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Aseptic technique training and infection-risk reduction practices among healthcare workers: a quasi-experimental study in Kwara State, Nigeria

Pelatihan teknik aseptik dan praktik pengurangan risiko infeksi di kalangan tenaga kesehatan: studi quasi-eksperimental di Negara Bagian Kwara, Nigeria

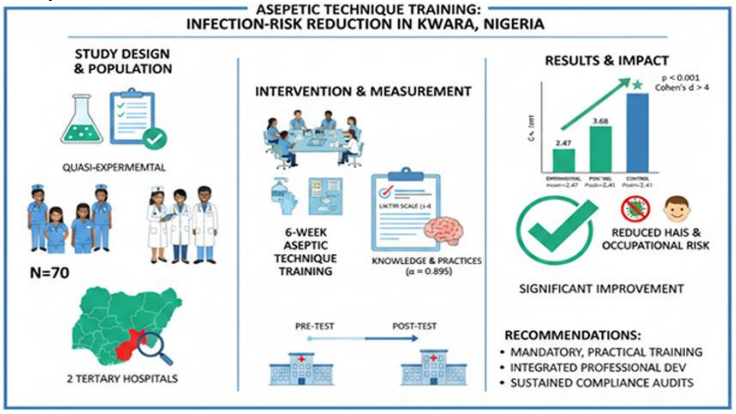
Abdulmuhit T. Isiaq*[1], Seun N. Akorede[2], Adamu A. Biu[3], Muhammad Sanusi[4]

[1, 2, 3, 4] Department of Human Kinetics and Health Education, Ahmadu Bello University, Zaria, Nigeria

Abstract
Healthcare-associated infections (HAIs) remain a persistent burden in resource-limited health systems, yet evidence on structured, sustained aseptic technique education for healthcare workers (HCWs) in Nigerian tertiary hospitals is still limited. This study aimed to determine the effect of a six-week aseptic technique training on HCWs' work-related infection-risk reduction practices in tertiary hospitals in Kwara State, Nigeria. A quasi-experimental pre-test/post-test design with experimental and control groups was used. Seventy (70) nurses and medical laboratory scientists were recruited from two tertiary hospitals, which were randomly assigned to intervention or control sites using a fishbowl technique. Data were collected using a researcher-developed questionnaire rated on a Likert scale with high internal consistency (α = 0.895). The experimental group received a six-week aseptic technique education programme, while the control group received no intervention. Paired and independent samples t-tests were applied. Findings indicated a significant improvement in the experimental group's practices (pre-test mean = 2.47, post-test mean = 3.68; t = 27.96, p < 0.001; Cohen's d = 4.73), and a significant post-test difference between experimental (mean = 3.68) and control groups (mean = 2.41; t = 23.90, p < 0.001; Cohen's d = 5.70). These results support institutionalising mandatory, practical, and reinforced training within Infection Prevention and Control (IPC) policies, aligned with family health protection and Islamic ethical values of cleanliness, harm prevention, and communal responsibility, to sustain safer care and reduce infection risks.

Abstrak
Infeksi yang terkait dengan pelayanan kesehatan (HAIs) tetap menjadi beban yang persisten dalam sistem kesehatan dengan sumber daya terbatas, namun bukti mengenai pendidikan teknik aseptik yang terstruktur dan berkelanjutan bagi tenaga kesehatan (HCWs) di rumah sakit tersier di Nigeria masih terbatas. Studi ini bertujuan untuk menentukan efek pelatihan teknik aseptik selama enam minggu terhadap praktik pengurangan risiko infeksi terkait pekerjaan di kalangan HCW di rumah sakit tersier di Negara Bagian Kwara, Nigeria. Desain quasi-eksperimental pre-test/post-test dengan kelompok eksperimen dan kontrol digunakan. Tujuh puluh perawat dan ilmuwan laboratorium medis direkrut dari dua rumah sakit tersier, yang secara acak ditugaskan ke situs intervensi atau kontrol menggunakan teknik fishbowl. Data dikumpulkan menggunakan kuesioner yang dikembangkan oleh peneliti, yang dinilai menggunakan skala Likert dengan konsistensi internal yang tinggi (α = 0.895). Kelompok eksperimen menerima program pendidikan teknik aseptik selama enam minggu, sementara kelompok kontrol tidak menerima intervensi. Uji t sampel berpasangan dan independen diterapkan. Temuan menunjukkan peningkatan signifikan dalam praktik kelompok eksperimen (rata-rata pra-tes = 2,47, rata-rata pasca-tes = 3,68; t = 27,96, p < 0,001; Cohen's d = 4,73), serta perbedaan pasca-tes yang signifikan antara kelompok eksperimen (rata-rata = 3,68) dan kelompok kontrol (rata-rata = 2,41; t = 23,90, p < 0,001; Cohen's d = 5,70). Hasil ini mendukung pengimplementasian pelatihan wajib, praktis, dan diperkuat dalam kebijakan Pencegahan dan Pengendalian Infeksi (PPI), yang selaras dengan perlindungan kesehatan keluarga dan nilai-nilai etika Islam mengenai kebersihan, pencegahan bahaya, dan tanggung jawab bersama, guna mempertahankan perawatan yang lebih aman dan mengurangi risiko infeksi.

Graphical Abstract



Keyword
family health; healthcare; infection control; nigeria; risk reduction behavior

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Correspondence
Samaru Campus, Zaria, Kaduna State, 810211, Nigeria.
aisiaq@education.abu.edu.ng

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INTRODUCTION

Healthcare-associated infections (HAIs), also termed nosocomial infections, are infections acquired by patients or healthcare workers during the process of receiving care within healthcare facilities (World Health Organization [WHO], 2024). Although HAIs are largely preventable, they continue to cause avoidable morbidity and mortality, prolong hospitalisation, and increase healthcare costs globally (Abban et al., 2023; Gidey et al., 2023). Current estimates indicate that approximately 7% of hospitalised patients in high-income countries and about 15% in Low- and Middle-Income Countries (LMICs) acquire at least one HAI, demonstrating persistent inequities in health system capacity and Infection Prevention and Control (IPC) implementation (Balasubramanian et al., 2023). This burden aligns with the global agenda for Sustainable Development Goal (SDG) 3 (good health and well-being), which emphasises improving health outcomes through quality care and preventing avoidable deaths, and SDG 6 (clean water and sanitation), which is directly linked to hygiene and safe healthcare environments that reduce infection transmission.

In Africa, HAIs are amplified by structural and operational constraints, including inadequate infrastructure, limited access to essential supplies, and insufficient training and supervision of healthcare workers (HCWs) (Allegranzi et al., 2021). These challenges undermine standardised IPC implementation and contribute to low adherence to aseptic practices, with reported HAI prevalence ranging from 12% to 25% in several African settings (Abubakar et al., 2022; Hutton et al., 2024; Melariri et al., 2024). In Nigeria, HAI prevalence has been reported between 14% and 22%, often associated with overcrowding, inadequate sterilisation practices, and suboptimal hand hygiene among HCWs (Abubakar, 2020). Within Kwara State, concerns persist regarding HCWs' work-related risk reduction practices; evidence indicates limited IPC knowledge and low compliance with hand hygiene protocols, alongside poor translation of knowledge into consistent preventive practice (Ilesanmi et al., 2021).

Despite the preventable nature of HAIs, work-related infection-risk reduction practices among HCWs in resource-limited settings remain inconsistent, creating sustained risks for patients and occupational exposure for healthcare staff. In Kwara State, empirical evidence indicates that HCWs may have awareness of HAIs and IPC requirements but demonstrate poor preventive practices, including low compliance with hand hygiene and inadequate measures to reduce transmission from inanimate objects and routine clinical activities (Ilesanmi et al., 2021). This practice gap has been reflected in recurring HCW infections during outbreaks, including COVID-19 and other reported events, suggesting that available PPE or general IPC messaging alone may be insufficient to produce durable behavioural change in daily clinical routines (Okonkwo et al., 2025; WHO, 2024). A feasible and scalable solution is strengthening HCWs' competencies through structured, practical, and reinforced aseptic technique education embedded within routine IPC systems, targeting not only knowledge but also sustained practice adoption and compliance.

Aseptic techniques comprise a set of clinical practices intended to prevent pathogen introduction into sterile sites and reduce cross-contamination, commonly including meticulous hand hygiene, correct use of personal protective equipment (PPE), and appropriate sterilisation and disinfection of instruments and surfaces (Barton et al., 2022; Hawker et al., 2023). Because HCW practices often reflect underlying cognition and attitudes, targeted educational strategies are frequently used to improve adherence to IPC behaviours, especially where systemic barriers and high workload contribute to noncompliance (Alhumaid et al., 2021; Lowe et al., 2021; Schutte et al., 2024; Yilma et al., 2024). International guidance also supports training as a core IPC component, noting that effective education programmes should be competency-based and reinforced to influence routine clinical practice and reduce infection risks (WHO, 2022).

Evidence from sub-Saharan Africa suggests that educational and training interventions can improve HCWs' IPC compliance and may reduce HAI incidence. For instance, intervention programmes in Tanzania have been associated with significant improvements in HCWs' adherence to IPC protocols (Mboya et al., 2020). Similarly, an educational intervention was reported to yield a substantial reduction in HAIs, supporting training as a pragmatic approach to strengthening IPC performance in comparable contexts (Tomczyk et al., 2021). Collectively, these findings indicate that structured education—particularly when practical and sustained—can address behavioural gaps in aseptic technique application, providing a rationale for intervention-focused research in settings such as Kwara State where HAI burden and occupational exposure remain prominent (WHO, 2024).

While descriptive studies in Nigeria and other LMICs have repeatedly documented suboptimal IPC compliance and persistent HAI prevalence, many investigations primarily assess knowledge, attitudes, and self-reported practices without testing structured interventions capable of producing sustained behavioural change in clinical workflows (Abubakar, 2020; Ilesanmi et al., 2021). In Kwara State, findings that only a minority of HCWs demonstrate adequate IPC knowledge and that compliance with key practices such as hand hygiene can be low underscore the urgent need to move beyond problem description toward evaluated solutions. Moreover, repeated HCW infections during outbreaks highlight a concerning gap between IPC awareness, resource availability, and consistent day-to-day aseptic practice, implying that periodic or one-off training may not be sufficient to ensure safe routines in high-exposure environments (Okonkwo et al., 2025; WHO, 2024).

Accordingly, a key research gap is the scarcity of experimental or quasi-experimental studies in tertiary hospitals that measure the effectiveness of structured aseptic technique interventions on HCWs' work-related infection-risk reduction practices, particularly in contexts of high patient acuity and elevated occupational exposure risk. This study is novel in its intervention-focused approach by implementing and evaluating an aseptic technique education programme within tertiary healthcare facilities in Kwara State, Nigeria, to determine whether training can measurably improve risk reduction practices. Therefore, the study objective is to examine the effect of an aseptic technique intervention on healthcare workers' work-related risk reduction practices toward infectious diseases in tertiary hospitals in Kwara State, Nigeria.

METHODS

Study design

This study adopted a quasi-experimental pre-test/post-test design with experimental and control groups. Quasi-experimental designs involve manipulation of an independent variable without random assignment of participants to conditions, making them suitable for evaluating interventions in real-world health settings where randomisation at the individual level may be impractical. The design was considered appropriate for determining the effect of an aseptic technique education intervention on healthcare workers' (HCWs') work-related risk reduction practices toward infectious diseases in tertiary hospitals in Kwara State, Nigeria.

Study setting, period, and population

The study was conducted in tertiary hospitals in Kwara State, Nigeria. The target population comprised nurses and medical laboratory scientists working in tertiary healthcare facilities. The accessible population across the three tertiary hospitals in the state was 1,221 HCWs: University of Ilorin Teaching Hospital (UITH) (n = 756), Kwara State University Teaching Hospital (KWASUTH) (n = 421), and Federal Neuro-Psychiatric Hospital, Budo Egba (FNPHB) (n = 44) (Administrative Offices of the Hospital, 2025). UITH and KWASUTH were comparable in professional composition (nurses and medical laboratory scientists), years of work experience, and prior exposure to infection prevention training; however, UITH had a relatively higher patient load and more specialised service units, while KWASUTH operated with fewer staff and resources. These contextual differences were noted and considered during analysis to minimise potential confounding effects.

Sample size and sampling technique

A total sample of 70 participants was recruited: 35 HCWs in the experimental group and 35 HCWs in the control group. The sample size was determined using an a priori power analysis to ensure adequate statistical power to detect a meaningful intervention effect at a significance level (α) of 0.05 and a desired power of 0.80.

A multistage sampling procedure was adopted in this study. First, simple random sampling was used to select two tertiary hospitals from the three available facilities in Kwara State by writing the hospital names on slips of paper, folding them uniformly, and drawing them from a container to ensure equal probability of selection. Second, the selected hospitals were randomly assigned to experimental and control conditions using a fishbowl technique, with the University of Ilorin Teaching Hospital (UITH) designated as the experimental site and the Kwara State University Teaching Hospital (KWASUTH) designated as the control site. Third, proportionate sampling was applied to ensure adequate representation of healthcare personnel across clinical units, including the General Outpatient Department, Accident and Emergency, Male and Female Medical and Surgical Wards, Antenatal, Maternity, and Paediatric Wards. Finally, within each unit, simple random sampling was conducted by writing staff

Table 1
Scheme of work for the intervention programme (11:00 am – 12:00 pm)

Week	Topic	Title	Objective	Content	Researcher's Activities	Participants' Activities	Learning Outcomes	Resources	Evaluation
One	Hospital-Acquired Infections	Understanding Hospital-Acquired Infections	To explain the concept, types, and prevention of hospital-acquired infections	- Meaning of hospital-acquired infections (HAIs) - Types of HAIs - Methods of prevention	- Deliver a lecture on HAIs - Facilitate group discussion	- Participate in lecture - Engage in group discussion on prevention methods	Participants will be able to define HAIs, identify types, and explain prevention methods	Whiteboard, markers, handouts	Question and answer session, group report
Two	Infection Prevention and Control	Importance of Infection Prevention and Control	To explain the significance of infection prevention and identify risk management practices	- Benefits of infection prevention and control - Risk management steps	- Deliver lecture - Explain risk management strategies	- Participate in discussions - Ask and answer questions	Participants will recognize the value of IPC and describe risk management practices	Flip charts, handouts	Oral feedback, short quiz
Three	Occupational Risks	Injuries and Work-Related Risk Reduction Practices	To describe causes of injuries and preventive measures in the healthcare setting	- Causes of injuries, especially from sharps - Prevention of infection transmission	- Facilitate interactive session - Demonstrate safe practices	- Share experiences - Practice safe techniques	Participants will explain injury causes and apply infection prevention measures	PPE samples, posters, case studies	Practical demonstration, peer review
Four	Safety Standards	Standard Precautions and Aseptic Techniques	To differentiate standard precautions and aseptic techniques in infection control	- Definition of standard precaution - Definition of aseptic technique - Differences between both	- Explain both concepts - Highlight practical differences	- Discuss and compare methods - Note key differences	Participants will define and differentiate standard precautions and aseptic techniques	Video clips, diagrams, printed guidelines	Group discussion, individual reflection
Five	Aseptic Techniques	Principles and Types of Aseptic Techniques	To identify and explain types, principles, and processes in aseptic technique	- Types of aseptic technique - Principles of aseptic technique - Medical asepsis - Decontamination and sterilization	- Give lecture on each sub-topic - Use real-life examples	- Note-taking - Participate in Q&A	Participants will identify and describe types and principles of aseptic techniques	Sterile equipment, posters, samples	Quiz, role play
Six	Disinfection Procedures	High-Level Disinfection and Instrument Handling	To explain high-level disinfection and proper equipment storage	- Meaning of high-level disinfection (HLD) - steps in HLD - Proper storage of processed instruments	- Demonstrate HLD steps - Explain storage techniques	- Observe demonstration - Practice storage methods	Participants will describe HLD and demonstrate correct instrument storage	Disinfectants, equipment, storage containers	Practical exercise, observation checklist

members' names on separate papers, folding them, placing them in a container, and randomly selecting participants until the required sample size for each unit was attained.

Inclusion criteria

Eligible participants were nurses and medical laboratory scientists who were currently employed in the selected hospitals, assigned to the specified clinical units, and willing to provide informed consent and complete both pre-test and post-test assessments. Participants were required to be available for the duration of the study period.

Instrumentation and validity/reliability

Data were collected using a researcher-developed questionnaire titled Effect of Aseptic Techniques Intervention on Health Workers' Work-related Risk Reduction Practices towards Infectious Diseases (EATIHWWRRPID). The instrument comprised 23 items assessing work-related risk reduction practices aligned with aseptic technique behaviours in clinical settings, including (but not limited to) sterilisation of instruments after use, safe disposal of sharps, hand hygiene before and after patient contact, appropriate use of gloves and protective eyewear during procedures, adoption of hands-free techniques during procedures, and safe handling of needles and syringes.

Responses were measured using a four-point modified Likert scale: Always (4), Often (3), Sometimes (2), and Never (1). Mean aggregate scores of ≥ 2.50 were interpreted as positive practice, while mean scores of < 2.50 were interpreted as negative practice.

Table 2
Characteristics of the respondents

Variables	Experimental		Control	
	n	%	n	%
Age Range in Years				
18 – 25	6	17.1	5	14.3
26 – 35	13	37.1	12	34.3
36 – 45	9	25.7	9	25.7
46 – 55	5	14.3	5	14.3
> 55	2	5.7	4	11.4
Gender				
Female	23	65.7	23	65.7
Male	12	34.3	12	34.3
Health Worker				
Medical Laboratory Scientist	5	14.3	5	14.3
Nurse	30	85.7	30	85.7

Face and content validity were established through expert review by five specialists: four from the Department of Human Kinetics and Health Education and one from the Department of Nursing Sciences, Ahmadu Bello University, Zaria. A pilot study was conducted at FNPHB using 30 copies of the questionnaire, distributed and retrieved immediately to reduce missing data. Internal consistency reliability was assessed using Cronbach's alpha, yielding $\alpha = 0.895$, indicating high reliability. This interpretation is consistent with reliability guidance that coefficients closer to 1 reflect stronger internal consistency (Imasuen, 2022).

Intervention procedure

A structured aseptic technique education intervention manual was developed and used to deliver the training. The manual covered: types and principles of aseptic techniques; safety of the healthcare work environment; selection and correct use of personal protective equipment (PPE); correct donning and doffing of PPE; and core work-related risk reduction practices (e.g., injection safety, hand hygiene, decontamination, sterilisation, and safe disposal of sharps).

Data collection procedures

Data collection spanned eight weeks: one week for pre-test administration, six weeks for the intervention, and one week for post-test administration (see Table 1). Four research assistants supported the process: the head nurses from UITH and KWASUTH and two senior nurses from UITH who assisted with the experimental procedures. Following approval from the Kwara State Ministry of Health and permissions from hospital management, baseline (pre-test) data were obtained from both groups using the questionnaire.

The experimental group then received the aseptic technique education programme delivered weekly for six weeks, held on Saturdays from 11:00 am to 12:00 pm at the UITH premises. The control group received no intervention during the same period. After completion of the six-week programme, the post-test was administered to both groups using the same instrument. Pre-test and post-test data were collated for within-group and between-group comparisons.

Ethical considerations and informed consent

Ethical approval was obtained from the Ahmadu Bello University Ethics and Research Committee (Approval No.: ABUCUHSR/2025/005). Participation was voluntary, and written informed consent was obtained prior to enrolment. Participants were informed about study objectives, procedures, benefits/risks, confidentiality protections, and the right to withdraw at any time without penalty. To ensure confidentiality, questionnaires were coded without personal identifiers. Data were stored securely and accessible only to the research team. A potential conflict of interest was recognised due to the involvement of head nurses as research assistants, which could have influenced subordinates' responses; this risk was mitigated by emphasising voluntariness, anonymising responses, and restricting access to identifiable information during analysis.

Data analysis and presentation

Data were analysed using SPSS version 30. Descriptive statistics (frequencies and percentages) summarised participants' demographic characteristics, while means and standard deviations addressed the

Table 3
Paired sample t-test representation of pre and post-test

Work-Related Risk Reduction Practices	N	Mean	Std. Dev.	Mean Difference	df	t-value	p-value
Pretest	35	2.47	0.79	1.21	34	27.96	< 0.001
Post-test	35	3.68	0.81				

Note: * = significant (p < 0.05)

study's research questions. Inferential analyses were conducted at a 0.05 level of significance. A paired-samples t-test assessed within-group changes in risk reduction practices (pre-test vs. post-test) among participants in the experimental group. An independent-samples t-test compared post-test mean scores between the experimental and control groups to determine the intervention effect between two independent groups. Findings were presented in tables using appropriate descriptive and inferential statistics.

RESULTS

Table 2 presented the demographic characteristics of the respondents who participated in the study on the effect of aseptic technique intervention on health workers' work-related risk reduction practices towards infectious diseases in Kwara State, Nigeria. The table presents the distribution of respondents in the experimental and control groups, each comprising 35 participants, according to age range, gender, and professional category. In terms of age distribution, both groups show a relatively similar pattern, indicating baseline comparability. In the experimental group, the majority of participants (37.1%) were within the 26–35 years age range, followed by those aged 36–45 years (25.7%). Participants aged 18–25 years constituted 17.1%, while 14.3% were within 46–55 years, and 5.7% were above 55 years. Similarly, in the control group, the largest proportion (34.3%) fell within the 26–35 years category, with 25.7% aged 36–45 years. Those aged 18–25 years and 46–55 years each accounted for 14.3%, while 11.4% were above 55 years. The close distribution across age categories suggests that both groups were demographically comparable prior to the intervention, thereby reducing the likelihood that age differences could confound the study outcomes.

Regarding gender and professional category, the distribution was identical in both groups, further demonstrating group equivalence. Females constituted the majority in both the experimental and control groups (65.7%), while males accounted for 34.3%. This indicates that the sample was predominantly female across both groups. In terms of professional category, nurses formed the overwhelming majority in each group (85.7%), whereas Medical Laboratory Scientists represented 14.3%. The equal representation of gender and professional cadre in both groups enhances internal validity, as it ensures that any observed differences in post-intervention outcomes are more likely attributable to the intervention rather than to variations in demographic or occupational characteristics.

Table 3 presented the paired-samples t-test assessing changes in work-related risk reduction practices among participants in the experimental group between pre-test and post-test. The findings indicated a marked improvement following the six-week aseptic technique intervention, with the mean practice score increasing from 2.47 at pre-test to 3.68 at post-test, yielding a mean difference of 1.21. The computed t-value was 27.96 with 34 degrees of freedom and an associated p-value < 0.001, which was below the 0.05 significance threshold. This result demonstrates a statistically significant improvement in work-related risk reduction practices after exposure to the intervention. Consequently, the null hypothesis of no significant effect of the aseptic technique intervention on HCWs' work-related risk reduction practices was rejected, indicating that the intervention significantly enhanced participants' adoption of safer infection prevention behaviours during routine clinical practice.

Table 4 showed the independent-samples t-test comparing post-intervention work-related risk reduction practice scores between the experimental

Table 4
Differences in occupational risk reduction practices after the aseptic technique intervention

Work-Related Risk Reduction Practices	N	Mean	Std. Dev.	Mean Difference	df	t-value	p-value
Control	35	2.41	0.72	1.27	68	23.9	< 0.001
Experimental	35	3.68	0.81				

Note: * = significant (p < 0.05)

and control groups. The results revealed that the control group recorded a substantially lower mean score (2.41) compared with the experimental group (3.68), producing a mean difference of 1.27. The calculated t-value of 23.90 with 68 degrees of freedom and $p < 0.001$ indicated that the difference between groups was statistically significant and unlikely to have occurred by chance. This finding confirms that the aseptic technique intervention produced a meaningful improvement in work-related risk reduction practices among HCWs in the experimental group relative to those in the control group who received no intervention, supporting the conclusion that the training programme was effective in strengthening infection-risk reduction behaviours.

DISCUSSION

The present study demonstrated a statistically significant improvement in work-related risk reduction practices following a six-week aseptic technique intervention ($t = 27.96$; $p < 0.001$). This finding is consistent with intervention studies reporting measurable practice gains after structured infection control education. For example, Akande (2020) reported substantial improvements in tuberculosis infection control practices among Nigerian nurses (79.1% to 98.5% at six months) with significant differences from a comparison group (78.8%). Farotimi et al. (2018) similarly found significant post-intervention differences between experimental and control groups in Nigerian tertiary hospitals ($P = 0.001$). Beyond Nigeria, Khalil et al. (2022) documented improved practice scores among intensive care unit staff and a concurrent reduction in patient infection rates from 26% to 9.7%, supporting the plausibility that practice improvements translate into safer care environments. International evidence further reinforces this pattern: Koota et al. (2024) concluded in a systematic review that interventions combining theoretical and practical learning activities yield significant practice improvements.

Notably, the magnitude of improvement in the current study contrasts with outcomes from brief or single-session interventions. Kakkar et al. (2021) found that a single educational module improved knowledge and attitude but did not significantly improve practices or infection outcomes ($P = 0.15$ for IV line-related infections). This divergence highlights the advantage of the present study's six-week structure, which likely enabled repeated exposure, supervised practice, and behavioural reinforcement—elements that facilitate skills consolidation beyond short-term cognitive gains. In addition, the study's quasi-experimental design with a control group strengthens causal inference relative to purely descriptive studies by directly attributing practice change to the intervention rather than baseline characteristics or secular trends (Akande, 2020; Zhang & Ning, 2023).

Although many studies document knowledge-practice gaps, the present findings suggest that a structured intervention can bridge this gap when training is sufficiently comprehensive. Cross-sectional research from Ethiopia illustrates that high knowledge does not automatically translate into safe practice: Bayleyegn et al. (2021) reported that despite 90% of HCWs having good knowledge, only 36% demonstrated good infection prevention practices, while Gezie et al. (2019) found favourable knowledge and attitudes (86.4% and 76.4%, respectively) alongside 77% poor practice. Rather than contradicting the current results, these studies underscore the need for intervention-based designs and reinforced training. The present intervention likely succeeded because it moved beyond knowledge dissemination toward skill-building and routine integration, consistent with Koota et al. (2024) conclusion that effective programmes must include both theoretical and practical components.

From a behavioural and systems perspective, the results align with evidence that practice improvements depend on both education and enabling conditions. Assefa et al. (2020) showed that infection prevention training increased safe practices (AOR: 2.4; 95% CI: 1.01–4.75), yet practices were lower where there was no continuous water supply (AOR = 0.48). Yosef (2023) similarly linked good practice to both PPE availability (aOR = 3.63) and infection prevention knowledge (aOR = 3.08), while Ataiyero et al. (2023) documented persistent challenges in Nigeria, including resource shortages and time constraints that hinder aseptic practice implementation. Practically, these findings imply that hospitals should pair training with supportive infrastructure and ongoing reinforcement mechanisms (e.g., audits, mentoring, reminders) to sustain behaviour change. Although the present study did not measure clinical endpoints such as HAI incidence, prior evidence indicates that improved practices may reduce infections (Khalil et al., 2022), which carries downstream benefits for patient safety, healthcare costs, and family wellbeing due to reduced prolonged admissions and caregiver burden (Scott et al., 2023; Haroen et al., 2025).

The significant post-intervention difference between the experimental and control groups ($t = 23.90$; $p < 0.001$) supports the effectiveness of the aseptic technique programme beyond within-group improvements. This between-group pattern aligns with quasi-experimental evidence demonstrating superior outcomes among trained participants compared with untrained controls. Farotimi et al. (2018) reported significant practice score differences between experimental and control groups after infection control training ($P = 0.001$), while Shaban et al. (2024) observed marked improvements in universal safety precaution practice following intervention, with control groups showing no comparable change. The current results are also compatible with broader Nigerian evidence that training can shift practices when the content is targeted and skills-oriented, particularly in high-risk clinical behaviours such as hand hygiene and standard precautions (Akinsulie et al., 2024; Shaban et al., 2024). Although some educational programmes show stronger effects on knowledge and attitudes than practice (Hill et al., 2024), the present study's strong between-group difference suggests that the intervention design and implementation conditions were sufficient to translate training into measurable behavioural outcomes.

The post-intervention gap between groups indicates that practice-oriented education can generate measurable improvements beyond routine exposure to clinical work, thereby supporting institutional investment in structured IPC capacity building. However, evidence also cautions that improvements may be moderated by environmental constraints: Abu-Odah et al. (2022) found that practices remained poor despite large knowledge gains due to facility limitations, and Lowe et al. (2021) reported that many HCWs faced situations where aseptic techniques could not be implemented because of resource shortages. Therefore, to sustain the observed group differences, hospitals should embed training within a broader IPC system that ensures supplies (water, PPE, sterilisation resources), supportive supervision, and continuous monitoring using standard indicators. Such system strengthening has potential downstream benefits for reducing occupational infections and limiting HCWs' role as inadvertent transmission vectors to households, thereby supporting family health protection (Mishra et al., 2025; Scott et al., 2023). Future evaluations should incorporate longitudinal follow-up and, where feasible, cluster-adjusted analytic approaches to account for institutional influences on behaviour.

Integrating Islamic ethical values can provide an additional motivational framework for sustaining aseptic practices. The ethical obligation to prevent harm aligns with the universal principles of beneficence and non-maleficence and resonates with Islamic moral accountability in safeguarding life and preventing avoidable injury to patients and communities (Hasan et al., 2025). Framing infection prevention as an ethical trust may strengthen intrinsic motivation and reinforce adherence to aseptic protocols, complementing skill-based training models and supporting behavioural maintenance beyond immediate post-intervention gains (Issac et al., 2026). This value-based approach does not replace technical training; rather, it may enhance commitment and professionalism by linking IPC behaviours with moral responsibility to protect vulnerable patients and their families.

Improved aseptic technique practices have implications that extend beyond healthcare facilities. Reduced occupational exposure lowers the likelihood that HCWs become vectors of infection transmission to household members, thereby supporting family health and community resilience (Scott et al., 2023). Additionally, preventing HAIs may reduce prolonged hospital stays and financial and emotional burdens on families who often provide caregiving and support during illness and recovery (Haroen et al., 2025). The study's strengths include the use of a quasi-experimental design with control comparison and a sustained six-week intervention that likely promoted behavioural reinforcement. Nonetheless, limitations should be acknowledged. Self-reported Likert-type measures are vulnerable to social desirability bias, potentially inflating adherence reporting. Hospital-level group allocation may introduce clustering effects, as shared supervision and norms within a hospital could violate independence assumptions and inflate effect estimates. The absence of long-term follow-up limits conclusions about sustainability, and the study did not directly measure clinical outcomes such as HAI incidence, which would strengthen causal inference regarding patient safety impacts. Future studies should incorporate longitudinal assessment, cluster-adjusted designs (e.g., cluster randomisation or multilevel modelling), and clinical endpoints to better capture sustained effectiveness and real-world infection reduction.

CONCLUSIONS

This study demonstrated that a six-week aseptic technique education intervention significantly improved healthcare workers' work-related infection-risk reduction practices in tertiary hospitals in Kwara State, Nigeria. The experimental group achieved markedly higher post-intervention practice scores than the control group, indicating that structured and practice-oriented training can effectively strengthen Infection Prevention and Control (IPC) behaviours in the short term and promote safer clinical routines that reduce occupational and patient exposure risks.

However, because outcome assessment was limited to the immediate post-test period without extended follow-up, conclusions regarding long-term sustainability of improved practices cannot be made. It is therefore recommended that hospital IPC Committees, in collaboration with Quality Assurance units, institutionalise mandatory aseptic technique retraining (e.g., quarterly or each semester depending on facility capacity) and implement routine supervisory audits using clearly defined indicators such as hand hygiene compliance, appropriate PPE use, adherence to sterile field protocols, and trends in procedure-related infections. Monitoring should incorporate documented feedback and accountability mechanisms, with prioritisation of high-risk units (e.g., emergency, intensive care, surgical theatres, and maternity) where lapses may disproportionately affect vulnerable patients and family health. Future studies should incorporate longitudinal follow-up to assess behavioural retention and sustainability, evaluate the cost-effectiveness of periodic retraining, and measure downstream impacts on HAI incidence and patient outcomes using designs that account for institutional clustering (e.g., cluster-randomised trials or multilevel modelling).

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AUTHORS' CONTRIBUTIONS
Abdulmuhit T. Isiaq: Conceptualization, study design, data curation, formal analysis, investigation (participant recruitment and field work), and writing original draft. Seun N. Akorede: Conceptualization, study design, review & editing. Adamu A. Biu: Conceptualization, writing, review & editing, and final approval of the manuscript. Muhammad Sanusi: Conceptualization, review & editing, and final approval of the manuscript.

AUTHORS' INFORMATION
Mr. Abdulmuhit Temitope Isiaq is a Researcher and PhD Candidate in the Department of Human Kinetics and Health Education, Faculty of Education, Ahmadu Bello University, Zaria, Nigeria. Dr. Seun Nurudeen Akorede is an Associate Professor in the Department of Human Kinetics and Health Education, Faculty of Education, Ahmadu Bello University, Zaria, Nigeria, and serves as the Deputy Dean, Faculty of Education, Ahmadu Bello University. Dr. Adamu Abdulkareem Biu is an Associate Professor in the Department of Human Kinetics and Health Education, Faculty of Education, Ahmadu Bello University, Zaria, Nigeria, and serves as the Deputy Director, Institute of Education, Ahmadu Bello University. Dr. Muhammad Sanusi is a Senior Lecturer in the Department of Human Kinetics and Health Education, Faculty of Education, Ahmadu Bello University, Zaria, Nigeria, and serves as the General Secretary, Nigeria Football Federation.

COMPETING INTERESTS
The author(s) declare no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

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