ADHERENCE TO INFECTION PREVENTION AND CONTROL PROTOCOLS FOR CATHETER-RELATED URINARY TRACT INFECTIONS AMONG NURSES IN UNIVERSITY OF BENIN TEACHING HOSPITAL, EDO STATE

BY

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FACULTY OF NURSING SCIENCE

COLLEGE OF MEDICAL SCIENCES

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UGBOWO, BENIN CITY

OCTOBER, 2025

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IN PARTIAL FUFILLMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF NURSING SCIENCE (BNSC), COLLEGE OF MEDICAL SCIENCES, UNIVERSITY OF BENIN, BENIN CITY.

OCTOBER, 2025

DECLARATION

This is to declare that this research project titled **"ADHERENCE TO INFECTION PREVENTION AND CONTROL PROTOCOLS FOR CATHETER-RELATED URINARY TRACT INFECTIONS AMONG NURSES IN UNIVERSITY OF BENIN TEACHING HOSPITAL"** was carried out by **EZEOKEKE CHINEMEREM ADACHUKWU.** It is solely the result of my work except where acknowledged as being derived from other person (s) or resources.

EXAMINATION NUMBER: _____

FACULTY/COLLEGE: NURSING SCIENCE, COLLEGE OF MEDICAL SCIENCES, UNIVERSITY OF BENIN, BENIN CITY.

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CERTIFICATION/APPROVAL

This is to certify that this research project by **EZEOKEKE CHINEMEREM ADACHUKWU** with matriculation number _____ has been examined and approved for the award of BACHELOR OF NURSING SCIENCE CERTIFICATE

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EXTERNAL EXAMINER

DEDICATION

This research project work is dedicated to Almighty God for His Grace and Mercy through the period of this research.

ACKNOWLEDGEMENT

I give all glory to the Almighty God for His unwavering guidance, protection, and provision throughout my life and academic journey.

My heartfelt appreciation goes to my supervisor Sr. J. N. Chukwurah, whose expert guidance, insightful corrections, and consistent support were instrumental to this research. I also sincerely thank my HOD Prof (Mrs) C.E Omorogbe, as well as Prof. F. U. Okafor, Prof(Mrs) R.E Esewe, Prof (Mrs) J. A. Afemikhe, Dr (Mrs) C. Enuku, Mrs M. A. Iniomor, Mrs C. C. Edo-Osagie, Dr T. A. Ehwarieme, Mrs E. N. Oyana, Mrs R. Lawal, Mrs Ikhuobase, Mrs F. Esebanme, Mr Aragua, and all other lecturers and non-academic staff for their dedication, contributions, and support.

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ABSTRACT

This study aimed to evaluate nurses' adherence to evidence-based infection prevention and control protocols for catheter associated urinary tract infections prevention at the University of Benin Teaching Hospital (UBTH), identify influencing factors, and propose strategies to enhance compliance. A descriptive cross-sectional design was employed, using a structured questionnaire administered to 211 nurses across various clinical departments. Data were analyzed using descriptive and inferential statistics, with significance set at $p < 0.05$. The findings revealed that while 80.6% of nurses demonstrated good knowledge of CAUTI prevention protocols, only 67.3% reported strict adherence to them. Factors affecting adherence included high patient loads, time constraints, inadequate supply of personal protective equipment, and lack of institutional support. A significant relationship ($p < 0.05$) was found between nurses' knowledge and their level of adherence, affirming the relevance of the Theory of Planned Behavior in predicting IPC compliance. The study concludes that although knowledge levels are relatively high, adherence is hindered by modifiable barriers. To improve compliance, the study recommends regular in-service training, implementation of nurse-led catheter protocols, improved resource allocation, and enhanced leadership engagement. These interventions are expected to reduce CAUTI rates, enhance patient outcomes, and strengthen infection control practices. The study contributes to the growing body of evidence emphasizing the need for context-specific interventions in Nigerian healthcare settings to support nurses in delivering safe, evidence-based care.

Keywords: CAUTI, infection prevention, nursing adherence, evidence-based practice,

UBTH, Nigeria

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CHAPTER ONE

INTRODUCTION

1.1. Background to the Study

Urinary tract infections (UTIs) are among the most common healthcare-associated infections (HAIs) in developing countries. A UTI occurs when any part of the urinary system, including the kidneys, ureters, bladder, or urethra becomes infected (Center for Disease Control [CDC], 2024). According to a study by Yang et al., (2022), UTIs make up approximately 40% of all HAIs, with over 80% of cases linked to the use of indwelling urinary catheters. These catheters, typically made from various polymers such as silicone and latex rubber, are inserted through the urethra into the bladder to facilitate urine drainage, a procedure known as catheterization (Kanti et al., 2022).

Catheter-associated urinary tract infection (CAUTI) is characterized by the significant presence of bacteria in the urine of a patient with an indwelling catheter. This infection occurs when bacteria or other pathogens gain access to the urinary tract through the catheter, leading to complications (Rubi et al., 2022). The increasing prevalence of CAUTIs has emerged as a critical global health issue, with a particularly high burden in developing countries (Werneburg, 2022).

A study conducted by Zelalem et al., (2024) reported a pooled prevalence of catheter-associated urinary tract infections (CAUTI) at 43.28%. Gram-negative bacteria were identified as the primary causative agents, accounting for 82.9% of cases. Among these, *Escherichia coli* was the most frequently isolated pathogen (45.06%), followed by *Klebsiella* species (24.17%). On the

other hand, *Staphylococcus aureus* was the predominant gram-positive bacterial isolate, responsible for 53.24% of gram-positive CAUTI cases.

The presence of a urinary catheter and prolonged catheterization are major risk factors for CAUTI. However, studies indicate that 21–65% of catheter insertions are unnecessary, and extended use without a clear medical indication is common. To address this issue, prior intervention studies have emphasized key strategies, including strict criteria for catheter placement, prompt removal of unnecessary catheters, and adherence to proper insertion and maintenance protocols. For instance, the Keystone Bladder Bundle Initiative introduced a standardized protocol incorporating catheter utilization guidelines, reminders and stop orders, alternative urinary management techniques, bladder volume assessment via portable ultrasound, and strict adherence to best practices for catheter care (Schweiger et al., 2020).

Within intensive care units (ICUs), Blot et al., (2022) documented an 18.9% incidence of CAUTIs, identifying key risk factors such as diabetes mellitus, advanced age, female gender, and systemic antibiotic use. These findings underscore the importance of implementing targeted preventive measures, particularly for high-risk patient groups.

Infection prevention and control (IPC) protocols are specifically designed to reduce the risk of healthcare-associated infections, including catheter-associated urinary tract infections (CAUTIs). These protocols serve as crucial guidelines for healthcare professionals, particularly nurses, by promoting proper hygiene practices, maintaining sterile techniques during catheter insertion, and ensuring routine monitoring of catheter sites (Goorts et al., 2021). Despite their importance, compliance with these protocols varies significantly among healthcare workers, making it an ongoing challenge in healthcare settings worldwide (Babore et al., 2024).

To address this, the World Health Organization [WHO] (2022) and the Nigerian Centre for Disease Control [CDC] (2022) have developed comprehensive guidelines aimed at preventing catheter-related infections. These guidelines include recommendations for proper hand hygiene, the use of personal protective equipment, aseptic insertion techniques, and appropriate catheter maintenance. Research indicates that consistent adherence to evidence-based IPC practices can substantially lower infection rates. In fact, studies have shown that strict compliance with these protocols can reduce CAUTI incidence by up to 70%, underscoring the necessity of following these preventive measures (Ejemot-Nwadiaro et al., 2021).

Nurses play a vital role in preventing catheter-related urinary tract infections, as they are directly responsible for catheter insertion, maintenance and patient monitoring (Patel et al., 2023). To effectively reduce infection rates, strict adherence to infection prevention and control (IPC) guidelines is essential. However, several factors can hinder compliance including knowledge gaps, inadequate training, workforce shortages, and challenging workplace environments (Abalkhail & Alslamah, 2022). Moreover, institutional factors such as resource availability, organizational policies, and leadership support significantly influence adherence levels (Milella et al., 2021).

In Nigeria, nurses encounter unique obstacles that impact their ability to follow IPC protocols. One major challenge is the high patient-to-nurse ratio, which often exceeds global recommendations by three times or more in many tertiary healthcare institutions (Akinwumi et al., 2023). At the University of Benin Teaching Hospital, as in many other Nigerian tertiary facilities, persistent issues such as inconsistent water supply and shortages of personal protective equipment further complicate infection control efforts (Ochie et al., 2022). These systemic

challenges create significant barriers to achieving optimal adherence to infection prevention measures.

This study intends to evaluate the level of compliance with infection prevention protocols among nurses at the University of Benin Teaching Hospital. It also seeks to identify the key factors influencing their adherence and propose strategies to enhance compliance. By conducting this research, the study will generate context-specific insights that address the unique challenges nurses face. The findings will be instrumental in strengthening infection control measures, reducing the incidence of CAUTIs, and ultimately improving patient outcomes.

1.2. Statement of Problem

Catheter-associated urinary tract infections (CAUTIs) continue to be a major healthcare-associated infection (HAI), leading to higher rates of morbidity, mortality, and healthcare expenses worldwide (WHO, 2023). Advances in infection prevention and control (IPC) protocols have resulted in the creation of evidence-based guidelines that prioritize standardized catheter insertion methods, diligent maintenance practices, and timely removal when no longer medically necessary (CDC, 2024). These updated protocols often integrate nurse-driven initiatives for catheter removal along with enhanced care bundles to improve patient outcomes.

A recent study by the International Society for Infectious Diseases (2024) emphasized that the most effective strategy for preventing catheter-associated urinary tract infections (CAUTIs) is to avoid the use of indwelling urinary catheters unless absolutely necessary. It recommends conducting regular risk assessments for CAUTIs and implementing a comprehensive, organization-wide program to identify and remove catheters that are no longer clinically

indicated. The study also stresses the importance of ensuring that the physical environment supports proper catheter positioning such as securely attaching tubing to beds or wheelchairs at an appropriate height to prevent kinking. Furthermore, it advocates for the establishment and strict enforcement of institutional policies that require daily evaluation of catheter necessity. This may include the use of automatic stop orders, which prompt clinicians to reassess the ongoing need for catheterization and renew orders only when justified.

Although protocols for preventing catheter-associated urinary tract infections (CAUTIs) have been introduced, focusing on standardized practices and prompt catheter removal, research consistently reveals substantial challenges in translating these guidelines into practice. Key obstacles include limited knowledge among nursing personnel, inconsistent adherence to care bundles, and underutilization of nurse-led urinary catheter removal protocols (Alhumaid et al., 2021; Kamel, 2025; Plando et al., 2024). Additionally, the real-world implementation of these standardized guidelines often differs across healthcare settings, highlighting the need for contextual adaptation (Lowe et al., 2021). Contributing factors such as insufficient understanding of infection prevention and control (IPC) protocols, lack of awareness regarding daily preventive practices, and the tendency to underestimate the risks posed by microbial transmission during routine care further hinder compliance with established IPC protocols (Houghton et al., 2020).

At the University of Benin Teaching Hospital (UBTH), the extent to which nurses comply with the latest CAUTI prevention and control protocols remains uncertain. UBTH faces an increased risk of higher CAUTI rates, leading to greater patient morbidity, extended hospital stays, and added strain on the healthcare system. Factors such as heavy workloads, limited resources, and time constraints (Carratalá-Munuera et al., 2022) further challenge adherence. These issues are compounded by systemic challenges like severe understaffing with nurse-to-patient ratios

reaching 1:15 during the day and 1:30 at night far exceeding the WHO's recommended 1:4 ratio for general wards (Musa & Hamid, 2021).

To address these risks, it is essential to evaluate how well nurses at UBTH adhere to the CAUTI prevention protocols. This study seeks to pinpoint specific areas of non-compliance and guide the development of targeted interventions to enhance patient safety and care quality. In particular, an investigation is needed to determine whether nurses are correctly implementing updated guidelines for catheter selection, insertion, maintenance, and timely removal.

1.3. Objectives of the Study

This study's primary objective is to evaluate the adherence of nurses to infection prevention and control (IPC) protocols for catheter associated urinary tract infection in University of Benin Teaching Hospital.

Specific Objectives:

1. To evaluate nurses' knowledge of infection prevention and control protocols for CAUTIs in University of Benin Teaching Hospital.
2. To determine the level of adherence to infection prevention and control protocols for CAUTIs among nurses in University of Benin Teaching Hospital.
3. To identify factors influencing the adherence of nurses to the infection prevention and control protocols for CAUTIS in University of Benin Teaching Hospital.

1.4. Research Questions

1. What is the level of knowledge among nurses regarding infection prevention and control protocols for CAUTIs in University of Benin Teaching Hospital?
2. To what extent do nurses adhere to the infection prevention and control protocols for CAUTIs in University of Benin Teaching Hospital?
3. What factors affect nurses' adherence to infection prevention and control protocols for CAUTIs in University of Benin Teaching Hospital?

1.5. Research Hypothesis

H0: There is no significant relationship between nurses' knowledge and their adherence to infection prevention and control (IPC) protocols for CAUTIs in UBTH

1.6. Significance of the Study

This study is crucial as it aims to provide insights into nurses' compliance with infection prevention and control (IPC) protocols for CAUTI prevention at UBTH. By identifying knowledge gaps and barriers to adherence, the research will help inform the development of targeted training programs and enhance compliance with best practices.

Through an assessment of adherence levels and the challenges faced, the study will generate data-driven recommendations to strengthen infection control policies, optimize resource allocation, and improve staff support systems at UBTH. Greater adherence to IPC protocols is expected to reduce CAUTI incidence, enhance patient outcomes, lower hospital-acquired infection rates, and decrease healthcare costs.

Additionally, this research will contribute to the existing body of knowledge on infection prevention and control in Nigeria, serving as a valuable reference for future studies and interventions aimed at mitigating CAUTI-related morbidity and mortality.

1.7. Scope of the Study

This study will focus on adherence of nurses to infection prevention and control (IPC) protocols for catheter associated urinary tracts infections thereby it is limited to nurses working in university of Benin Teaching Hospital.

1.8. Operational Definition of Terms

1. Adherence: Adherence refers to the degree to which nurses follow the infection prevention and control protocols for catheter-related urinary tract infections (CAUTIs).
2. Infection Prevention and Control Protocols: These protocols are guidelines or practices based on the latest scientific research and evidence typically aimed at reducing and preventing catheter-related urinary tract infections (CAUTIs).
3. Catheter-Related Urinary Tract Infections (CAUTIs): A catheter-related urinary tract infection (CAUTI) is an infection that occurs in a patient who has a urinary catheter in place and is caused when bacteria enter the urinary tract. The infection is identified when symptoms such as fever, pain, increased urinary frequency, or changes in the urine's appearance are observed.
4. Nurse: A nurse is a person who has received authorized education, acquired specialized knowledge, skills and attitudes and is registered and licensed by the Nursing and Midwifery Council of Nigeria to provide safe, competent and ethical nursing care to individuals, families and communities in a variety of health care settings.

5. University of Benin Teaching Hospital (UBTH): UBTH is a tertiary healthcare institution in Benin city, Nigeria where the study adherence to infection control protocols is being conducted.

CHAPTER TWO

LITERATURE REVIEW

To explore the current state of adherence to these protocols among nurses, a comprehensive review of the literature was conducted. The literature was sourced from academic databases, reputable journals, books, and authoritative online platforms, including peer-reviewed articles, government publications, and clinical guidelines. Materials were gathered through systematic searches in databases such as PubMed, Google Scholar, and the Cochrane Library using keywords including "catheter-associated urinary tract infections," "infection control protocols," and "nursing adherence." Peer-reviewed journals were accessed via university subscriptions and open-access platforms, while books and clinical guidelines were obtained from libraries and reputable sources such as the World Health Organization and the Centers for Disease Control and Prevention.

The selection process prioritized studies published within the last five years, focusing on materials directly related to infection prevention, urinary catheter management, and nursing practice in healthcare settings. Peer-reviewed and English-language sources were emphasized to ensure credibility and accessibility. Older studies were generally excluded unless they provided foundational or theoretical frameworks relevant to the study. Non-peer-reviewed sources and materials not directly addressing the core topics were also excluded. This rigorous approach ensured the inclusion of the most relevant, credible, and up-to-date materials to inform the study.

This chapter reviews the relevant literature on infection prevention and control, focusing specifically on adherence to CAUTI-related protocols among nurses. It begins by clarifying key concepts and theoretical underpinnings that guide infection control practices. Subsequently,

empirical studies are examined to understand the current state of adherence and the determinants affecting nurses' compliance in similar settings. The chapter concludes with a summary that highlights the gaps in existing research and sets the stage for the present study.

2.1 Conceptual review

2.1.1 Concept of Catheter-Associated Urinary Tract Infections

Catheter-associated urinary tract infection (CAUTI) is defined as a urinary tract infection that occurs in a patient who had an indwelling urinary catheter in place within the previous 48 hours before the onset of the infection (Centers for Disease Control and Prevention [CDC], 2023). CAUTIs represent one of the most common healthcare-associated infections (HAIs) globally, accounting for approximately 30-40% of all HAIs in acute care settings (Mong et al., 2022; Al-Sayaghi et al., 2023). According to the World Health Organization (WHO), these infections not only increase patient morbidity and mortality but also significantly extend hospital stays and elevate healthcare costs (WHO, 2021).

CAUTIs can be classified into two main types: symptomatic CAUTIs, which present with clinical manifestations such as fever, suprapubic tenderness, and altered mental status in elderly patients; and asymptomatic bacteriuria, which involves significant bacteriuria without clinical symptoms (Rubi-H et al., 2022). The distinction between these types is crucial for appropriate management strategies and accurate surveillance reporting; otherwise, resistance will develop against the antimicrobial drug (Rubi-H et al., 2022).

The prevalence of CAUTIs varies across different healthcare settings and geographical regions. In a large multinational study across 623 intensive care units (ICUs), a total of 2,010 catheter-

associated urinary tract infections (CAUTIs) were recorded, resulting in a pooled CAUTI rate of 2.83 per 1,000 urinary catheter (UC) days. The highest rates were observed among patients using suprapubic catheters (3.93 CAUTIs per 1,000 UC days), those hospitalized in Eastern Europe (14.03), Asia (6.28), trauma ICUs (7.97), neurologic ICUs (6.28), and neurosurgical ICUs (4.95). Additionally, elevated rates were noted in lower-middle-income countries (3.05) and public hospitals (5.89). Independent risk factors for CAUTI acquisition included age (adjusted odds ratio [aOR], 1.01; $P < .0001$), female sex (aOR, 1.39; $P < .0001$), length of stay before CAUTI acquisition (aOR, 1.05; $P < .0001$), urinary catheter device utilization ratio (aOR, 1.09; $P < .0001$), public hospital setting (aOR, 2.24; $P < .0001$), and admission to neurologic ICUs (aOR, 11.49; $P < .0001$) (Rosenthal et al., 2024).A Nigerian study conducted in an intensive care unit reported a CAUTI incidence rate of 18.9% among catheterized patients, underscoring the significant burden of catheter-associated urinary tract infections in local healthcare settings (Hassan et al., 2020).

The classification of CAUTIs is essential for standardized diagnosis and reporting. The CDC's National Healthcare Safety Network (NHSN) provides standardized surveillance definitions that are widely used internationally (CDC 2023). According to these definitions, a CAUTI is confirmed when a catheterized patient develops signs and symptoms compatible with UTI, with no other identified source of infection, and has significant bacteriuria (≥105 colony-forming units/ml) with no more than two species of microorganisms (Payal et at., 2023).

Table 2.1: Classification of Urinary Tract Infections in Catheterized Patients

Category	Clinical Presentation	Bacteriuria Level	Management Approach
Asymptomatic Bacteriuria	No symptoms	≥105 CFU/ml	Generally, no treatment required unless in high-risk patients
Symptomatic CAUTI	Fever, suprapubic tenderness, urgency, frequency, dysuria	≥103 CFU/ml	Antimicrobial therapy based on culture results
Complicated CAUTI	Symptoms plus systemic involvement (e.g., pyelonephritis, sepsis)	≥103 CFU/ml	Broad-spectrum antibiotics, possible catheter removal, extended treatment
Recurrent CAUTI	Repeated episodes after treatment	Variable	Individualized approach, possible urological evaluation

Source: Adapted from CDC NHSN guidelines (2023) and Victor et al., (2025)

2.1.2 Etiology of Catheter-Associated Urinary Tract Infections

CAUTIs develop through complex pathophysiological mechanisms involving microbial colonization, biofilm formation, and host defense disruption. The insertion of urinary catheters creates a direct pathway for microorganisms to enter the bladder, bypassing natural defense mechanisms (Flores-Mireles et al., 2019). Additionally, the presence of a foreign body in the urinary tract triggers inflammatory responses and provides a surface for microbial attachment and biofilm formation (Goda et at., 2022).

The most common causative organisms of CAUTIs include Escherichia coli, Klebsiella pneumoniae, Staphylococcus, Pseudomonas aeruginosa, Enterococcus species, and Candida species (Gambrill et al., 2024). A recent cross-sectional prospective study conducted across selected hospitals in Kano Metropolis, Nigeria, reported a high incidence of catheter-associated urinary tract infections (CAUTIs), with an overall prevalence rate of 70.6% among 231 catheterized patients aged 18 years and above (Abubakar et al., 2022). The most frequently isolated uropathogen was *Escherichia coli* (38.0%), followed by *Staphylococcus aureus* (35.6%).

The study found a higher CAUTI incidence among male participants (54.6%), with the highest rate observed in patients aged 68–77 years (22.7%). The antibiotics nitrofurantoin and amoxicillin demonstrated the most effectiveness against the isolates. Additionally, prolonged catheterization was significantly associated with increased CAUTI risk, highlighting the importance of timely catheter removal and infection prevention protocols (Abubakar et al., 2022).

Several risk factors contribute to the development of CAUTIs, which can be categorized as modifiable and non-modifiable factors:

Modifiable Risk Factors:

- Duration of catheterization (risk increases by 3-7% per day)
- Inappropriate catheter insertion techniques
- Breaches in the closed drainage system
- Inadequate aseptic maintenance of catheters
- Improper positioning of drainage bags
- Inappropriate catheter use (when not medically indicated)
- Inadequate hand hygiene among healthcare workers
- Insufficient nurse-to-patient ratios

Non-modifiable Risk Factors:

- Advanced age (>65 years)
- Female gender

- Diabetes mellitus
- Impaired immune system
- Renal insufficiency
- Malnutrition
- Prior urological surgery
- Presence of other active infections

Several recent studies have reaffirmed that the duration of catheterization remains the most critical modifiable risk factor for the development of catheter-associated urinary tract infections (CAUTIs). The risk of infection significantly increases with each additional day a urinary catheter remains in place. As such, limiting catheter use and ensuring prompt removal when it is no longer clinically indicated is a fundamental preventive strategy to reduce CAUTI incidence (Victor et al., 2025; Payal et al., 2024)

2.1.3 Epidemiology of Catheter-Associated Urinary Tract Infections

Epidemiologically, CAUTIs represent a significant global healthcare challenge. According to recent global estimates, approximately 150 million UTIs occur annually worldwide, with CAUTIs accounting for roughly 40% of these infections (Fitzgerald et at., 2024). The financial burden associated with CAUTIs is substantial, with annual costs estimated at approximately $340-450 million in the United States alone (Fitzgerald et al., 2024).

The results from a recent systematic review and meta-analysis, incorporating twenty studies, revealed a pooled prevalence of catheter-associated urinary tract infections (CAUTIs) in Africa at 43.28%. Gram-negative bacteria accounted for 82.9% of the cases, with *Escherichia coli*

(45.06%) being the most common, followed by *Klebsiella* species (24.17%). *Staphylococcus aureus* was the predominant gram-positive bacteria, comprising 53.24% of the cases. This high prevalence highlights the pressing healthcare challenge posed by CAUTIs in Africa, underscoring the need for improved health education, infection prevention measures, and resource allocation. The study emphasizes that minimizing catheterization duration is crucial, as prolonged use increases the risk of infection; catheters should only be used when clinically indicated and removed promptly when no longer necessary (Asmare et al., 2024).

In Nigeria, CAUTIs represent a significant component of healthcare-associated infections. A recent study conducted at the Maternal and Child Centre, Ifako-Ijaiye, Lagos State, specifically focused on CAUTI following Caesarean Sections (CS). This study found a CAUTI prevalence of 2% among 100 women who underwent elective and emergency C-sections with urethral catheterization. Notably, one participant cultured *Staphylococcus aureus*, while another cultured *Escherichia coli*. This study highlights the importance of catheterization duration and aseptic techniques in reducing CAUTI incidence in this patient population (Bola-Oyebamiji et al., 2024).

2.1.4 Symptomatology of Catheter-Associated Urinary Tract Infections

The clinical presentation of catheter-associated urinary tract infections (CAUTIs) ranges from asymptomatic bacteriuria to severe systemic infections. The presence of an indwelling catheter often masks classic symptoms such as dysuria, urgency, and frequency, making diagnosis particularly challenging (Givler & Givler, 2023). This diagnostic difficulty can lead to the underdiagnosis or misdiagnosis of CAUTIs in many healthcare settings (Givler & Givler, 2023). When symptoms do occur, they may include fever (>38°C), suprapubic tenderness,

costovertebral angle pain, altered mental status (especially in the elderly), malaise, flank pain, or signs of sepsis (Sabih & Leslie, 2024).

In elderly patients, CAUTIs may present atypically with non-specific symptoms such as confusion, agitation, lethargy, or decreased appetite, while patients with neurological conditions or spinal cord injuries may not experience pain at all, further delaying diagnosis (Givler & Givler, 2023; Sabih & Leslie, 2024). Laboratory findings may show pyuria (>10 WBCs per high-power field), bacteriuria ($\geq 10^3$ CFU/mL for symptomatic patients), or hematuria, but it is critical to distinguish asymptomatic bacteriuria from symptomatic infection to prevent unnecessary antibiotic use and reduce antimicrobial resistance (Givler & Givler, 2023).

Prompt recognition and management of CAUTIs are essential to prevent complications such as pyelonephritis, renal scarring, bacteremia, and sepsis. Nurses and frontline healthcare workers play a key role in detecting early signs and initiating timely intervention (Sabih & Leslie, 2024).

2.1.5 Prevention and Control Protocols for CAUTIs

The prevention of CAUTIs centers on evidence-based protocols focused on appropriate catheter use, proper insertion techniques, and meticulous catheter maintenance. These protocols have evolved significantly over the past decade, with increasingly robust evidence supporting their effectiveness in reducing CAUTI rates (Victor et al., 2024).

2.1.5.1 Core Components of CAUTI Prevention Protocols

1. **Appropriate Catheter Use:** Current guidelines strongly emphasize limiting urinary catheter use to specific clinical indications and removing catheters as soon as they are no

longer necessary (Payal et al., 2023). The Centers for Disease Control and Prevention (CDC) and the Healthcare Infection Control Practices Advisory Committee (HICPAC) provide comprehensive recommendations regarding appropriate indications for indwelling catheter use, which include acute urinary retention or bladder outlet obstruction, accurate measurement of urinary output in critically ill patients, perioperative use for specific surgical procedures, assistance with healing of open sacral or perineal wounds in incontinent patients, and to provide comfort for end-of-life care (CDC, 2025).

2. **Proper Catheter Insertion Techniques:** Proper Catheter Insertion Techniques: insertion protocols emphasize strict aseptic technique, including hand hygiene, use of sterile equipment, cleaning of the urethral meatus with antiseptic solution, maintaining a closed drainage system, and securing the catheter to prevent movement and urethral traction (Awoyomi et al., 2024). Additionally, broader multi-modal programs focusing on reducing Foley catheter use days and associated CAUTI rates have shown significant success. A retrospective evaluation across the Indiana University Health (IUH) system, comprising 16 hospitals and 2,703 beds, implemented a comprehensive program that included technologies, clinical training, and feedback from clinicians. This program, which aimed to standardize practices and reduce catheter utilization, resulted in significant reductions in the National Healthcare Safety Network's Standardized Infection Ratio (SIR), Standardized Utilization Ratio (SUR), and Incidence Density Ratio (IDR) rates post-implementation (Fish et al., 2024).

3. **Catheter Maintenance:** Maintenance protocols focus on daily assessment of catheter necessity, proper hygiene practices, maintaining unobstructed urine flow, keeping the collection bag below bladder level, and preventing reflux of urine (Payal et al., 2023). Regular documentation of catheter care activities and systematic reminders for catheter removal are also essential components of maintenance protocols (Awoyomi et al., 2024).

4. **Education and Training:** Infection prevention and control protocols emphasize comprehensive education and training for healthcare providers, particularly nurses who are primarily responsible for catheter care (Patel et al., 2023). Educational programs should address catheter insertion techniques, maintenance procedures, recognition of CAUTI symptoms, and the importance of prompt catheter removal (Patel et al., 2023).

5. **Surveillance and Feedback:** Continuous monitoring of catheter use, duration, and CAUTI rates, coupled with regular feedback to healthcare providers, is an essential component of infection prevention and control protocols (Patel et al., 2023). Surveillance data can identify trends, areas for improvement, and the effectiveness of implemented interventions (Patel et al., 2023).

2.1.5.2 CAUTI Prevention Bundles

CAUTI prevention bundles combine multiple interventions into a comprehensive approach that, when implemented together, has been shown to achieve greater reductions in CAUTI rates than individual interventions (Patel et al., 2023). These bundles typically include:

1. **Insertion Bundle:** Hand hygiene, sterile equipment, perineal cleaning with antiseptic solution, maintaining sterile field, aseptic insertion technique, and secure catheter fixation.

2. **Maintenance Bundle:** Daily catheter necessity assessment, perineal care with soap and water at least twice daily, maintaining closed drainage system, keeping collection bag below bladder level but off the floor, and regular emptying of collection bags.
3. **Removal Bundle:** Standardized nurse-driven removal protocols, automatic stop orders, reminder systems, and catheter removal algorithms.

2.1.6 Nurses' Role in CAUTI Prevention

Nurses play a pivotal role in preventing CAUTIs through their direct involvement in catheter insertion, maintenance, and removal procedures (Patel et al., 2023). As the healthcare professionals most consistently involved in patient care, nurses serve as the frontline defenders against CAUTIs and are ideally positioned to implement infection prevention and control protocols (Patel et al., 2023).

The specific responsibilities of nurses in CAUTI prevention include:

1. **Assessment of Catheter Necessity:** Nurses are responsible for continuously assessing the ongoing need for catheterization and advocating for catheter removal when no longer medically necessary. Research indicates that nurse-driven protocols for catheter removal can reduce catheter duration by 1.7 days on average and decrease CAUTI rates by up to 53% (Patel et al., 2023).

2. **Proper Catheter Insertion:** Nurses often perform or assist with catheter insertion and are responsible for ensuring adherence to aseptic technique. A study conducted in the ICU units of four public hospitals in Addis Ababa, Ethiopia, revealed gaps in nurses'

knowledge and practices related to CAUTI prevention. Out of 184 participating nurses, 63.04% demonstrated poor knowledge, while 47.83% reported poor practices in preventing catheter-associated UTIs. Importantly, the study found a statistically significant association between professional work experience and nurses' knowledge of CAUTI prevention ($p = 0.031$), highlighting the need for continuous education and training to improve aseptic technique and reduce infection risk during catheter insertion (Teshager et al., 2022).

3. **Maintenance of Catheter Systems:** Nurses play a critical role in daily catheter care, including perineal hygiene, maintaining closed drainage systems, ensuring unobstructed urine flow, and preventing catheter-related trauma. Recent literature highlights the potential of nurse-driven protocols (NDPs) in improving patient outcomes by empowering nurses to direct care independently, without requiring physician orders. A systematic review and meta-analysis by (Su et at., 2025) assessed the effectiveness of NDPs in preventing CAUTIs and reducing catheter utilization rates across ten studies with over 58,000 patients. The findings revealed that the implementation of NDPs led to a significant 29.48% reduction in catheter use and a 55.91% decrease in CAUTI incidence compared to traditional methods. These results underscore the importance of nurse-led initiatives in enhancing catheter maintenance practices and reducing infection rates, suggesting that NDPs could be a valuable strategy in hospital settings to curb CAUTIs.

4. **Early Detection of CAUTIs:** Given their frequent patient contact, nurses are often the first to identify signs and symptoms of CAUTIs, enabling prompt intervention (Htwe et al., 2021).

5. **Patient and Family Education:** Nurses provide essential education to patients and families regarding catheter care, signs of infection, and the importance of maintaining catheter hygiene (Teshager et al., 2022).

2.1.7 Adherence to CAUTI Prevention Protocols

Adherence to CAUTI prevention protocols is essential for reducing infection rates and improving patient outcomes (Patel et al., 2023). However, despite the availability of infection prevention guidelines, adherence rates among healthcare providers, including nurses, remain suboptimal in many healthcare settings (Teshager et al., 2022).

2.1.7.1 Factors Influencing Adherence to CAUTI Prevention Protocols

1. **Knowledge and Awareness:** Nurses' knowledge of infection control protocols is a fundamental determinant of their adherence to best practices in preventing catheter-associated urinary tract infections (CAUTIs). A study conducted in intensive care units (ICUs) including 115 nurses at the Northwest Bank Hospitals revealed that the majority of nurses demonstrated moderate to low levels of knowledge regarding infection control measures (Bawaqneh et al., 2025). This gap in knowledge poses a challenge in ensuring consistent application of evidence-based practices. Nurses with higher levels of

knowledge are more likely to adhere to CAUTI prevention protocols, highlighting the critical need for continuous education and training to improve patient outcomes.

2. **Attitudes and Beliefs:** Positive attitudes toward infection control measures significantly influence adherence to CAUTI prevention protocols. The same study found that 63.5% of ICU nurses exhibited a positive attitude toward infection control (Bawaqneh et at., 2025). A positive attitude can encourage nurses to actively engage with infection prevention protocols and improve their practice. However, it is crucial to recognize that attitude alone does not guarantee the effectiveness of infection control practices (Teshager et al., 2022).

3. **Organizational Factors:** The presence of clear and standardized infection control policies is vital in ensuring adherence to CAUTI prevention protocols. The study by Bawaqneh et al., (2025) identified the absence of formal infection control policies and standards as a significant barrier to achieving infection prevention goals in ICU settings. Additionally, a lack of equipment and insufficient isolation rooms were reported as barriers that hindered effective infection control. These organizational challenges underline the importance of institutional commitment to infection control by providing necessary resources and implementing clear guidelines for nurses to follow. Without these organizational supports, adherence to CAUTI prevention protocols becomes difficult, even for nurses who are knowledgeable and committed (Teshager et al., 2022; Bawaqneh et al., 2025).

4. **Workload and Time Constraints:** Workload and time constraints significantly impact the ability of nurses to adhere to infection control protocols. The study indicated that heavy workloads were a major barrier to implementing infection control measures effectively. In critical care units, nurses often face high patient acuity and time pressure, which can limit their ability to adhere to every step of the prevention protocol. A heavy workload can lead to rushed procedures, skipped steps, or inadequate monitoring of catheter care, all of which increase the risk of CAUTI. Addressing this barrier requires better staffing, time management strategies, and institutional support (Teshager et al., 2022).

5. **Leadership and Champions:** Leadership within healthcare institutions plays a key role in ensuring adherence to infection control protocols. Effective leadership that promotes a culture of infection prevention is essential for motivating nurses to follow best practices. Additionally, having infection control champions who advocate for adherence to CAUTI prevention protocols can positively influence practice among nurses (Teshager et al., 2022; Bawaqneh et al., 2025).

2.1.7.2 Strategies to Improve Adherence

1. **Multifaceted Educational Interventions:** Comprehensive educational programs that address knowledge gaps, skills development, and attitudinal factors have been shown to improve adherence to prevention protocols (Patel et al., 2023).

2. **Reminders and Decision Support Systems:** Electronic reminders, checklists, and decision support tools can enhance adherence by prompting healthcare providers to follow evidence-based protocols (Patel et al., 2023).

3. **Audit and Feedback Mechanisms:** Regular audits of practice with constructive feedback can identify areas for improvement and motivate better adherence (Bawaqneh et al., 2025).

4. **Leadership Engagement:** Active involvement of organizational leaders in promoting and supporting infection prevention initiatives enhances adherence levels (Teshager et al., 2022).

5. **Multidisciplinary Collaboration:** Collaborative approaches involving physicians, nurses, infection preventionists, and other healthcare providers improve adherence to prevention protocols (Patel et al., 2020).

6. **Organizational Culture Change:** Creating a culture that prioritizes infection prevention and patient safety enhances adherence to prevention protocols (Teshager et al., 2022).

2.1.8 Challenges in Implementing CAUTI Prevention Protocols in Nigerian Hospitals

Implementing CAUTI prevention protocols in Nigerian healthcare facilities faces significant challenges. A study conducted by Calistus et al., (2023) in a Nigerian tertiary health facility revealed several key barriers to the effective application of CAUTI bundles among nurses:

1. **Lack of Written Guidelines**: The absence of formal written guidelines or protocols for CAUTI prevention was identified as a major barrier. In the study, 100% of the participants reported that no written policy or guideline on CAUTI bundles existed in their facility (Calistus et al., 2023). Without standardized guidelines, nurses are left to rely on informal practices, which can vary widely and undermine the consistency of care.

2. **Lack of Monitoring and Feedback**: The study also highlighted the absence of effective monitoring and feedback mechanisms, with nearly 99% of the participants indicating that there were no existing tools for monitoring CAUTI bundle compliance or providing feedback on performance (Calistus et al., 2023). The lack of regular evaluation of adherence to protocols can prevent healthcare workers from recognizing areas for improvement and hinder efforts to optimize infection control practices.

3. **Empowerment and Supervision**: The study found that over half of the nurses felt that supervisors and staff were not empowered to challenge suboptimal practices in a safe and constructive manner (Calistus et al., 2023). This lack of empowerment may lead to reluctance in addressing lapses in infection control practices, contributing to the persistence of substandard care.

4. **Lack of Routine Team Meetings**: The absence of routine team meetings or ward rounds focused on patients with indwelling urinary catheters was another barrier identified in the study. Nearly 79% of nurses reported that such meetings did not occur regularly (Calistus

et al., 2023). These meetings are essential for discussing patient care and ensuring that infection prevention protocols are followed consistently.

Despite these barriers, the study indicated that while nurses had some knowledge about CAUTI prevention bundles, the application of these bundles was generally poor, with only 46.4% of the respondents correctly applying the bundles to patients' care (Calistus et al., 2023). The identified barriers are modifiable, and addressing them could significantly improve adherence to CAUTI prevention protocols in Nigerian hospitals.

2.2 Theoretical Framework

2.2.1. The Theory of Planned Behavior

This study adopts the Theory of Planned Behavior (TPB) as its theoretical foundation. The TPB was developed by Icek Ajzen in 1985 as an extension of the Theory of Reasoned Action (Kan et al., 2020). The theory proposes that an individual's intention to perform a specific behavior is influenced by three key components: attitudes toward the behavior, subjective norms, and perceived behavioral control. These components collectively determine behavioral intentions, which are the immediate precursors to actual behavior (Ajzen, 2019a).

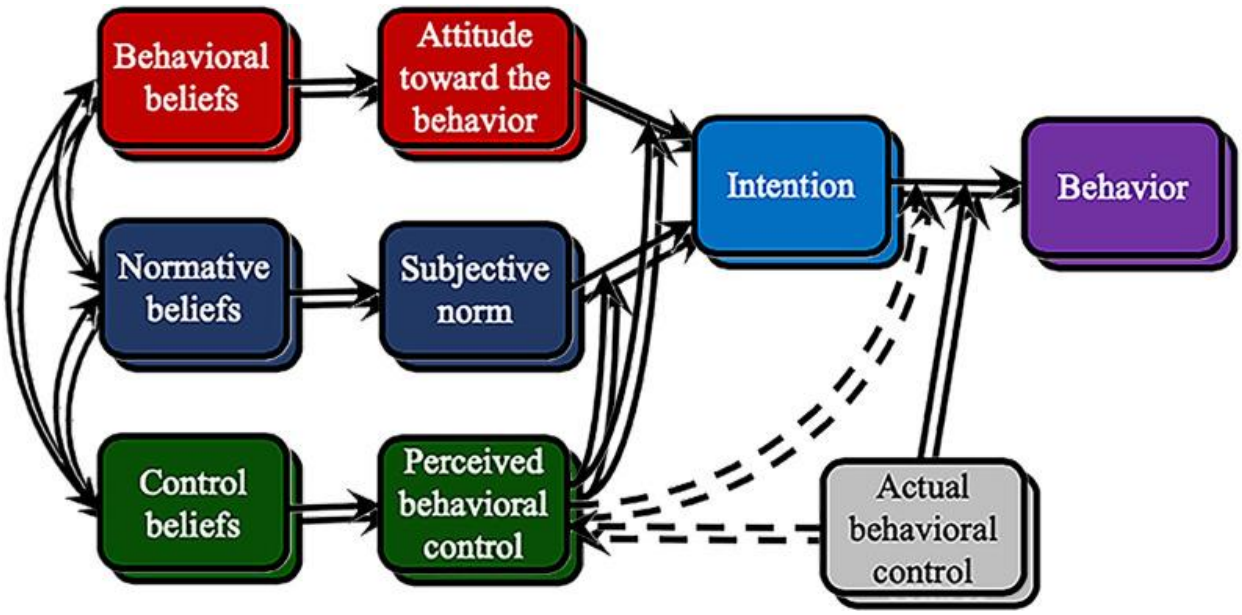


Figure 2.1: Graphical depiction of the theory of planned behaviour (Ajzen, 2019b)

The TPB has been extensively applied in healthcare settings to understand and predict healthcare professionals' adherence to clinical guidelines and protocols. The theory provides a systematic framework for analyzing factors that influence nurses' intentions to adhere to infection prevention and control (IPC) protocols.

The TPB comprises the following key constructs that are relevant to this study:

2.2.1.1. Attitudes toward the behavior

This refers to a nurse's positive or negative evaluation of performing infection prevention practices related to urinary catheter care. Nurses' attitudes toward IPC protocols are shaped by their beliefs about the outcomes of adhering to these protocols (Bawaqneh et al., 2025). When nurses believe that following CAUTI prevention protocols will lead to positive outcomes such as

reduced infection rates and improved patient outcomes, they are more likely to develop favorable attitudes toward implementing these practices.

A 2021 cross-sectional study by (Dessie et al., 2024) conducted in five public hospitals in Addis Ababa, Ethiopia, assessed nurses' knowledge, attitude, and practice (KAP) toward the prevention of CAUTI. Among the 344 participating nurses, only 42.7% had good knowledge, 48.0% had a positive attitude, and 54.9% demonstrated good practice. The study identified a positive attitude as a key factor associated with both good knowledge and practice.

Additionally, (Mong et al., 2022) related cross-sectional study conducted in a tertiary teaching hospital in Malaysia further confirmed these insights. The study recruited 301 nurses from medical and surgical inpatient wards using stratified and simple random sampling. Results indicated that nurses generally had good knowledge, a positive attitude, and good perceived practice regarding CAUTI prevention. Nurses aged over 30 and with more than ten years of experience exhibited higher knowledge levels. Importantly, while knowledge positively correlated with both attitude and perceived practice, attitude accounted for a higher variance in perceived practice than knowledge. The authors emphasized that educational programs should focus not only on disseminating knowledge but also on fostering positive attitudes among nurses to enhance IPC behaviors. They also recommended that future research assess nurses' actual practices and their impact on patient outcomes.

Collectively, these studies highlight that while knowledge is essential, attitude plays a more decisive role in influencing nurses’ adherence to CAUTI prevention protocols.

2.2.1.1. Subjective norms

These represent the perceived social pressure to perform or not perform a particular behavior. In the context of nursing practice, subjective norms include the influence of colleagues, supervisors, and organizational culture on nurses' adherence to CAUTI prevention protocols. When nurses perceive those important others, such as nurse managers, physicians, or respected colleagues, expect and value adherence to IPC protocols, they are more likely to comply with these expectations.

A study by Annisha et al., (2020) found that background factors such as knowledge and work experience significantly influenced nurses' subjective norms related to the implementation of the CAUTI bundle. Nurses with more experience and better knowledge were more likely to adhere to normative beliefs, influenced by the support and guidance from peers and superiors, which ultimately shaped their intentions to follow CAUTI prevention protocols.

2.2.1.2. Perceived behavioral control

This refers to nurses' perceptions of their ability to perform infection prevention behaviors related to catheter care. According to (Muscat et al., 2025), perceived behavioral control encompasses both internal factors (skills, knowledge, and abilities) and external factors (resources, opportunities, and institutional support) that may facilitate or impede the implementation of CAUTI prevention protocols.

2.2.1.3. Behavioral intention

Behavioral intention represents the immediate determinant of behavior and reflects how much effort individuals are willing to invest in performing a particular behavior (Ajzen, 2019b). In the

context of this study, behavioral intention refers to nurses' commitment to adhering to Catheter-Associated Urinary Tract Infection (CAUTI) prevention protocols in their daily practice.

The study by Annisha et al., (2020) demonstrated a strong relationship between nurses' intentions and their actual compliance behavior with the CAUTI prevention bundle. Nurses who expressed strong intentions to follow the protocols were significantly more likely to demonstrate compliance. The correlation between intention and compliance behavior was substantial, with a Spearman rank correlation of $r = 0.510$ ($p < 0.001$). This finding underscores the importance of strengthening nurses' behavioral intentions as a means of improving adherence to CAUTI prevention protocols.

2.2.1.5. Actual behavior

Actual behavior refers to the observable actions performed by individuals, in this case, nurses' adherence to the CAUTI prevention protocols. According to the Theory of Planned Behavior (TPB), actual behavior is largely determined by behavioral intention but can also be influenced by perceived behavioral control, especially when it aligns with the individual's ability to perform the behavior (Ajzen, 2019b). Annisha et al., (2020) study found that nurses with strong intentions were significantly more likely to engage in compliant behavior, suggesting that intention is a reliable predictor of behavior in the context of CAUTI prevention.

2.2.2. Application of the Theory of Planned Behavior to this study

The TPB provides a comprehensive framework for understanding the factors that influence nurses' adherence to CAUTI prevention protocols at the University of Benin Teaching Hospital. By examining nurses' attitudes, subjective norms, and perceived behavioral control, this study

aims to identify key determinants of adherence behavior and develop targeted interventions to improve compliance with CAUTI prevention protocols.

2.2.2.1. Attitudes toward CAUTI prevention protocols

This study will examine nurses' beliefs about the outcomes of adhering to CAUTI prevention protocols. According to (Dessie et al., 2024), nurses' attitudes toward IPC protocols are significantly influenced by their knowledge of the evidence supporting these protocols and their previous experiences with implementing them. Educational interventions that highlight the effectiveness of CAUTI prevention protocols in reducing infection rates and improving patient outcomes can positively influence nurses' attitudes and increase their intention to adhere to these protocols.

2.2.2.2. Subjective norms regarding CAUTI prevention

The influence of professional peers, supervisors, and organizational culture on nurses' adherence to CAUTI prevention protocols will be assessed in this study. Research by Dessie et al., (2024) suggests that creating a supportive professional environment where adherence to evidence-based protocols is the expected norm can significantly enhance nurses' compliance with these protocols. This study will explore how the social and professional context at the University of Benin Teaching Hospital influences nurses' intentions to implement CAUTI prevention practices.

2.2.2.3. Perceived behavioral control over CAUTI prevention

This study will investigate nurses' perceptions of their ability to implement CAUTI prevention protocols in their daily practice. Factors such as knowledge, skills, resource availability,

workload, and institutional support will be examined as potential determinants of perceived behavioral control. According to Teshager et al., (2022), interventions that enhance nurses' competence and self-efficacy while addressing systemic barriers can significantly improve their perceived behavioral control and, consequently, their adherence to IPC protocols.

2.2.2.4. Behavioral intention to adhere to CAUTI prevention protocols

The study will assess nurses' intentions to implement CAUTI prevention protocols in their practice. According to the TPB, behavioral intention is the immediate precursor to actual behavior and is influenced by attitudes, subjective norms, and perceived behavioral control (Ajzen, 2019b). By identifying the factors that most strongly influence nurses' intentions, this study will provide insights for developing targeted interventions to enhance adherence to CAUTI prevention protocols.

2.3 Empirical Review

Recent empirical studies provide critical insight into the knowledge, attitudes, and practices (KAP) of nurses, as well as the effectiveness of training programs and systemic interventions.

2.3.1 Nurses' Knowledge and Practice of CAUTI Prevention

Evidence from Nigeria and other low- and middle-income countries suggests that although many nurses are aware of CAUTI prevention protocols, their actual practices do not always align with this knowledge. For instance, a study conducted at the Federal Medical Center in Azare, Nigeria, involving 148 nurses, reported that over 80% of participants demonstrated good catheter care practices, and 84.7% agreed that using a closed drainage system reduces infection risk. However, the study lacked statistical validation or regression analysis to determine associations between variables, which limits the reliability of its findings (Dahuwa & Umar, 2021).

In contrast, a well-structured cross-sectional study from Ethiopia assessed 344 nurses and applied both binary and multivariate logistic regression to identify predictors of good CAUTI prevention practices. Only 42.7% of nurses exhibited good knowledge, while 54.9% demonstrated adequate practice. The study found that the availability of guidelines, higher monthly income, and a positive attitude significantly predicted better performance. These findings are statistically robust and provide greater confidence due to the use of adjusted odds ratios and confidence intervals, which enhanced the validity of associations drawn (Dessie et al., 2024).

Supporting this trend, another Ethiopian study at the University of Gondar Comprehensive Specialized Hospital evaluated 423 nurses and reported that 53% had good knowledge while 50% had good practice. The researchers used multivariate regression to reveal that sex, training, work experience, and presence of guidelines were significant predictors of knowledge, while good attitude and knowledge strongly influenced practice. This study is notable for its methodological rigor, including the use of the Hosmer-Lemeshow test to assess model fit, thereby adding reliability to its conclusions (Zegeye et al., 2022).

Outside of Africa, similar discrepancies between knowledge and practice have been documented. In Pakistan, a study of 164 nurses revealed that although 95.7% recognized the importance of aseptic technique during catheter insertion, only 67.4% adhered to it, and 79.3% failed to perform daily catheter care. Despite moderate knowledge, 52.2% of nurses were categorized as having poor practice. While these findings underscore the global relevance of the knowledge-practice gap, the study's reliance on self-reported questionnaires introduces the possibility of social desirability bias, potentially inflating adherence rates (Bibi et al., 2023).

The collective evidence across these studies reveals consistent trends, while nurses generally understand the principles of CAUTI prevention, translating this knowledge into routine practice remains a challenge. Methodologically, studies that employed multivariate analyses and larger sample sizes offer more credible evidence compared to descriptive studies with limited statistical evaluation (Dessie et al., Zegeye et al) . Furthermore, external factors such as access to guidelines, training, and institutional support repeatedly emerge as critical enablers of best practices (Dahuwa & Umar)

In summary, while the baseline awareness of CAUTI prevention is moderately high among nurses, especially in tertiary settings, the strength of evidence varies across studies. Higher-quality studies underscore that improving CAUTI-related outcomes will require not just knowledge dissemination, but also structural interventions that support implementation, including training, policy reinforcement, and regular monitoring.

2.3.2 Factors Influencing Adherence to CAUTI Prevention Protocols

Adherence to catheter-associated urinary tract infection (CAUTI) prevention protocols is shaped by a combination of individual, organizational, and systemic factors. Research consistently shows that while protocols are well established, consistent implementation remains challenging due to multiple contextual influences.

A multi-center retrospective study conducted in eight hospitals in Xiamen, China, evaluated the impact of bundle interventions on CAUTI prevention in intensive care settings. The study found a significant reduction in CAUTI rates from 3.84 to 1.31 per 1,000 catheter days, along with a decrease in catheter utilization and duration. The intervention’s success was attributed to

structured educational programs, audit-feedback loops, and clearly defined policies. While the study demonstrated strong outcome metrics, its retrospective design poses limitations in establishing causality. However, the use of multicenter data and pre-post comparisons provides robust support for the effectiveness of multi-component interventions (Huang et al., 2025).

Complementing this, a quasi-experimental study by Yahia et al., (2023) at Minia University Hospital in Egypt demonstrated the significant role of structured nursing guidelines in reducing CAUTI incidence among critically ill patients. The intervention group, which received targeted protocols, had significantly fewer infections compared to the control group. Although the study's sample size was limited to 60 patients, the use of a control group and repeated assessments over time increased the internal validity of the findings. Moreover, the study's focus on organizational support highlights the importance of leadership in reinforcing adherence.

A 2025 cross-sectional study by Qu et al., (2025) in Shanghai further emphasized that healthcare workers' knowledge, attitudes, and practices (KAP) toward CAUTI prevention were significantly influenced by training frequency, leadership emphasis, and professional role. Multivariate analysis revealed that repeated training and visible leadership commitment were strong predictors of better practice scores. This study adds methodological rigor by using a large sample (n=327) and employing both univariate and multivariate analysis, strengthening the reliability of its conclusions.

In a related 2025 study, (Muscat et al., 2025) evaluated 215 healthcare professionals in a Maltese rehabilitation facility. They found that knowledge, attitudes, and adherence to CAUTI protocols were interdependent. Specifically, knowledge positively correlated with both attitudes ($r = 0.471$) and practice ($r = 0.383$), suggesting that cognitive understanding plays a foundational role in

compliance. However, this study relied on self-reported practices, which could be influenced by social desirability bias, limiting the generalizability of reported adherence rates.

Interestingly, findings from Sweden revealed critical gaps in real-world practice. A survey involving 910 nurses showed that only 9.9% could consistently maintain sterility during catheter insertion, and nearly half had never been audited on protocol adherence. These findings underline the disconnect between knowledge and execution and point to the need for more structured supervision and quality control measures (González et al., 2024). Despite a strong sample size and detailed descriptive analysis, the study's lack of inferential statistical testing limits its depth of analysis on causal factors.

Another study conducted by Mong et al., (2021) in Malaysia involving 301 nurses reported that while knowledge was generally high, it was the nurses' attitudes that most significantly predicted their practice. Hierarchical regression analysis showed attitude accounted for a greater variance in perceived practice than knowledge, reinforcing the importance of motivational and behavioral components in protocol adherence.

Across these studies, critical factors influencing adherence include access to training, leadership support, audit systems, professional experience, and positive workplace culture. Methodologically, studies that used experimental or multivariate designs, such as those by Yahia et al. (2023) and Qu et al. (2025), provided stronger causal inferences and greater insight into predictive variables. Conversely, studies relying solely on self-report or descriptive designs contributed valuable context but had more limited explanatory power.

In conclusion, adherence to CAUTI prevention protocols is not determined by knowledge alone. Effective implementation requires an enabling environment that prioritizes leadership

commitment, continuous training, and behavioral reinforcement. Methodologically rigorous studies consistently highlight that multifaceted, system-level interventions are most effective in translating policy into practice.

2.5. Summary of Literature Review

This literature review explores catheter-associated urinary tract infections (CAUTIs) as a significant global health concern, with a focus on nursing knowledge, practice, and adherence to prevention protocols. CAUTIs account for 30 to 40 percent of healthcare-associated infections in acute care settings and contribute to increased morbidity, mortality, and healthcare costs. Prevention measures such as proper catheter indication, aseptic insertion, regular maintenance, and timely removal have been shown to reduce infection rates, especially when implemented as part of bundled protocols. Nurses are key to prevention efforts due to their direct involvement in catheter care and patient monitoring.

Recent studies confirm that nurse-led protocols can significantly reduce CAUTI rates. However, gaps remain between knowledge and practice. For example, studies from Ethiopia and Nigeria report moderate knowledge levels among nurses but low adherence to standard prevention practices. Factors such as limited training, high workload, lack of written guidelines, and minimal feedback mechanisms often hinder consistent implementation. The Theory of Planned Behavior has been applied in international studies to explain how nurses' attitudes, perceived norms, and perceived behavioral control influence their adherence, but this framework remains underused in Nigerian contexts.

Most existing research in Nigeria focuses on prevalence or microbial trends rather than evaluating adherence behaviors. In addition, many studies are cross-sectional, limiting

understanding of how adherence evolves over time. There is also limited exploration of how organizational factors such as leadership, culture, and institutional policy affect protocol compliance. These gaps point to the need for theory-driven, context-specific, and longitudinal research in Nigerian tertiary hospitals.

This review provides a foundation for examining nurses' knowledge, practice, and adherence to CAUTI prevention protocols. It highlights the importance of addressing behavioral and institutional barriers in resource-limited settings to improve infection control outcomes.

CHAPTER THREE

METHODOLOGY

This chapter presents the methodology that guided the conduct of the study. It outlines the design, study setting, target population, sample size determination, sampling technique, instrument for data collection, validity and reliability of the instrument, method of data collection, method of data analysis, and ethical considerations.

3.1. Design

Research design is the structured plan that guides how a research study is carried out. It outlines how data were collected, analyzed, and interpreted to answer research questions (Sharma et al., 2023). For this study, a descriptive cross-sectional research design was adopted. A descriptive design is used to systematically describe a situation, problem, phenomenon, or the attributes of a population without manipulating any variables (Dibekulu, 2020). It helps in identifying patterns, behaviors, or attitudes as they exist in a natural setting. A cross-sectional design allows data to be collected at a single point in time from a defined population. This design was suitable for this study as it aimed to assess the adherence of nurses to infection prevention protocols for catheter-related urinary tract infections.

3.2. Setting

This study was conducted at the University of Benin Teaching Hospital (UBTH), located in Ugbowo, Benin City, Edo State, Nigeria. UBTH, established on May 12, 1973, is one of Nigeria's foremost tertiary healthcare institutions and serves as the teaching hospital for the University of Benin. Strategically located along the Lagos–Benin expressway, the hospital functions as a major referral center for Edo, Delta, Ondo, Kogi, and neighboring states, with a capacity of 900 beds and more than 20 clinical departments.

The selection of UBTH as the study setting was based on its status as a tertiary institution with a large and diverse workforce, particularly within the nursing cadre. The hospital's established infection prevention and control program, as well as its structured nursing hierarchy, made it an

ideal location for a study focused on adherence to protocols in the prevention of catheter-associated urinary tract infections (CAUTIs).

3.3 Target Population

Target population refers to the entire set of individuals, groups, or entities that possess specific characteristics relevant to the objectives of a study and to whom the results are intended to be generalized (Willie, 2024) It represents the larger group from which a researcher draws a sample and seeks to make inferences.

The target population for this study are all registered nurses currently practicing in the clinical departments of UBTH that are involved in urinary catheter insertion. These include nurses working in the medical, surgical, emergency and maternity wards. Table 3.1 below shows the number of nurses in clinical areas.

Table 3.1: Number of Nurses in Clinical Areas

Units	Number of Nurses
Surgical Unit	92
Medical unit A	82
Medical Unit B	69
Accident and Emergency Unit	88
Obstetrics and Gynecology	90
Total	421

(Human Resources Department of UBTH, February 2025).

3.4 Sampling (size and formula)

Sample size determination is the act of choosing the number of observations to include in a statistical sample (Barthlert, 2020). The sample size was determined using Yamane Taro's formula (1967). The formula ensures that the sample accurately represents the larger population, thus enhancing the reliability and generalizability of the study findings.

The formular is as follows:

Where:

- n = sample size
- N = total population of eligible nurses
- e = margin of error (expressed as 0.05)

$$n = \frac{N}{1+N(e)^2}$$

N = 421

$$N = \frac{421}{(1 + 421(0.05)^2)}$$

$$n = \frac{421}{2}$$

n = 210.5

Therefore, the sample is approximately 211 nurses.

INCLUSION CRITERIA

Only registered nurses working at the University of Benin Teaching Hospital (UBTH) participated in this study, ensuring that the sample is composed of professionals who are directly involved in patient care and infection control practices.

3.5 Sampling Technique

Purposive sampling is a method where researchers intentionally select participants who are most likely to provide rich, relevant, and insightful data based on specific characteristics related to the study (Dibekulu, 2020). Unlike random sampling, where every member of a population has an equal chance of being selected, purposive sampling allows researchers to choose participants deliberately based on their knowledge, experience, or involvement in the research topic.

For this study, purposive sampling was ideal because it focused on a specific group of nurses, those who are directly involved in infection prevention and control in the context of catheter-related urinary tract infections (CAUTIs) at the University of Benin Teaching Hospital (UBTH).

3.6 Instrument for Data Collection

A self-structured questionnaire (Appendix 1) was utilized for data collection in this study. A self-structured questionnaire is a tool created by researchers to collect data directly from respondents without the need for an interviewer (Leon et al., 2022). It was particularly suitable for this research because it consisted of a series of pre-determined, standardized questions, allowing respondents to provide their answers independently in alignment with the objectives of the study. This questionnaire consisted of closed-ended questions which were carefully designed, organized and structured to obtain in-depth information from the respondents. It was divided into four sections: A, B, C and D comprising a total of 31 items.

- **Section A**: This section gathered demographic information about the participants, such as their age, gender, marital status, and level of education.
- **Section B**: This section assessed the participants' knowledge of CAUTI prevention protocols, containing 10 questions using true or false response format related to their understanding of infection control measures.
- **Section C**: This section measured the nurses' adherence to CAUTI prevention protocols, containing 11 items using a 4-point modified Likert scale with frequency-based response options (Always, Often, Rarely, Never).
- **Section D**: This section explored the factors influencing adherence to CAUTI prevention protocols, with an agreement scale (Strongly Agree to Strongly Disagree) featuring 10 questions where respondents expressed their opinions freely.

3.7 Validity of the instrument

Validity refers to the extent to which a research instrument accurately measures what it is intended to measure (Moore, 2021). The instrument was validated through face and content validity. To ensure the validity of the instrument, the questionnaire was carefully structured to align with the research topic and it was reviewed by my project supervisor. Necessary revisions were made based on the supervisor's feedback before the questionnaire was finalized and distributed. The face and content validation processes confirmed that the instrument effectively measured the intended variables related to adherence to CAUTI prevention protocols.

3.8 Reliability of the Instrument

Reliability refers to the degree to which a research instrument consistently produces stable and dependable results when measuring the same variable under similar conditions (Moore, 2021). A reliable instrument ensures that if the same group of participants responds to the tool multiple times under similar circumstances, the results would remain consistent. In this study, reliability was essential to confirm that the questionnaire accurately and consistently measured nurses' adherence to infection prevention and control protocols for catheter-associated urinary tract infections (CAUTIs).

To assess the reliability of the self-structured questionnaire, a pilot study was conducted before the main data collection. The pilot study served as a small-scale trial run that helped identify potential issues with the instrument, such as ambiguous questions, formatting problems, or inconsistencies in responses. It also allowed the researcher to evaluate the internal consistency of the questionnaire items.

For the pilot study, 21 nurses (approximately 10% of the total sample size of 211) who were involved in catheter-related care at the University of Benin Teaching Hospital (UBTH) were selected. These participants were not included in the main study to avoid response bias. Data collected from the pilot study were analyzed using Cronbach's alpha to determine internal consistency. A Cronbach's alpha coefficient of 0.71 or higher was considered acceptable, indicating that the instrument was reliable and suitable for use in the main study. For this study the Cronbach alpha coefficient was 0.82.

Conducting the pilot study in this manner ensured that the instrument was clear, well-structured, and capable of producing consistent results. It also helped the researcher make necessary revisions before deploying the questionnaire on a larger scale.

3.9 Method of Data Collection

Questionnaires were administered to nurses at the University of Benin Teaching Hospital (UBTH) until the required sample size of 211 participants was reached. Nurses were approached during their clinical shifts in relevant departments with prior approval obtained from the head of the respective departments. The purpose of the study was clearly explained to them, and the questionnaire was distributed for completion. The data collection process was carried out by the researchers.

Data were gathered on-site during the nurses' shifts, with the completed questionnaires collected immediately to ensure all responses were retrieved on the same day. The data collection spanned approximately two weeks to allow sufficient time for all participants to complete the

questionnaire. This approach ensured that a representative sample of nurses involved in catheter-related care was included in the study, and the data were gathered efficiently.

3.10 Method of Data Analysis

Data analysis refers to the process of systematically applying statistical or logical techniques to describe and illustrate, condense and recap, and evaluate data (Chadli et al., 2021). In research, it involves organizing, interpreting, and summarizing data in order to draw meaningful conclusions and support the research objectives (Manolov & Rochat, 2024).

The data collected were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0. Descriptive statistics, such as mean, frequency, and percentages, were computed to summarize the data.

- **Section A**: The demographic data were analyzed using frequency and percentage distributions.
- **Section B**: This section, consisting of 10 True/False knowledge questions, was scored with 1 point for each correct answer. A cutoff score of 5 was used to classify respondents as having either good (≥5) or poor (<5) knowledge.
- **Sections C**: These sections contained Likert scale questions that measured nurses' adherence to CAUTI prevention protocols where frequency-based options were used.
- **Sections D:** This section explored the factors influencing adherence to CAUTI prevention protocols, with an agreement scale (Strongly Agree to Strongly Disagree) featuring 10 questions where respondents expressed their opinions freely.

- Hypothesis testing was conducted using the Chi-square test of association, with the level of significance set at $p < 0.05$.

The results were presented in tables, graphs, frequencies, and percentages to provide a clear and comprehensive overview of the findings related to adherence to infection prevention and control protocols for catheter-related urinary tract infections (CAUTIs) among nurses at UBTH.

3.11 Ethical Considerations

Ethical approval for this study was obtained from the Health Research Ethics Committee of the University of Benin Teaching Hospital (UBTH) (Appendix 2).

Prior to data collection, participants were provided with detailed information regarding the study's purpose, procedures, and potential implications. Ethical guidelines were rigorously followed throughout the research, addressing the following key considerations:

- **Confidentiality**: All personal information provided by participants was treated with the utmost confidentiality. The questionnaire did not request names or other identifying information, and participants were assured that their responses were only used for the purposes of the study. No identifying details were included in the final report or any publications resulting from the research to maintain participants' anonymity.
- **Voluntary Participation**: Nurses were informed that participation was entirely voluntary, and they could choose to withdraw from the study or decline to answer any question at any time without facing any negative consequences. Their decision to participate was not influenced by their professional standing or any work-related outcomes.

- **Avoidance of Plagiarism**: Proper attribution and citation of all sources were ensured, both in the text and the reference list, to uphold academic integrity and avoid any form of plagiarism.
- **Informed Consent**: Nurses were required to provide informed consent before participating in the study. This involved explaining the study's objectives, the data collection methods, any potential risks and benefits, and their right to ask questions or seek further clarification. Consent was voluntary, and participants had the right to withdraw at any stage of the research.
- **Beneficence and Non-Maleficence**: The study was conducted with the goal of maximizing the benefits to the participants and minimizing any potential harm. The well-being of participants was a top priority throughout the research process. There was no physical or psychological harm imposed on the participants, and any risks were minimized as much as possible.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION

This chapter presents the analysis of data obtained from a survey conducted among 211 nurses at the University of Benin Teaching Hospital (UBTH). The data were collected to assess their adherence to evidence-based infection prevention and control protocols for catheter-associated urinary tract infections (CAUTIs). The chapter is structured into five sections: Socio-Demographic Characteristics of Respondents, Knowledge of Evidence-Based CAUTI Prevention Protocols, Adherence to CAUTI Prevention Protocols, Factors Influencing Adherence, and Hypothesis Testing.

4.1. Section A: Socio-Demographic Characteristics of Respondents

The socio-demographic analysis of the 211 nurses at the University of Benin Teaching Hospital (UBTH) revealed several key characteristics that provide context for understanding their adherence to evidence-based infection prevention and control protocols for catheter-related urinary.

Table 4.1. Demographic and Professional Characteristics of Nurses (N = 211)

Category	Subcategory	Number of Nurses	Percentage (%)
Age Distribution	20–29	68	32.2
	30–39	89	42.2
	40–49	38	18.0
	50 and above	16	7.6
Sex	Male	47	22.3
	Female	164	77.7
Marital Status	Single	76	36.0
	Married	121	57.3
	Separated	0	0.0
	Divorced	9	4.3
	Widowed	5	2.4
Highest Educational Qualification	Diploma	53	25.1
	Higher Diploma	44	20.9
	B.NSc	48	22.7
	M.Sc	40	19.0
	PhD	26	12.3
Department/Unit	Medical	76	36.0
	Surgical	46	21.8
	Maternity	45	21.3
	Emergency	44	20.9
Years of Clinical Experience	Less than 1 year	23	10.9
	1–5 years	87	41.2
	6–10 years	64	30.3
	More than 10 years	37	17.6

Table 4.1indicate that the majority of nurses at the University of Benin Teaching Hospital were females in their productive working age, married, and possessed a range of academic qualifications and professional experiences across various clinical departments.

4.2. Section B: Nurses' Knowledge of CAUTI Prevention Protocols

The assessment of nurses' knowledge regarding evidence-based prevention of catheter-associated urinary tract infections (CAUTIs) at the University of Benin Teaching Hospital (UBTH) reveals a generally positive trend. Ten key knowledge areas were evaluated based on frequency responses (Always, Often, Rarely, Never), and an overall knowledge score was computed.

Table 4.2: Responses Regarding Nurses' Knowledge of CAUTI Prevention

Statement	True (%)	False (%)	Mean	SD	Remark
Hand hygiene before and after catheter insertion helps prevent CAUTI.	91.9	8.1	3.59	0.68	Excellent
Sterile gloves are not required during catheter insertion.	9.1	90.9	3.61	0.69	Excellent
Prolonged catheterization reduces the risk of CAUTI.	6.2	93.8	3.66	0.61	Excellent
The drainage bag should be positioned above the bladder level.	7.6	92.4	3.55	0.66	Excellent
CAUTIs are mainly caused by poor catheter maintenance.	89.0	11.0	3.49	0.73	Good
Daily review of catheter necessity is part of CAUTI prevention protocol.	88.1	11.9	3.38	0.74	Good
Biofilm formation is not a concern in urinary catheters.	11.8	88.2	3.40	0.73	Good
Closed drainage systems are recommended to prevent CAUTIs.	92.4	7.6	3.55	0.66	Excellent
Patient education is irrelevant to catheter care.	14.7	85.3	3.33	0.78	Good
CAUTIs do not significantly contribute to hospital-acquired infections.	11.4	88.6	3.45	0.73	Good

The responses regarding nurses' knowledge of CAUTI (Catheter-Associated Urinary Tract Infections) prevention, as presented in Table 4.2, reveal a generally high level of awareness across most key areas. These findings indicate that while most core preventive practices are well understood and consistently applied, additional training may be needed to strengthen areas such as patient education and understanding of biofilm-related infection risks.

Figure 4.1: Level of UBTH Nurses' Knowledge of CAUTI Prevention

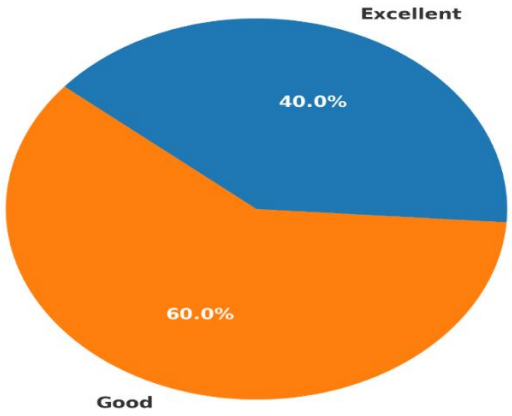


Figure 4.1 illustrates that 60% of responses were rated as "Good", indicating a solid understanding of key preventive measures, while a significant portion, 40%, was rated "Excellent", reflecting strong knowledge in certain areas. No responses fell under the "Fair" or "Poor" categories, highlighting an overall positive trend in CAUTI-related knowledge among the nurses surveyed.

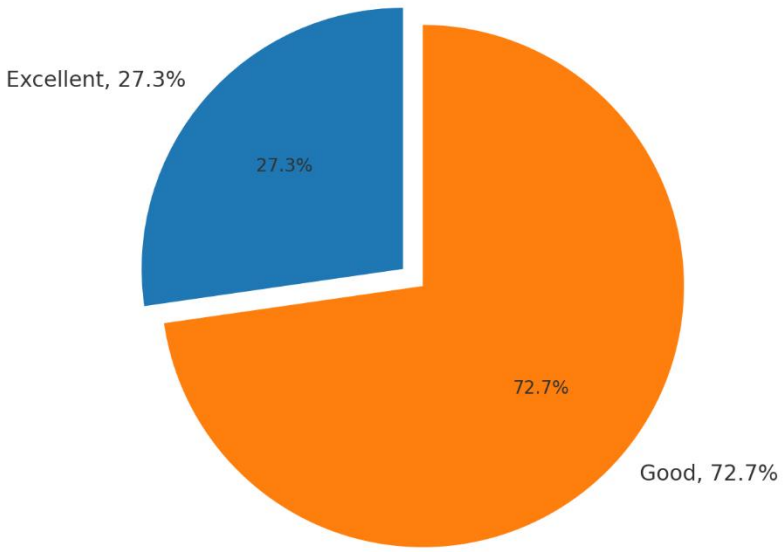
4.3. Section C: Adherence to CAUTI Prevention Protocols

Table 4.3: Distribution of UBTH Nurses' Adherence to CAUTI Prevention Protocols

Statement	Always (%)	Often (%)	Rarely (%)	Never (%)	Mean	SD	Remark
Assessing need before catheterization	53.6	32.2	11.8	2.4	3.37	0.74	Good
Using aseptic techniques	65.9	24.2	8.5	1.4	3.55	0.67	Excellent
Securing catheter properly	57.8	29.9	10.4	1.9	3.44	0.72	Good
Maintaining closed drainage system	62.6	27.0	8.5	1.9	3.51	0.69	Excellent
Proper positioning of drainage bag	68.7	21.8	8.1	1.4	3.58	0.67	Excellent
Regular hand hygiene	59.2	29.4	9.5	1.9	3.46	0.71	Good
Using clean container each time	54.5	28.9	14.2	2.4	3.36	0.78	Good
Assessing catheter site for infections	51.7	32.2	14.2	1.9	3.34	0.76	Good
Documenting insertion and maintenance	48.3	33.7	15.2	2.8	3.28	0.79	Good
Following hospital protocol	56.9	29.8	11.4	1.9	3.42	0.72	Good
Advocating for early removal	53.6	30.3	13.7	2.4	3.35	0.77	Good

The level of adherence to evidence-based CAUTI prevention protocols, as shown in the table, reflects generally positive practices among nurses, with notable strengths and areas for improvement. These findings underscore the need for continuous education, monitoring, and institutional support to strengthen areas where adherence is less consistent.

Figure 4.2: Distribution of UBTH Nurses' Adherence to CAUTI Prevention Protocols



CAUTI prevention protocols, as shown in Figure 4.2, indicates that most practices were rated positively. A significant 72.7% of the practices were classified as "Good," reflecting consistent adherence to the protocols, though with room for improvement in certain areas. The remaining 27.3% of practices received an "Excellent" rating, suggesting a smaller but important subset of practices where adherence was notably strong. These findings highlight that while overall compliance is strong, targeted efforts are still needed to elevate practices from "Good" to "Excellent," ensuring optimal infection prevention and care outcomes.

4.4. Section D: Factors Influencing Adherence

Table 4.4: Factors Influencing Adherence to CAUTI Prevention Protocol

Factor	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)	Mean	SD	Remark
Inadequate training	42.7	38.9	14.2	4.2	3.20	0.83	Moderate Influence
Heavy workload	57.8	31.8	8.1	2.3	3.45	0.74	Moderate Influence
Lack of adequate supplies	61.1	29.9	7.1	1.9	3.50	0.71	Strong Influence
Poor supervision	39.8	40.8	16.1	3.3	3.17	0.81	Moderate Influence
Regular updates on guidelines	45.5	43.1	9.0	2.4	3.32	0.74	Moderate Influence
Motivation and recognition	48.8	39.3	9.5	2.4	3.34	0.75	Moderate Influence
Availability of policy documents	37.9	45.5	13.3	3.3	3.18	0.78	Moderate Influence
Fear of patient infection	53.6	37.4	7.1	1.9	3.43	0.71	Moderate Influence
Peer support	42.2	44.1	11.8	1.9	3.27	0.74	Moderate Influence
Time constraints	59.2	31.8	7.1	1.9	3.48	0.71	Moderate Influence

The data in Table 4.4 reveals that all assessed items were rated as either moderate or strong influences, with none falling below a mean score of 3.17. This indicates that each factor presents a substantive influence on nurses' ability to consistently follow CAUTI prevention protocols, highlighting the need for multifaceted interventions that address training, resources, supervision, and workplace dynamics.

4.5. Hypothesis Testing

Table 4.5: Association Between Knowledge Level and Adherence to Protocols

Knowledge Level	Good Adherence n (%)	Poor Adherence n (%)	Total	Percentage (%)
High Knowledge	102 (78.5)	28 (21.5)	130	61.6%
Moderate Knowledge	38 (54.3)	32 (45.7)	70	33.2%
Low Knowledge	6 (52.2)	11 (47.8)	17	5.2%
Total	146 (69.2)	71 (30.8)	211	100.0

$\chi^2 = 18.673$; df = 2; $p < 0.001$

The chi-square test result ($\chi^2 = 18.673$, df = 2, $p < 0.001$) reveals a statistically significant association between nurses' knowledge of CAUTI prevention protocols and their adherence to these protocols. Nurses with high knowledge were substantially more likely to exhibit good adherence behaviors (78.5%), whereas those with moderate or low knowledge showed lower adherence. This significant relationship leads us to reject the null hypothesis and accept the alternative: that a nurse's level of knowledge is significantly associated with their adherence to evidence-based CAUTI prevention protocols at the University of Benin Teaching Hospital.

CHAPTER FIVE

DISCUSSION, SUMMARY, CONCLUSION, AND RECOMMENDATIONS

This chapter presents an in-depth discussion of the research findings from Chapter Four, linking them with existing literature on adherence to evidence-based infection prevention and control (IPC) protocols for catheter-associated urinary tract infections (CAUTIs). The chapter also outlines the implications for nursing, study limitations, summary, conclusion, recommendations, and suggestions for future research.

5.1 Discussion of Findings

5.1.1 Socio-Demographic Characteristics of Respondents

The demographic data showed that most respondents (42.2%) were aged 30–39 years, followed by 32.2% aged 20–29 years. This indicates a predominantly young and active nursing workforce at UBTH, likely receptive to new evidence-based practices. The majority were females (77.7%), which reflects the gender distribution commonly seen in the nursing profession.

More than half of the respondents were married (57.3%), suggesting stability and a sense of responsibility that may positively influence professional behavior. In terms of educational qualification, many possessed post-basic and higher degrees such as B.NSc, M.Sc, and PhD, indicating a well-qualified workforce capable of applying infection prevention protocols effectively.

Nurses were fairly distributed across the medical, surgical, maternity, and emergency departments, providing representation from major clinical areas where urinary catheters are often

used. Most respondents had between 1 and 10 years of clinical experience, suggesting a balanced mix of enthusiasm and practical expertise.

Overall, these findings describe a knowledgeable, experienced, and youthful nursing population capable of adhering to and sustaining evidence-based infection prevention and control practices for catheter-related urinary tract infections.

5.1.2 Nurses' Knowledge of CAUTI Prevention Protocols

The findings of this study revealed that a significant proportion of the nurses at the University of Benin Teaching Hospital (UBTH) demonstrated good knowledge of evidence-based CAUTI prevention protocols. Specifically, 80.6% of respondents correctly identified key components of catheter care such as the importance of aseptic technique, appropriate catheter indications, and timely catheter removal. This high level of knowledge is consistent with the results of (Campos Mota and de Oliveira, 2023), who reported that ICU nurses' knowledge significantly improved following targeted training interventions. Similarly, (Muscat et al.,2025) found moderate to adequate knowledge levels among healthcare workers in a rehabilitation facility, highlighting the crucial role of continuous education.

Despite these findings, knowledge gaps were observed in specific areas such as consistent maintenance of catheter hygiene and risk assessment practices. This agrees with (Teshager et al., 2022), who identified that over 60% of nurses in Ethiopian ICUs had poor knowledge of CAUTI prevention measures. Such variations underscore the need for regular and targeted educational initiatives tailored to the unique practice environment and evolving guidelines.

5.1.3 Adherence to CAUTI Prevention Protocols

Although knowledge levels were high among respondents, only 67.3% of the nurses reported consistent adherence to CAUTI prevention protocols. This finding suggests a gap between knowledge and actual practice. Several studies support this observation, including (Al-Sayaghi et al., 2023), who found that despite moderate awareness, a considerable percentage of healthcare workers still demonstrated unsafe practices such as skipping hand hygiene or using non-sterile materials during catheter care.

The significant association observed in this study between knowledge and adherence ($p < 0.05$) aligns with the Theory of Planned Behavior (Ajzen, 2019b), which suggests that an individual's behavioral intention is shaped by knowledge, attitudes, and perceived control. However, even with adequate knowledge, actual adherence was influenced by other factors such as institutional barriers, staff shortages, and time constraints.

This gap has practical implications. As noted by (Patel et al., 2023), nurses with good knowledge who operate in poorly supported environments may still fail to follow protocols if resources, institutional support, or adequate supervision are lacking. Therefore, improving adherence requires not only knowledge but also supportive systems and leadership.

5.1.4. Factors Influencing Adherence

Several factors were found to affect nurses' adherence to CAUTI prevention protocols at UBTH. Chief among them were high patient-to-nurse ratios, lack of consistent access to personal protective equipment, and inadequate institutional support. These findings are consistent with (Teshager et al., 2022; Bawaqneh et al.,2025), who reported that heavy workloads, lack of

infection control policies, and resource limitations significantly hinder nurses' ability to follow best practices.

Additionally, organizational culture, leadership involvement, and peer influence (subjective norms) were critical. (Annisha et al., 2020) emphasized that nurses are more likely to comply with infection control guidelines when there is a strong culture of safety and support from supervisors. Similarly, (Muscat et al., 2025) suggested that perceived behavioral control, which includes access to resources and institutional backing, directly impacts nurses' behavior.

Furthermore, some respondents highlighted the absence of monitoring and feedback mechanisms. This lack of accountability weakens adherence and mirrors findings from (Calistus et al., 2023), who found that less than half of Nigerian nurses consistently applied CAUTI bundles due to absent guidelines and monitoring systems.

In summary, while knowledge is a necessary foundation for practice, it must be reinforced by enabling institutional frameworks, sufficient staffing, regular supervision, and leadership commitment.

5.2 Implications for Nursing

The results of this study carry significant implications for nursing education, practice, and policy. Nurses are central to the prevention of catheter-associated urinary tract infections due to their direct involvement in catheter insertion, maintenance, and removal. Therefore, enhancing their capacity to adhere to evidence-based protocols is critical for improving patient safety and reducing healthcare-associated infections.

First, nursing education curricula should incorporate more robust modules on infection prevention and control, particularly focusing on CAUTI prevention strategies. Practical demonstrations, simulations, and periodic retraining should also be emphasized.

Second, in-service training programs at healthcare institutions should be institutionalized and made mandatory to ensure that nurses remain up-to-date with the latest guidelines from organizations such as the Centers for Disease Control and Prevention (CDC, 2025) and the World Health Organization (WHO, 2022).

Third, hospital administrators must foster a culture of accountability and patient safety. This includes ensuring the availability of catheter kits, antiseptic solutions, gloves, and other essential supplies, as well as the presence of clear written protocols that are accessible and regularly reviewed.

Lastly, nurse managers should be empowered to implement reminder systems, lead ward-level audits, and mentor junior staff. As (Su et al., 2025; Patel et al., 2023) indicated, nurse-driven protocols can significantly reduce CAUTI incidence and improve care outcomes.

5.3 Limitations of the Study

This study has some limitations which must be acknowledged:

1. **Self-reported data**: The study relied on self-reported questionnaires, which may have been influenced by social desirability bias. Respondents might have overstated their adherence to protocols.
2. **Single-site focus**: The study was conducted solely at the University of Benin Teaching Hospital. Therefore, the findings may not be generalizable to other healthcare institutions across Nigeria or in other countries with different operational contexts.

3. **Cross-sectional design**: Data were collected at one point in time, which does not allow for the observation of changes in adherence behaviors or knowledge over time.

4. **Exclusion of other healthcare workers**: The focus was limited to nurses, even though physicians and support staff also influence catheter management. Future research could include these groups for a more holistic understanding.

5.4 Summary

This study investigated adherence to evidence-based CAUTI prevention protocols among nurses at UBTH. It found that a majority of the nurses (80.6%) had a good level of knowledge regarding CAUTI prevention. However, a smaller proportion (67.3%) reported strict adherence to these protocols in their clinical practice.

The study also identified key barriers to adherence, including high workload, limited resources, and absence of institutional policies or monitoring frameworks. These findings were consistent with existing literature and emphasized the need for a systems-based approach that addresses not only knowledge but also contextual and organizational factors.

Additionally, statistical analysis showed a significant relationship between nurses' knowledge and adherence, reinforcing the importance of targeted training and ongoing education.

5.5 Conclusion

This study concludes that while nurses at UBTH have a sound understanding of evidence-based practices for preventing catheter-associated urinary tract infections, adherence is compromised by multiple structural and systemic challenges. These include inadequate staffing, time constraints, inconsistent resource availability, and weak leadership support.

The significant correlation between knowledge and adherence suggests that interventions aimed at improving nurses' understanding of CAUTI prevention protocols can positively impact their practice. However, knowledge alone is insufficient. Effective adherence requires an integrated approach involving training, leadership involvement, availability of materials, and strong institutional policies.

Improving adherence to CAUTI protocols is essential to reducing infection rates, shortening patient hospital stays, lowering treatment costs, and improving overall patient outcomes.

5.6 Recommendations

Based on the findings of this study, the following recommendations are made:

1. **Regular In-service Training**: Organize frequent workshops and seminars to update nurses on evolving evidence-based CAUTI prevention protocols and practices.
2. **Develop Nurse-led Protocols**: Empower nurses to implement nurse-driven urinary catheter removal protocols, which have been shown to reduce catheterization duration and CAUTI risk.
3. **Policy Implementation**: Hospital management should ensure that written CAUTI prevention protocols are available, visible, and enforced across all clinical departments.
4. **Leadership Involvement**: Nurse managers should actively monitor catheter practices, provide real-time feedback, and mentor junior staff.
5. **Improve Resource Availability**: Ensure consistent supply of essential materials such as gloves, antiseptics, and catheter kits to facilitate adherence to hygiene standards.

6. **Address Staffing Needs**: Employ more nursing staff to reduce workload and allow sufficient time for protocol compliance.

5.7 Suggestions for Further Studies

1. **Longitudinal Studies**: Future research should track nurses' adherence behavior over time to assess the sustainability of interventions and changes in practice patterns.
2. **Multisite Comparative Studies**: Conduct research across different tertiary hospitals in Nigeria to compare adherence rates and identify best practices.
3. **Inclusion of Multidisciplinary Teams**: Expand studies to include doctors, aides, and ward assistants to capture the full scope of CAUTI prevention.
4. **Qualitative Studies**: Explore the lived experiences of nurses in preventing CAUTIs to gain deeper insights into the challenges and motivations behind adherence behavior.
5. **Evaluation of Intervention Outcomes**: Assess the effectiveness of specific educational or policy interventions on adherence and infection rates in different settings.

REFERENCES

Abalkhail, A., & Alslamah, T. (2022). Institutional factors associated with infection prevention and control practices globally during the infectious pandemics in resource-limited settings. *Vaccines, 10*(11), 1811. https://doi.org/10.3390/vaccines10111811

Abdelmoaty, A. M., Abdelghany, E. O., Soliman, M., Kenawy, A. M., & Saleh, D. A. (2022). Improving nurses' knowledge about prevention of catheter acquired urinary tract infections in intensive care units. *Open Access Macedonian Journal of Medical Sciences, 10*(E), 638–642. https://doi.org/10.3889/oamjms.2022.8674

Abubakar, S. A., Gwaram, M. A., Yakubu, E. G., Saidu, I. Y., & Muhammad, A. (2022). Evaluation of catheter-associated urinary tract infection among patients attending some selected hospitals in Kano Metropolis. *Bayero Journal of Medical Laboratory Science, 7*(1), 1–9. https://www.ajol.info/index.php/bjmls/article/view/230424

Abdelmoaty, S. A., Abdelghany, M. A. S., & Helmy, G. (2022). Improving nurses' knowledge about prevention of catheter-associated urinary tract infections. *SAGE Open Nursing*, *8*, 1–7. https://doi.org/10.1177/23779608221087548

Ajzen, I. (2019a). *Theory of planned behavior questionnaire construction*. https://people.umass.edu/aizen/pdf/tpb.measurement.pdf

Ajzen, I. (2019b). *Theory of planned behavior diagram*. https://people.umass.edu/aizen/tpb.diag.html

Alhumaid, S., Al Mutair, A., Al Alawi, Z., Al Salman, K., Al Dossary, R., Alshulaih, S., Mubarak, M., & Al Mutair, M. (2021). Knowledge of infection prevention and control among healthcare workers and factors influencing compliance: A systematic review. *Antimicrobial Resistance & Infection Control, 10*, 86. https://doi.org/10.1186/s13756-021-00957-0

Almagharbeh, W. T., Alfanash, H. A., Alnawafleh, K. A., Alasmari, A. A., Alsaraireh, F. A., Dreidi, M. M., & Nashwan, A. J. (2025). Application of artificial intelligence in nursing practice: A qualitative study of Jordanian nurses' perspectives. *BMC Nursing, 24*(1). https://doi.org/10.1186/s12912-024-02658-6

Al-Sayaghi, K. M., Alqalah, T. A. H., Alkubati, S. A., Alshoabi, S. A., Alsabri, M., Alrubaiee, G. G., Almoliky, M. A., Saleh, K. A., Al-Sayaghi, A. K., Elshatarat, R. A., Saleh, Z. T., Saleh, A. M., & Abdel-Aziz, H. R. (2023). Healthcare workers' compliance with the catheter associated urinary tract infection prevention guidelines: An observational study in Yemen. *Antimicrobial Resistance and Infection Control, 12*(1), 144. https://doi.org/10.1186/s13756-023-01352-7

Annisha, N., Kurniawati, N. D., & Pratiwi, I. (2020). Nurses' compliance with the catheter associated urinary tract infection prevention bundle. *International Journal of Psychosocial Rehabilitation, 24*, 7942-7948. https://doi.org/10.37200/IJPR/V24I7/PR270769

Asmare, Z., Erkihun, M., Abebe, W., Ashagre, A., Misganaw, T., & Feleke, S. F. (2024). Catheter-associated urinary tract infections in Africa: Systematic review and meta-analysis. *Infection, Disease & Health, 29*(3), 172-179. https://doi.org/10.1016/j.idh.2024.02.005

Awoyomi, O., Wang, Y., Bakare, T., Bradbury, A., Episcopia, B., Castro-Auvet, P., Fornek, M., & Quale, J. (2024). Reduction in catheter-associated urinary tract infections following a diagnostic stewardship intervention. *American Journal of Infection Control, 52*(2), 255-257. https://doi.org/10.1016/j.ajic.2023.09.020

Awuor, S. O., Omwenga, E. O., Mariita, R. M., Musila, J. M., & Musyoki, S. (2023). Monitoring the battleground: Exploring antimicrobial resistance and virulence factors in wound bacterial isolates. *Access Microbiology, 5*(11), 000613.v6. https://doi.org/10.1099/acmi.0.000613.v6

Babore, G. O., Eyesu, Y., Mengistu, D., Foga, S., Heliso, A. Z., & Ashine, T. M. (2024). Adherence to infection prevention practice standard protocol and associated factors among healthcare workers. *Global Journal on Quality and Safety in Healthcare, 7*(2), 50-58. https://doi.org/10.36401/JQSH-23-14

Bawaqneh, K. A., Ayed, A., & Salameh, B. (2025). Nurses' knowledge, attitude, practice, and perceived barriers of infection control measures in the intensive care units at Northwest Bank hospitals. *Critical Care Nursing Quarterly, 48*(2), 160-171. https://doi.org/10.1097/CNQ.0000000000000538

Bibi, A., Khan, R.A., Bilal, U., Abbas, Z., Ali, D., Noman, K., & Aziz, A. (2023). Knowledge of Nursing Students on Catheter-Associated Urinary Tract Infection Prevention. *Pakistan Journal of Health Sciences*.

Blessy, M., Tode, S., & PrabhudasRaiboarde, M. (2023). EFFECT OF VIDEO ASSISTED TEACHING MODULE (VATM) ON PREVENTION OF CATHETER ASSOCIATED URINARY-TRACT INFECTION (CAUTI) AMONG STAFF NURSES WORKING IN SELECTED TERTIARY CARE HOSPITALS, MAHARASHTRA

Blot, S., Ruppé, E., Harbarth, S., Asehnoune, K., Poulakou, G., Luyt, C. E., Rello, J., Klompas, M., Depuydt, P., Eckmann, C., Martin-Loeches, I., Povoa, P., Bouadma, L., Timsit, J. F., & Zahar, J. R. (2022). Healthcare-associated infections in adult intensive care unit patients: Changes in epidemiology, diagnosis, prevention and contributions of new technologies. *Intensive & Critical Care Nursing, 70*, 103227. https://doi.org/10.1016/j.iccn.2022.103227

Bola-Oyebamiji, S. B., Agbara, J. O., Ojewuyi, A. A., Oladele, A., Abiodun, M. O., & Gbadegesin, A. (2024). Pattern of catheter-associated urinary tract infection following caesarean section at an urban tertiary hospital in Lagos, Nigeria. *Western Nigeria Journal of Medical Sciences, 7*(1), 53–62. https://doi.org/10.4314/wnjms.v7i1.7

Brockway, P., Hill, D. M., Moll, V., Stanton, K., Malbrain, M. L., & Velamuri, S. R. (2022). A retrospective, observational study of catheter-associated urinary tract infection events post-implementation of a novel urinary catheter system with active drain line clearance and automated intra-abdominal pressure monitoring. *Life, 12*(12), 1950.

Calistus, E. O., Odikpo, L. C., Onyia, E., Okoronkwo, I. L., Ogbonnaya, E. S., Ndie, E. C., Ezenduka, P. O., & Ilo, C. I. (2023). CAUTI-bundle application in patients' care among nurses in a Nigerian tertiary health facility. *International Journal of Urological Nursing, 17*(3), 165-171. https://doi.org/10.1111/ijun.12360

Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D., & Walker, K. (2020). Purposive sampling: Complex or simple? Research case examples. *Journal of Research in Nursing, 25*(8), 652-661. https://doi.org/10.1177/1744987120927206

Campos Mota, É., & de Oliveira, A. C. (2023). Prevention of catheter-associated infection: Effect of an intervention on the knowledge of intensivists. *O Mundo Da Saúde, 47*. https://doi.org/10.15343/0104-7809.202347e12792022P

Carratalá-Munuera, C., Cortés-Castell, E., Márquez-Contreras, E., Castellano, J. M., Perez-Paramo, M., López-Pineda, A., & Gil-Guillen, V. F. (2022). Barriers and solutions to improve therapeutic adherence from the perspective of primary care and hospital-based physicians. *Patient Preference and Adherence, 16*, 697-707. https://doi.org/10.2147/PPA.S319084

Centers for Disease Control and Prevention. (2024). *Preventing catheter-associated urinary tract infections (CAUTIs)*.

Centers for Disease Control and Prevention. (2025). *Guideline for prevention of catheter-associated urinary tract infections 2022*. https://www.cdc.gov/nhsn/pdfs/pscmanual/7psccauticurrent.pdf

Chadli, F.E., Gretete, D., & Moumen, A. (2021). Data Analysis within a Scientific Research Methodology. *Proceedings of the 2nd International Conference on Big Data, Modelling and Machine Learning*.

Dahuwa, A. A., & Umar, S. (2021). Attitude and practice of nurses toward prevention of catheter associated urinary tract infection at federal medical center Azare, Nigeria. *International Journal of Advanced Research in Nursing, 4*(1), 01-05.

Dessie, Z., Gela, D., & Yusuf, N. T. (2024). Knowledge, attitude, practice, and associated factors toward the prevention of catheter-associated urinary tract infection among nurses in Ethiopia: Cross-sectional study. *SAGE Open Nursing, 10*, 23779608241281317. https://doi.org/10.1177/23779608241281317

Dibekulu, D. (2020). An overview of data analysis and interpretations in research. https://doi.org/10.14662/IJARER2020.015

Emergency Care Research Institute. (2023). *Evidence-based strategies for preventing CAUTIs from indwelling catheters*.

Fish, L., Heathers, R., Litherland, M., Jung, M., & Yu, K. (2024). Implementation of a multi-modal intervention adopting new technologies, clinical services, and feedback improves catheter-associated urinary tract infections. *UroToday*. https://www.urotoday.com/urinary-catheters-

home/indwelling-catheters/complications/1702-urotoday/urinary-tract-infection-cautis/151369-implementation-of-a-multi-modal-intervention-adopting-new-technologies-clinical-services-and-feedback-improves-catheter-associated-urinary-tract-infections.html

Fitzgerald, M. J., Pearson, M. M., & Mobley, H. L. T. (2024). Proteus mirabilis UreR coordinates cellular functions required for urease activity. *Journal of Bacteriology, 206*(4), e0003124. https://doi.org/10.1128/jb.00031-24

Flores-Mireles, A., Hreha, T. N., & Hunstad, D. A. (2019). Pathophysiology, treatment, and prevention of catheter-associated urinary tract infection. *Topics in Spinal Cord Injury Rehabilitation, 25*(3), 228-240. https://doi.org/10.1310/sci2503-228

Gambrill, B., Pertusati, F., Hughes, S. F., Triantafyllopoulos, G. K., & Subramanian, P. (2024). Materials-based incidence of urinary catheter associated urinary tract infections and the causative micro-organisms: Systematic review and meta-analysis. *BMC Urology, 24*, 186. https://doi.org/10.1186/s12894-024-01565-x

Givler, D. N., & Givler, A. (2025). Asymptomatic bacteriuria. In *StatPearls*. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK441848/

Goda, R. M., El-Baz, A. M., Khalaf, E. M., Alharbi, N. K., Elkhooly, T. A., & Shohayeb, M. M. (2022). Combating bacterial biofilm formation in urinary catheter by green silver nanoparticle. *Antibiotics, 11*(4), 495. https://doi.org/10.3390/antibiotics11040495

Goorts, K., Dizon, J., & Milanese, S. (2021). The effectiveness of implementation strategies for promoting evidence informed interventions in allied healthcare: A systematic review. *BMC Health Services Research, 21*(1), 241. https://doi.org/10.1186/s12913-021-06190-0

Gupta, P., Thomas, M., Mathews, L., Zacharia, N., Ibrahim, A. F., Garcia, M. L. B., Simbulan, C., Mohamed, F., & Hassan, M. E. (2023). Reducing catheter-associated urinary tract infections in the cardiac intensive care unit with a coordinated strategy and nursing staff empowerment. *BMJ Open Quality, 12*(2), e002214.

Hassan, A. O., Ibrahim, M. I., Habib, Z. G., & Mohammed, H. (2020). Incidence of catheter-associated urinary tract infection in the intensive care unit of a tertiary hospital in Nigeria. *African Journal of Anaesthesia and Intensive Care, 20*(2), 35–40. https://www.ajol.info/index.php/ajaic/article/view/228997

Houghton, C., Meskell, P., Delaney, H., Smalle, M., Glenton, C., Booth, A., Chan, X. H. S., Devane, D., & Biesty, L. M. (2020). Barriers and facilitators to healthcare workers' adherence with infection prevention and control (IPC) guidelines for respiratory infectious diseases: A rapid qualitative evidence synthesis. *Cochrane Database of Systematic Reviews, 4*(4), CD013582. https://doi.org/10.1002/14651858.CD013582

Huang, H., Huang, L., Yan, S., Zhang, X., Zheng, Y., Zhu, X., Liu, Q., & Yi, F. (2025). A bundle-based approach on catheter-associated urinary tract infection: A multi-center study in Chinese tertiary hospitals. *BMC Infectious Diseases, 25*(1), 248. https://doi.org/10.1186/s12879-025-10638-7

International Society for Infectious Diseases. (2024). *Preventing catheter-associated urinary tract infections: A position paper of the International Society for Infectious Diseases*.

Kamel, M., Harris, N., Berry, A., Warsavage, T., Bessesen, M. T., & Kon, S. E. (2025). Implementation of a nurse-driven protocol for indwelling urinary catheter removal and novel utilization dashboard: A pre/postintervention observational study. *Therapeutic Advances in Infectious Disease, 12*. https://doi.org/10.1177/20499361251317900

Kan, M. P., & Fabrigar, L. R. (2020). Theory of planned behavior. In V. Zeigler-Hill & T. K. Shackelford (Eds.), *Encyclopedia of personality and individual differences*. Springer. https://doi.org/10.1007/978-3-319-24612-3_1191

Kanti, S. P. Y., Csóka, I., Jójárt-Laczkovich, O., & Adalbert, L. (2022). Recent advances in antimicrobial coatings and material modification strategies for preventing urinary catheter-associated complications. *Biomedicines, 10*(10), 2580. https://doi.org/10.3390/biomedicines10102580

Leon, R.J., Lapkin, S., Fields, L., & Moroney, T. (2022). Developing a self-administered questionnaire: methods and considerations. *Nurse researcher*.

Lowe, H., Woodd, S., Lange, I. L., Janjanin, S., Barnet, J., & Graham, W. (2021). Challenges and opportunities for infection prevention and control in hospitals in conflict-affected settings: A qualitative study. *Conflict and Health, 15*(1), 94. https://doi.org/10.1186/s13031-021-00428-8

Luque González, M., Armas Moreno, C., Mòdol Vidal, M., Endrényi, S., Castellano Santana, P.R., Muñoz Calahorro, C., Serrano Muñoz, M., & Santos, T. (2024). Urinary catheterisation among nurses in Sweden: A survey on routines and guideline adherence. *International Journal of Urological Nursing*.

Manolov, R., & Rochat, L. (2024). Analyzing data in single-case experimental designs: Objectives and available software options. *Journal of Behavioral and Cognitive Therapy*.

Mong, I., Ramoo, V., Ponnampalavanar, S., Chong, M. C., & Wan Nawawi, W. N. (2022). Knowledge, attitude and practice in relation to catheter-associated urinary tract infection (CAUTI) prevention: A cross-sectional study. *Journal of Clinical Nursing, 31*(1–2), 209–19. https://doi.org/10.1111/jocn.15899

Moore, A. (2021). Validity. In R. Jones & F. Jenkins (Eds.), *Managing and leading in the allied health professions* (2nd ed., Chapter 11). Routledge.

Muscat, D. C., Sciortino, M., & Tartari, E. (2025). Healthcare professionals' knowledge, attitudes, and practices in preventing catheter-associated urinary tract infections: A cross-sectional study in a rehabilitation facility. *Infection Prevention in Practice, 7*(1), 100438. https://doi.org/10.1016/j.infpip.2025.100438

Niederhauser, A., Züllig, S., Marschall, J., Schwappach, D. L., & progress! Safe Urinary Catheterization Collaboration Group. (2020). Nurses' and physicians' perceptions of

indwelling urinary catheter practices and culture in their institutions. *Journal of Patient Safety, 16*(2), e82-e89. https://doi.org/10.1097/PTS.0000000000000502

Onwuegbuzie, A. J. (2025). On quantitizing revisited. *Frontiers in Psychology, 15*. https://doi.org/10.3389/fpsyg.2024.1421525

Parmanik, A., Das, S., Kar, B., Bose, A., Dwivedi, G. R., & Pandey, M. M. (2022). Current treatment strategies against multidrug-resistant bacteria: A review. *Current Microbiology, 79*(12), 388. https://doi.org/10.1007/s00284-022-03061-7

Patel, P. K., Advani, S. D., Kofman, A. D., Lo, E., Maragakis, L. L., Pegues, D. A., Pettis, A. M., Saint, S., Trautner, B., Yokoe, D. S., & Meddings, J. (2023). *Infection Control & Hospital Epidemiology, 44*(8), 1209–1231. https://doi.org/10.1017/ice.2023.137

Plando, R., Obaid, L., Al Baker, A. S., Khan, O., Solatorio, M., De Leon, B. J., Tabasin, V. M., & Obsioma, R. A. (2024). Prevention and control of catheter-associated urinary tract infection (CAUTI): A patient safety and quality improvement project. *Cureus, 16*(10), e72105. https://doi.org/10.7759/cureus.72105

Qu, F., Pang, Y., Wang, M., Liu, X., Wang, J., & Li, L. (2025). Healthcare workers' knowledge, attitudes, and practices on catheter-associated UTI prevention: influencing factors in an OB/GYN hospital. *Frontiers in Public Health, 13*.

Rosenthal, V. D., Memish, Z. A., Nicastri, E., Leone, S., & Bearman, G. (2025). Preventing catheter-associated urinary tract infections: A position paper of the International Society for Infectious Diseases, 2024 update. *International Journal of Infectious Diseases, 151*, 107304. https://doi.org/10.1016/j.ijid.2024.107304

Rosenthal, V. D., Yin, R., Brown, E. C., Lee, B. H., Rodrigues, C., Myatra, S. N., Kharbanda, M., Rajhans, P., Mehta, Y., Todi, S. K., Basu, S., Sahu, S., Mishra, S. B., Chawla, R., Nair, P. K., Arjun, R., Singla, D., Sandhu, K., Palaniswamy, V., ... Jin, Z. (2024). Incidence and risk factors for catheter-associated urinary tract infection in 623 intensive care units throughout 37 Asian, African, Eastern European, Latin American, and Middle Eastern nations: A multinational prospective research of INICC. *Infection Control & Hospital Epidemiology, 45*(5), 567-575. https://doi.org/10.1017/ice.2023.215

Rubi, H., Mudey, G., & Kunjalwar, R. (2022). Catheter-associated urinary tract infection (CAUTI). *Cureus, 14*(10), e30385. https://doi.org/10.7759/cureus.30385

Sabih, A., & Leslie, S. W. (2025). Complicated urinary tract infections. In *StatPearls*. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK436013/

Schweiger, A., Kuster, S. P., Maag, J., Züllig, S., Bertschy, S., Bortolin, E., John, G., Sax, H., Limacher, A., Atkinson, A., Schwappach, D., & Marschall, J. (2020). Impact of an evidence-based intervention on urinary catheter utilization, associated process indicators, and infectious and non-infectious outcomes. *Journal of Hospital Infection, 106*(2), 364-371. https://doi.org/10.1016/j.jhin.2020.07.002

Sharif, F. B., Aminu, A., & Idris, A. M. (2020). Catheter-associated urinary tract infection among patients attending some selected hospitals in Kano Metropolis. *Bayero Journal of Medical Laboratory Science, 5*(2), 174-179. https://www.ajol.info/index.php/bjmls/article/view/230424

Sohail, R., Saddique, H., & Jabeen, R. (2024). To assess knowledge and practice among nurses regarding prevention of catheter-associated urinary tract infection. *Journal of Health and Rehabilitation Research*, *4*(2). https://doi.org/10.61919/jhrr.v4i2.895

Su, L. (2025). Effectiveness of nurse-driven protocols in reducing catheter-associated urinary tract infections: A systematic review and meta-analysis. *Journal of Nursing Care Quality, 40*(1), 39-45. https://doi.org/10.1097/NCQ.0000000000000811

Teshager, T., Hussien, H., Kefyalew, M., Geleto, B., Taye, B., & Agidew, M. (2022). Knowledge, practice and associated factors of nurses towards prevention of catheter-associated urinary tract infection in intensive care unit of public hospitals administered by Federal Government in Addis Ababa, Ethiopia: A cross-sectional institutional-based study. *BMC Nursing, 21*, 186. https://doi.org/10.1186/s12912-022-00968-1

Werneburg, G. T. (2022). Catheter-associated urinary tract infections: Current challenges and future prospects. *Research and Reports in Urology, 14*, 109-133. https://doi.org/10.2147/RRU.S273663

Whitaker, A., Colgrove, G., Scheutzow, M., Ramic, M., Monaco, K., & Hill Jr, J. L. (2023). Decreasing catheter-associated urinary tract infection (CAUTI) at a community academic medical center using a multidisciplinary team employing a multi-pronged approach during the COVID-19 pandemic. *American Journal of Infection Control, 51*(3), 319-323.

Willie, M. M. . (2024). Population and Target Population in Research Methodology. *Golden Ratio of Social Science and Education*, *4*(1), 75–79. https://doi.org/10.52970/grsse.v4i1.405

Yahia, M., Abo El Hussein, A., Ali Ahmed, L., & Abd Elbaky, M. (2023). Effect of applying nursing guidelines on reducing catheter associated urinary tract infection among critically ill patients. *Minia Scientific Nursing Journal, 14*(2), 42-53. https://doi.org/10.21608/msnj.2023.256087.1100

Yang, X., Chen, H., Zheng, Y., Qu, S., Wang, H., & Yi, F. (2022). Disease burden and long-term trends of urinary tract infections: A worldwide report. *Frontiers in Public Health, 10*, 888205. https://doi.org/10.3389/fpubh.2022.888205

Zegeye, A. F., Kassahun, C. W., & Temechu, Y. Z. (2022). Knowledge, practice and associated factors of catheter-associated urinary tract infection prevention among nurses. *[Preprint]*. https://doi.org/10.21203/rs.3.rs-1306083/v1

Zelalem, A., Mulat, E., Wagaw, A., Agenagnew, A., Tadesse, M., & Sefineh, F. F. (2024). Catheter-associated urinary tract infections in Africa: Systematic review and meta-analysis. *Infection, Disease & Health, 29*(3), 172-179. https://doi.org/10.1016/j.idh.2024.02.005

QUESTIONNAIRE

UNIVERSITY OF BENIN (UNIBEN) BENIN CITY, EDO STATE

DEPARTMENT OF NURSING SCIENCES

Dear Respondent,

I am a student of the above-named institution conducting a study on the topic: **"ADHERENCE TO INFECTION PREVENTION AND CONTROL PROTOCOLS FOR CATHETER-RELATED URINARY TRACT INFECTIONS AMONG NURSES IN UNIVERSITY OF BENIN TEACHING HOSPITAL, EDO STATE."**

This questionnaire is designed to seek your honest opinions and experiences regarding the research topic; it will take you approximately 10 minutes to complete. Your sincere responses will be highly appreciated. Participation in this research is voluntary, and all information provided will be treated with utmost confidentiality.

Thank you for your willingness to participate.

_____

Researcher's Signature
EZEOKEKE CHINEMEREM ADACHUKWU

Section A: Demographic Data

Please tick [✓] the option that applies to you.

1. Age on your last birthday:

   ☐ 20–29 ☐ 30–39 ☐ 40–49 ☐ 50 and above

2. Sex:

   ☐ Male ☐ Female

3. Marital Status:

   ☐ Single ☐ Married ☐ seperated ☐ Divorced ☐ Widowed

4. Highest Educational Qualification:

   ☐ Diploma ☐ Higher diploma ☐ B.NSc ☐ M.Sc ☐ phD

5. Department/Unit:

   ☐ Medical ☐ Surgical ☐ Maternity ☐ Emergency

6. Years of Clinical Experience:

   ☐ Less than 1 year ☐ 1–5 years ☐ 6–10 years ☐ More than 10 years

Section B: Nurses' Knowledge of CAUTI Prevention and control Protocols

Instruction: Choose the correct answer (True or False) for each of the following statements*:*

S/N	Statement	True	False
1	Hand hygiene before and after catheter insertion helps prevent CAUTI.	☐	☐
2	Sterile gloves are not required during catheter insertion.	☐	☐
3	Prolonged catheterization reduces the risk of CAUTI.	☐	☐
4	The drainage bag should be positioned above the bladder level.	☐	☐
5	CAUTIs are mainly caused by poor catheter maintenance.	☐	☐
6	Daily review of catheter necessity is part of CAUTI prevention protocol.	☐	☐
7	Biofilm formation is not a concern in urinary catheters.	☐	☐
8	Closed drainage systems are recommended to prevent CAUTIs.	☐	☐
9	Patient education is irrelevant to catheter care.	☐	☐
10	CAUTIs do not significantly contribute to hospital-acquired infections.	☐	☐

Section C: Adherence to CAUTI Prevention and control Protocols

Instruction: Indicate how often you carry out the following practices.

Scale:

4 = Always 3 = Often 2 = Rarely 1 = Never

S/N	Statement	4	3	2	1
1	I assess the necessity of catheterization before insertion.	☐	☐	☐	☐
2	I use aseptic technique during catheter insertion.	☐	☐	☐	☐
3	I properly secure the catheter to prevent movement.	☐	☐	☐	☐
4	I maintain a closed drainage system for catheterized patients.	☐	☐	☐	☐
5	I position the drainage bag below bladder level.	☐	☐	☐	☐
6	I perform hand hygiene before handling the catheter system.	☐	☐	☐	☐
7	I use a clean container when emptying catheter bags.	☐	☐	☐	☐
8	I inspect the catheter site regularly for infection.	☐	☐	☐	☐
9	I document all catheter-related care appropriately.	☐	☐	☐	☐
10	I advocate for early removal of catheters when no longer necessary.	☐	☐	☐	☐

Section D: Factors Influencing Adherence to CAUTI Prevention and control Protocols

Instruction: Please indicate the extent to which you agree or disagree with the following statements:

(4 = Strongly Agree, 3 = Agree, 2 = Disagree, 1 = Strongly Disagree)

S/N	Statement	4	3	2	1
1	Inadequate training affects my adherence to CAUTI protocols.	☐	☐	☐	☐
2	Lack of supplies (e.g., gloves, antiseptics) affects my compliance.	☐	☐	☐	☐
3	Supervision by senior staff improves my protocol adherence.	☐	☐	☐	☐
4	Regular updates on new guidelines help me adhere to protocols.	☐	☐	☐	☐
5	Peer support from colleagues influences my compliance.	☐	☐	☐	☐
6	High workload prevents me from strictly following CAUTI prevention steps.	☐	☐	☐	☐
7	Availability of written hospital policies encourages adherence.	☐	☐	☐	☐
8	Leadership emphasis on infection prevention motivates my compliance.	☐	☐	☐	☐
9	Time constraints during shifts make it difficult to follow all infection control measures.	☐	☐	☐	☐
10	Fear of causing patient infection drives me to follow CAUTI protocols strictly.	☐	☐	☐	☐