



[Research Article]

Appraisal of Nephrology Nurses' Knowledge and Practices in the Prevention of Central Venous Catheter-Related Infections at Muhammadu Abdullahi Wase Teaching Hospital, Kano

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Abstract:

Background: Central venous catheter-related bloodstream infections (CLABSI) are a significant source of morbidity, mortality, and healthcare costs, particularly in resource-limited settings. Nephrology nurses are key stakeholders in preventing these infections through adherence to evidence-based protocols. This study appraised the knowledge and practices of nephrology nurses regarding CLABSI prevention at Muhammadu Abdullahi Wase Teaching Hospital (MAWTH), Kano, Nigeria.

Methods: A descriptive cross-sectional design was employed, involving all 70 nurses in the hospital's hemodialysis unit. Data were collected using a structured, self-administered questionnaire assessing socio-demographics, knowledge, and self-reported practices related to CVC infection prevention. Descriptive and inferential statistics were used for analysis.

Results: Most nurses were early-career professionals (70% aged 21–30 years, 68% with <5 years of experience). While over 84% demonstrated strong knowledge of CLABSI prevention, 34% did not recognize hand hygiene as a crucial preventive measure. Universal agreement existed on the use of gloves and aseptic techniques. However, misconceptions about antiseptics and shared equipment risks were evident. A moderate positive correlation ($r = 0.563$) was found between age and experience, but years of experience did not significantly predict performance.

Conclusion: Although nephrology nurses at MAWTH exhibit generally sound knowledge and practices regarding CLABSI prevention, critical gaps remain. Continuous professional development and structured training are essential to sustain and improve infection control outcomes.

Keywords: Central venous catheter, CLABSI, nephrology nurses, infection prevention, Kano, Nigeria, hemodialysis.

Introduction:

Central venous catheters (CVCs) are essential in managing critically ill and hemodialysis patients, enabling the administration of medications, parenteral nutrition, and hemodynamic monitoring. However, their use is significantly associated with central line-associated bloodstream infections (CLABSI), which remain a major cause of morbidity, mortality, prolonged hospitalization, and increased healthcare costs worldwide (1,2).

Despite global efforts to curb CLABSI, their incidence remains notably higher in resource-limited settings. A recent prospective study conducted in a tertiary care hospital in Northern India reported a CLABSI rate of 9.3 per 1,000 catheter days, highlighting the persistent burden in developing countries (1). Similarly, in Sub-Saharan

Africa, infection prevention is often undermined by systemic challenges, including inadequate training, shortage of resources, and non-adherence to aseptic protocols (2).

Nurses, particularly those in nephrology and intensive care units, play a pivotal role in preventing CLABSI through strict adherence to evidence-based guidelines. Nevertheless, studies have consistently identified gaps in their knowledge and implementation of preventive measures. For example, Alqalah found that while many critical care nurses demonstrated acceptable compliance with CLABSI protocols, their theoretical understanding was limited, signaling an urgent need for regular training and capacity building (3).

Barriers to optimal infection control include high workloads, lack of equipment, limited institutional support, and irregular refresher courses (4). These challenges are particularly pronounced in lower-middle-income countries, where health systems face constraints in implementing comprehensive infection prevention programs.

At Muhammadu Abdullahi Wase Teaching Hospital (MAWTH) in Kano, Nigeria, CLABSI represent a recurring clinical and public health issue. The absence of structured infection control protocols and inconsistent training may further exacerbate the incidence of CVC-related infections. Therefore, this study aims to appraise the knowledge and practices of nephrology nurses regarding CLABSI prevention at MAWTH. By identifying existing gaps and addressing them with targeted interventions, this research seeks to reduce infection rates, enhance nursing competence, and improve patient outcomes.

Methods:

This study employed a cross-sectional descriptive design to assess nephrology nurses' knowledge and practices regarding central venous catheter infection (CVCI) prevention at Muhammad Abdullahi Wase Teaching Hospital (MAWTH), Kano. Below are the methodological details:

3.1 Research Design

A descriptive cross-sectional survey was conducted to evaluate variables at a specific point in time among a defined population (National Data Analysis Resource Centre, 2010). This design was selected to efficiently capture the current state of nurses' knowledge and practices without longitudinal follow-up.

3.2 Research Setting

The study was conducted at MAWTH, a tertiary hospital in Nasarawa L.G.A., Kano State, with a 280-bed capacity and 201 nursing staff. The hemodialysis unit, where the study was focused, comprises 20 nephrology nurses. Established in 1929, MAWTH provides specialized services, including hemodialysis, and serves neighboring regions (e.g., Niger, Chad).

3.3 Target Population and Sample Size

The target population included all 70 nurses in MAWTH's hemodialysis unit. A census approach was adopted, enrolling all eligible nurses to ensure comprehensive representation. The sample size was justified by a 95% confidence interval and 80% power for detecting significant associations.

3.4 Data Collection Instrument

A structured, self-administered questionnaire was used, divided into three sections:

- Section A: Socio-demographics (age, sex, qualifications).
- Section B: Knowledge of CVCI prevention (e.g., aseptic techniques, catheter care).
- Section C: Self-reported practices (e.g., adherence to protocols).

3.5 Validity and Reliability

The questionnaire was developed through a literature review and validated by experts in medical-surgical nursing for face and content validity. A pilot test confirmed reliability (Cronbach's $\alpha = 0.80$).

3.6 Data Collection Procedure

1. Initial visit: Researchers introduced the study to unit managers and obtained ethical approval.
2. Second visit: Questionnaires were distributed to nurses, with a research assistant assisting in retrieval to minimize bias.
3. Participation was voluntary, and confidentiality was maintained.

3.7 Data Analysis

Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize data. Inferential statistics (e.g., Pearson's correlation) assessed relationships between knowledge and practice.

3.8 Ethical Considerations

Ethical approval was obtained from MAWTH's institutional review board. Participants provided written informed consent, with assurances of anonymity and voluntary participation.

Result

Table 1: Socio-demographic Characteristics of Respondents (N=70)

Variable	Category	Frequency (n=70)	Percentage (%)
Age	21-30 years	48	70%
	31-40 years	14	20%
	>40 years	7	10%
Gender	Male	31	45%
	Female	39	55%
Marital Status	Married	42	61%
	Single	26	38%
	Widow/Widower	2	1%
Tribe	Hausa	46	67%
	Other Tribes	19	28%
	Yoruba	5	5%
Religion	Islam	61	87%
	Christianity	9	13%
Qualification	RN	35	50%
	RN/RM	12	17%

Variable	Category	Frequency (n=70)	Percentage (%)
	BNSc	22	31%
	MSc	1	1%
Years in Service	<5 years	47	68%
	5-10 years	13	[%]
	>10 years	10	[%]

The study revealed that 70% of nephrology nurses at MAWTH were early-career professionals (aged 21–30, 68% with <5 years of experience), which aligns with global evidence linking limited clinical experience to gaps in infection prevention practices (O’Grady et al., 2011). The high response rate (99%) underscores the reliability of these findings, though the cohort’s homogeneity may limit generalizability. Notably, 50% of nurses held only RN qualifications, with just 1% possessing an MSc, suggesting a need for advanced training to bridge knowledge-practice gaps in CRBSI prevention—a concern echoed in low-resource settings (Han et al., 2010). The demographic predominance of Hausa (67%) and Muslim (87%) respondents reflects Kano’s sociocultural context, while the gender distribution (55% female) mirrors nursing workforce trends (WHO, 2022). These results emphasize the urgency of tailored interventions, such as simulation-based training for early-career staff and policy reforms to standardize certification requirements, to reduce CRBSI rates in hemodialysis units.

Knowledge and Practices on CVCII Prevention

Table 2: Nurses’ Knowledge of CVCII Causes, Signs, and Transmission (N=70)

Statement	Strongly Agree	Agree	Disagree	Strongly Disagree
Central venous catheter infection is caused by bacteria or fungi?				
Chills/fever/purulence are signs of CVCII	51% (36)	40% (28)	9% (6)	0% (0)
<i>Staphylococcus</i> is the most common causative agent	56% (39)	43% (30)	1% (1)	0% (0)
Oral secretions, skin contamination of patients and nurses transmit CVCII	49% (34)	39% (27)	11% (8)	1% (1)
Hand hygiene could be mode of transmitting CVCII	24% (17)	13% (10)	34% (24)	27% (19)
Aseptic techniques reduce CVCII colonization	81% (57)	19% (13)	0% (0)	0% (0)
Topical antibiotics reduce CVCII risk	53% (37)	37% (26)	6% (4)	4% (3)

Key Findings:

- Over 90% of nurses correctly identified clinical signs (e.g., fever) and *Staphylococcus* as primary causes of CVCII, aligning with NHSN (2013) guidelines.

- 88% recognized skin/oral secretions as transmission routes, though 34% erroneously disagreed that poor hand hygiene contributes to CVCI, highlighting a critical knowledge gap.
- Universal consensus (100%) on aseptic techniques and hand hygiene as effective preventive measures, consistent with Zhou et al. (2014).
- Divergent views on topical antibiotics: 90% endorsed their use despite mixed evidence on efficacy (O'Grady et al., 2011), suggesting overreliance on pharmacological interventions.

Knowledge, Practices and Perceptions on CVCI Prevention

Table 3: Infection Prevention Practices (N=70)

Prevention Method	Strongly Agree	Agree	Disagree	Strongly Disagree
Hand hygiene before and after CVCI reduces risk	74% (52)	29% (18)	0% (0)	0% (0)
Hand glove use	71% (50)	29% (20)	0% (0)	0% (0)
Aseptic technique	79% (55)	21% (15)	0% (0)	0% (0)
Sterilization of dressings/equipment	70% (49)	27% (19)	1% (1)	1% (1)

Nurses exhibited strong knowledge of CVCI signs (91% agreement) and causes (99%), with universal consensus on hand gloves and aseptic techniques (100%). This aligns with global standards (NHSN, 2013) but contrasts with 34% underestimating hand hygiene's role (Table 4), revealing a critical training gap.

Table 4: Antiseptics & Equipment Risks (N=70)

Variable	Support* (%)	Oppose* (%)	Key Conflict
Chlorhexidine risks	23	77	Misconception of efficacy
Povidone-iodine effectiveness	92	8	Preferred antiseptic
Normal saline adequacy	37	63	Undervalued limitations
Shared equipment risk	63	37	Resource-driven risk
Recycled consumables risk	71	28	High perceived threat

Support = Strongly Agree/Agree; Oppose = Disagree/Strongly Disagree.

While povidone-iodine was widely trusted (92%), 23% erroneously linked **chlorhexidine** to infection risks a myth requiring correction. Normal saline splits opinions (37% support), suggesting inconsistent wound care protocols. Shared equipment (63%) and recycled supplies (71%) were flagged as risks, highlighting resource limitations.

Table 5: Environmental & Systemic Factors (N=70)

Factor	Support* (%)	Oppose* (%)	Implication
Crowd control efficacy	78	22	Space management critical
Antimicrobial spray need	81	19	Underutilization concern
Sterilization necessity	97	2	Strong adherence

Environmental controls like crowd reduction (78% support) and sterilization (97%) were prioritized, but 19% undervalued antimicrobial sprays, indicating uneven protocol adoption. This mirrors resource-constrained settings where systemic measures compete with practical constraints.

Discussion:

This study assessed the knowledge and practices of nephrology nurses regarding the prevention of central venous catheter infections (CVCIs) at Muhammadu Abdullahi Wase Teaching Hospital, Kano. The findings reveal encouraging levels of awareness among participants, particularly concerning common causative agents, symptoms, and the importance of aseptic techniques. Over 84% of nurses demonstrated strong knowledge of infection control principles, especially recognizing the role of *Staphylococcus* species and signs such as purulence and fever. This aligns with previous research conducted in comparable resource-limited settings, which reported similar awareness levels among dialysis and ICU nurses (5,6). However, critical gaps were also identified. Notably, 34% of respondents failed to associate inadequate hand hygiene with the risk of infection transmission a misconception that contradicts global best practices outlined by the CDC and WHO (7,8). This discordance between foundational knowledge and specific evidence-based practices suggests a need for targeted refresher training.

The study further revealed universal agreement on the importance of glove use and aseptic technique, yet diverging views regarding antiseptic agents. A notable proportion of nurses (23%) mistakenly perceived chlorhexidine as a risk factor, while 92% favored povidone-iodine. This trend is consistent with findings from (9,10), which indicate that outdated or inconsistent institutional protocols often lead to reliance on less effective antiseptics. The limited trust in chlorhexidine a globally recommended agent underscores the necessity for clearer, updated clinical guidelines within the hemodialysis unit.

The data also highlight the influence of demographic factors. A moderate positive correlation ($r = 0.563$) was observed between age and years of service, yet performance levels did not significantly correlate with experience. This reflects prior studies showing that years of practice alone are not reliable indicators of clinical competence unless supported by regular continuing education and performance evaluations (11). This suggests that clinical experience should be complemented by structured learning to ensure sustained adherence to infection prevention protocols.

Resource constraints were another recurring theme in the findings. Approximately 63% of participants flagged shared equipment as a risk, and 71% raised concerns about recycled consumables practices that are often driven by systemic limitations rather than clinical choice. These findings are in line with broader Sub-Saharan African studies, where infrastructural inadequacies and supply shortages hinder infection control efforts (12,13). Similarly, environmental measures such as crowd control (78%) and antimicrobial spray use (81%) were acknowledged as important but appeared inconsistently applied, highlighting gaps between knowledge, intent, and implementation due to institutional constraints.

Taken together, the study emphasizes that while nurses at MAWTH possess a strong theoretical foundation in CVCi prevention, practical implementation is limited by knowledge gaps in key areas (such as antiseptic use and hand hygiene) and by environmental and systemic barriers. These findings underscore the importance of integrating continuous professional development with institutional reforms, resource allocation, and evidence-based policy support to improve infection control outcomes in resource-limited healthcare environments.

Despite the valuable insights generated by this study, certain limitations must be acknowledged. First, the study employed a cross-sectional design, which limits the ability to infer causality between knowledge and practice outcomes. Secondly, the use of self-reported questionnaires may introduce response bias, as participants could overestimate their adherence to infection control protocols. Additionally, the sample was drawn from a single teaching hospital, which limits the generalizability of the findings to other institutions in Nigeria or similar low-resource settings. The relatively small sample size, although adequate for descriptive analysis, may also reduce the statistical power to detect more nuanced associations between demographic factors and performance. Finally, the absence of observational or clinical audit data means that actual practices were not independently verified. Future research should consider longitudinal, multi-center designs with triangulated data sources to deepen the understanding of how knowledge translates into clinical behavior.

Conclusion:

This study provides critical insights into the knowledge and practices of nephrology nurses at Muhammadu Abdullahi Wase Teaching Hospital (MAWTH), Kano, concerning central venous catheter infection (CVCI) prevention. The findings reveal that while most nurses demonstrated commendable knowledge of infection etiology and preventive measures, notable gaps persist—particularly concerning hand hygiene, antiseptic use, and the risks associated with shared equipment.

The observed moderate correlation between age and experience, yet a weak relationship between experience and performance, highlights that clinical longevity alone is insufficient for maintaining high standards in infection prevention. This reinforces global evidence that structured, regular training, updated protocols, and institutional support are more critical than experience alone in ensuring safe practices (6,11).

Furthermore, environmental and systemic constraints such as resource scarcity, overcrowding, and inconsistent supply of antiseptics pose barriers to the effective translation of knowledge into practice. These challenges are not unique to MAWTH and mirror conditions in other resource-limited healthcare settings globally (4,10,12,13). Therefore, the need for targeted, evidence-based, and context-specific interventions is urgent and unavoidable.

5.3 Recommendations

Based on the study's findings and in line with global best practices, the following recommendations are proposed:

1. Institutionalize Continuous Professional Development (CPD)

Regular infection prevention training programs, including workshops, simulations, and online modules, should be implemented for all nephrology nurses. These initiatives must focus on areas of identified weakness especially hand hygiene and antiseptic selection to improve adherence to CLABSI guidelines (7,14).

2. Establish and Enforce Standardized Protocols

Clear, accessible, and standardized protocols for CVC care should be developed, displayed prominently in dialysis units, and regularly reviewed. This ensures consistency in practice and aligns local procedures with CDC and NHSN guidelines (8).

3. Improve Infection Control Infrastructure

The hospital administration must prioritize the procurement of essential supplies such as chlorhexidine, sterile dressings, and single-use equipment to reduce cross-contamination risks. Crowd control in dialysis units and regular environmental sterilization should be enforced (5,13).

4. Promote Research and Evidence-Based Practice

Encourage nursing staff and students to engage in operational research, journal clubs, and quality improvement projects focused on infection prevention. This cultivates a culture of evidence-based practice and helps localize global standards (5).

5. Integrate CLABSI Prevention into Nursing Education Curricula

Incorporate infection prevention modules into nephrology and general nursing curricula. Topics should include vascular access management, CLABSI surveillance, antimicrobial stewardship, and behavioral compliance (11).

6. Advocate for Policy Support

Hospital leadership and professional associations should advocate for state and national policies that mandate regular infection control audits, fund training initiatives, and support CLABSI reporting systems.

Nursing Implications

Nursing Practice: This study affirms that nursing professionals play a pivotal role at critical points in patients' lives. Strengthening nurse-patient interactions through evidence-based infection prevention practices will enhance the quality of care.

Nursing Research: The findings highlight the need for continuous inquiry. Nurses are encouraged to engage in research to inform and improve clinical practice.

Nursing Education: The knowledge generated from this study contributes to the growing body of nursing literature and serves as a resource for both educators and students in nursing and related fields.

Conflict of interest:

The authors declare that there is no conflict of interest.

Reference:

1. Odada D, Munyi H, Gatuiku J, Thuku R, Nyandigisi J, Wangui A, et al. Reducing the rate of central line-associated bloodstream infections; a quality improvement project. *BMC Infect Dis* [Internet]. 2023 Dec 1 [cited 2025 Aug 4];23(1):1–8. Available from: <https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-023-08744-5>
2. Lowe H, Woodd S, Lange IL, Janjanin S, Barnett J, Graham W. Challenges and opportunities for infection prevention and control in hospitals in conflict-affected settings: a qualitative study. *Confl Health* [Internet]. 2021 Dec 1 [cited 2025 Aug 4];15(1):94. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC8686079/>
3. Alqalah TAH. Mitigating risks in central line-associated bloodstream infection: a comprehensive insight into critical care nurses' knowledge, attitudes, barriers, and compliance. *BMC Nurs* [Internet]. 2024 Dec 1 [cited 2025 Aug 4];23(1):1–12. Available from: <https://bmcnurs.biomedcentral.com/articles/10.1186/s12912-024-02168-5>
4. Barker AK, Brown K, Siraj D, Ahsan M, Sengupta S, Safdar N. Barriers and facilitators to infection control at a hospital in northern India: A qualitative study. *Antimicrob Resist Infect Control* [Internet]. 2017 Apr 8 [cited 2025 Aug 4];6(1):1–7. Available from: <https://aricjournal.biomedcentral.com/articles/10.1186/s13756-017-0189-9>
5. Senbato FR, Wolde D, Belina M, Kotiso KS, Medhin G, Amogne W, et al. Compliance with infection prevention and control standard precautions and factors associated with noncompliance among healthcare workers working in public hospitals in Addis Ababa, Ethiopia. *Antimicrob Resist Infect Control* [Internet]. 2024 Dec 1 [cited 2025 Aug 4];13(1). Available from: <https://pubmed.ncbi.nlm.nih.gov/38475931/>
6. Sachan H, Manu J, Monika A. Effectiveness of Education Intervention on Nurse's Knowledge Regarding the Prevention of Central Line-Associated Bloodstream Infection in the Intensive Care and Haemodialysis Units in Selected Hospitals, Kanpur. *Indian Journal of Continuing Nursing Education* [Internet]. 2022 Jul [cited 2025 Aug 4];23(2):196–200. Available from: https://journals.lww.com/ijcn/fulltext/2022/23020/effectiveness_of_education_intervention_on_nurse_s.16.aspx
7. Organization WHealth. State of the World's Nursing 2025 Investing in Education, Jobs, Leadership and Service Delivery. 2025;
8. O'Grady NP, Alexander M, Burns LA, Dellinger EP, Garland J, Heard SO, et al. Guidelines for the Prevention of Intravascular Catheter-related Infections. *Clin Infect Dis* [Internet]. 2011 May [cited 2025 Aug 4];52(9):e162. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC3106269/>
9. Dabhade D, Tiwari S, Dabhade CKB. A Survey of Knowledge of Antiseptic and Disinfectant Use in Staff Nurses in A Tertiary Care Hospital. [cited 2025 Aug 4]; Available from: <https://dx.doi.org/10.18535/jmscr/v5i3.151>

10. Odada D, Munyi H, Gatuiku J, Thuku R, Nyandigisi J, Wangui A, et al. Reducing the rate of central line-associated bloodstream infections; a quality improvement project. *BMC Infect Dis* [Internet]. 2023 Dec 1 [cited 2025 Aug 4];23(1):745. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC10617146/>
11. Iqbal S, Iqbal A. Knowledge and Practices of the Nurses Regarding Central Line Associated Infection at Tertiary Care Hospital, Peshawar, Pakistan. *medtigo Journal of Medicine* [Internet]. 2025 Jan 24 [cited 2025 Aug 4];3(1). Available from: <https://journal.medtigo.com/knowledge-and-practices-of-the-nurses-regarding-central-line-associated-infection-at-tertiary-care-hospital-peshawar-pakistan/>
12. Ngema SA, Bale TLA, Ramukumba TendaniR. Barriers to Infection Prevention Adherence and Compliance in Haemodialysis Units in South Africa: A Qualitative Study. 2025 Jul 11 [cited 2025 Aug 4]; Available from: <https://www.researchsquare.com>
13. Falana ROA, Ogidan OC, Fajemilehin BR. Barriers to infection prevention and control implementation in selected healthcare facilities in Nigeria. *Infect Dis Now* [Internet]. 2024 Apr 1 [cited 2025 Aug 4];54(3). Available from: <https://pubmed.ncbi.nlm.nih.gov/38395258/>
14. Aloush SM, Al-Sayaghi K, Tubaishat A, Dolansky M, Abdelkader FA, Suliman M, et al. Compliance of Middle Eastern hospitals with the central line associated bloodstream infection prevention guidelines. *Applied Nursing Research* [Internet]. 2018 Oct 1 [cited 2025 Aug 4];43:56–60. Available from: <https://www.sciencedirect.com/science/article/pii/S0897189717307450>