo V, Ponnampalavanar S, Chong MC, Wan Nawawi WNF. Knowledge, attitude and practice in relation to catheter-associated urinary tract infection prevention: a cross-sectional study. J Clin Nurs. 2022;31(1-2):209-19. doi: 10.1111/jocn.15899.

5. Haza'a A, Al-Jaradi A, Odhah M. Knowledge of nurses toward prevention for catheter-associated urinary tract infection in public hospital at Amran City, Yemen. Open J Nurs. 2021;11(11):933-46. DOI: 10.4236/ojn.2021.1111076

6. Rashmi KC, Dhakal B. Knowledge, attitude and practice on prevention of catheter-associated urinary tract infection among nurses of a tertiary care hospital. J Coll Med Sci Nepal. 2021;17(1):61-8. DOI:10.3126/jcmsn.v17i1.28543

7. Mohammed O, Gedamu S, Birrie E, Seid A, Dires A, Goshiye D. Knowledge, practice and associated factors of health care workers on prevention of catheter-associated urinary tract infections in South Wollo Zone public hospitals, Northeast Ethiopia. Infect Drug Resist. 2022;15:5729-39. doi: 10.2147/IDR.S380980.

8. Benny AM, Idiculla AS, Kunjumon A, George A, Roseline AA, Sequera SKL. Nurses' knowledge on prevention of

catheter-associated urinary tract infection in a selected hospital of Mangaluru. J Health Allied Sci NU. 2020;10(2):1-3. DOI:10.1055/s-0040-1716664

9. Le Thi Lien. Knowledge and practice of urinary tract infection prevention for catheter-inserted patients among nurses in the Emergency Department and Intensive Care Unit of the Central Tropical Diseases Hospital and some influencing factors [Master's Thesis]. Hanoi: University of Public Health; 2018.

10. Dang Xuan Hung. The current state of knowledge and practice of urinary catheter care among nurses at the National Burn Institute in 2019 [Master's Thesis]. Nam Dinh: Nam Dinh University of Nursing; 2019.

11. Nguyen Thi Thu Hien. Knowledge and attitudes of nurses regarding the prevention of urinary tract infections during catheterization at Hanoi Medical University Hospital [Master's Thesis]. Hanoi: Thang Long University; 2022.

12. Balu P, Ravikumar D, Muthuprakas S, Suga SDD, Sivaganannam P, Priyalesheeni V, et al. Assessment of knowledge, attitude and practice on prevention of catheter-associated urinary tract infection (CAUTI) among health care professionals working in a tertiary care teaching hospital. J Pure Appl Microbiol. 2021;15(1):335-45. https://doi.org/10.22207/JPAM.15.1.28

13. Nguyen Thi Thuy, Nguyen Thi Son, Truong Quang Trung, Nguyen Thi Thu Hien. Nurses' knowledge and attitudes on urinary tract infection prevention in patients with urinary catheters at Hanoi Medical University Hospital. Journal of Medical Research. 2024;185(12):225-36. https://doi.org/10.52852/tcncyh.v185i12.2845

14. Veer N, Biradar V. A correlational study to assess the knowledge and practices regarding catheter-associated urinary tract infection care bundle among staff nurses in selected hospitals of Maharashtra. Int J Nur Health Care. 2024;9(4):73-8. https://doi.org/10.31690/ijnh.2023.v09i04.016

15. Cutinho MC, Sheilini M, Harish B. Knowledge on practice of urinary catheter care and compliance to urinary catheter care guidelines: a hospital-based study. Indian J Public Health Res Dev. 2018;9(11):218-24. DOI:10.5958/0976-5506.2018.01455.9

16. Dessie Z, Gela D, Yusuf NT. Knowledge, attitude, practice and associated factors toward the prevention of catheter-associated urinary tract infection among nurses in Ethiopia: a cross-sectional study. SAGE Open Nurses. 2024;10:23779608241281317. doi: 10.1177/23779608241281317.

17. Zegeye AF, Kassahun CW, Temachu YZ. Work experience was associated with the knowledge and practice of catheter-associated urinary tract infection prevention among nurses at University of Gondar Comprehensive Specialized Hospital, northwest Ethiopia, 2021. BMC Womens Health. 2023;23(1):40. doi: 10.1186/s12905-023-02176-8.

18. Nure M, Dechasa A, Ifa M, Bedane J. Knowledge and practice of catheter-related urinary tract infection prevention and its associated factors among nurses working at public hospitals in the Oromia region of Ethiopia: a cross-sectional survey. Int J Nurs Stud Adv. 2024;8:100281. doi: 10.1016/j.ijnsa.2024.100281.