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Research paper

Nurses' Knowledge and Barriers to Filter-Needle Use in Preventing Glass-Related Medication Complications: A Cross-Sectional Study At LAUTECH Teaching Hospital, Nigeria.

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Abstract

Background: Filter needle use is a vital safety measure to prevent glass particle contamination during medication preparation from ampoules. Although international recommendations emphasize their importance, filter needles are rarely used consistently in resource-limited settings, exposing patients to risks such as embolism, inflammation, and infection caused by glass particle injection.
Aim: The study assessed nurses' knowledge of filter-needle use, identified barriers to implementation, explored strategies, and provided recommendations to promote safe medication practices at LAUTECH Teaching Hospital, Ogbomoso.
Methods: A descriptive cross-sectional design was employed with data collected from 145 registered nurses selected through stratified sampling across 12 wards and 5 clinics in the hospital. Data were collected using structured questionnaires and organized and analyzed using Microsoft Excel and SPSS v27. Descriptive statistics summarized responses, while Chi-square tests determined associations at a significance level of $p < 0.05$.
Results: Most nurses (95.9%) recognized the importance of filter needles, and 91.7% understood their clinical indications. However, only 57.2% reported confidence in practical use. Reported barriers included unavailability (100%), heavy workload (93.1%), lack of training (87.6%), absence of institutional policy (100%), and financial constraints (81.4%). Knowledge was significantly associated with financial limitations ($\chi^2 = 98.044$, $p < 0.001$) but not with sociodemographic factors ($p > 0.05$).
Conclusion: Nurses demonstrate strong theoretical knowledge but limited confidence and practice due to systemic barriers. Institutional reform, including policy mandates, regular training, and resource allocation, is urgently required to enhance safe medication practices.

Keywords: *Barrier; Filter Needle; Glass Ampoule; Knowledge; Medication; Safety practice.*

1. Introduction

1.1. Background

Glass ampoules remain widely used for parenteral medications because of their cost-effectiveness, chemical stability, and compatibility with diverse drugs such as anesthetics, antibiotics, and emergency medications (1,2). Ampoules are opened by applying pressure at the scored neck, after which the medication is aspirated into a syringe for intravenous, intramuscular, or subcutaneous administration. However, this process is frequently associated with particulate contamination in injectable solutions (3,4).
Manual breaking of ampoules commonly generates both visible and microscopic glass particles that may be aspirated into syringes and injected into patients (5,6). Hut and Yazici (2021) reported glass contamination in 94% of ampoule samples, with particle sizes ranging from 0.94 to 90.70 µm (5). Similarly, Yorioka et al. (2020) found that glass ampoules produced significantly more particulates than plastic ones (4). These particles have been implicated in complications such as phlebitis, embolism, tissue irritation, systemic inflammation, and multi-organ damage (7,8). Neonates and critically ill patients are particularly at risk, emphasizing the need for preventive filtration (8).
The technique used to open ampoules also affects contamination levels. Chiannilkulchai and Kejkornkaew (2021) observed that the direction of breakage and use of protective wrapping influenced both the size and number of released particles (6). Experimental studies further indicate that employing standardized tools and filtration can reduce particulate load by up to 85% (5).
Despite global best-practice recommendations, the use of filter needles remains inconsistent in clinical settings. Awareness among nurses and physicians is limited, with fewer than half recognizing the risks posed by glass particles (3). Cassista et al. (2014) linked poor compliance to behavioral and organizational barriers, highlighting the importance of institutional support and continuous training (9). Harmon (2014) also emphasized the anesthesia-related risks, noting that patient safety could be markedly improved through filter needle use (10).

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In low- and middle-income countries (LMICs), including those in sub-Saharan Africa, these challenges are intensified by infrastructural limitations, weak policy enforcement, and inconsistent training (11). Nigerian studies have reported similar patterns of unsafe medication preparation. Osuchukwu et al. (2025) found that pharmacovigilance training improved nursing students' knowledge, yet translation into clinical practice remained uncertain (12). Other studies identified frequent needle-stick injuries and poor adherence to safety protocols among nurses (11,13), while broader health system reviews noted weak safety governance and inadequate waste management as major risks (14).

At the Ladoke Akintola University of Technology (LAUTECH) Teaching Hospital, informal reports suggest filter needles are rarely used. Possible reasons include inadequate knowledge, insufficient training, equipment unavailability, and a lack of institutional policy. Without empirical data, effective interventions to enhance safe medication practices cannot be designed.

Overall, the literature underscores a persistent knowledge-practice gap regarding filter needle use, aggravated by infrastructural deficits and poor policy enforcement in LMICs (1,3,7). Addressing these challenges requires localized, evidence-based assessments of nurses' knowledge and implementation barriers. This study assesses registered nurses' knowledge, examines barriers, and proposes context-specific interventions to enhance patient safety in Nigeria and similar LMIC settings.

2. Methods

2.1. Ethical approval

Ethical approval was obtained from the Ladoke Akintola University of Technology (LAUTECH) Teaching Hospital Ethical Review Committee (Protocol No. LTH/OGB/2024/548). Verbal informed consent was secured from all participants before data collection. Confidentiality and anonymity were maintained throughout the study, and all data were securely stored and accessible only to the research team.

2.2. Setting and sampling

This cross-sectional study was conducted at LAUTECH Teaching Hospital, Ogbomoso, Oyo State, Nigeria, between November 2024 and March 2025, to assess nurses' knowledge and barriers to filter-needle use in preventing glass-related medication complications. The hospital, a tertiary institution and training center for nursing and medical students, provides a wide range of services, including Internal Medicine, Surgery, Pediatrics, Obstetrics and Gynecology, Emergency Medicine, Radiology, Laboratory Medicine, and Intensive Care.

Participation was voluntary, and no incentives were provided. Inclusion criteria were registered nurses actively involved in injectable medication preparation and administration who consented to participate by returning completed questionnaires. Questionnaires were distributed physically at nurses' stations across wards, clinics, and theatres using a stratified sampling approach.

2.3. Data collection

Participants completed a structured, self-administered questionnaire to provide data. The questionnaire was divided into four sections: socio-demographic characteristics (6 items); knowledge of filter needle use (7 items); institutional and practice-related barriers (7 items); and strategies or interventions to enhance usage (7 items). All items were closed-ended and aligned with the study objectives. Responses were scored dichotomously (Yes = 1, No = 0). Demographic variables included age, gender, marital status, highest educational qualification, years of professional experience, and department (Medical, Surgical, Pediatric, Maternity, Emergency, or Others).

2.4. Statistical analysis

Data were coded and analyzed using Microsoft Excel and SPSS version 27. Categorical variables such as age, gender, marital status, education, experience, and department were summarized using frequencies and percentages. Knowledge scores were derived from seven items, with a total possible score of 0-7. Participants scoring ≥4 (≥50%) were classified as having good knowledge, while those scoring <4 were categorized as having poor knowledge. Associations between categorical variables were assessed using Pearson's chi-square test, with statistical significance set at $p < 0.05$. Internal consistency was evaluated using Cronbach's α, with values ≥0.70 indicating acceptable reliability.

3. Result

Between November 2024 and March 2025, 145 questionnaires were administered and collected on-site, achieving a 100% response rate. Each questionnaire contained 27 items, and all were fully completed for analysis.

3.1. Sociodemographic data

A total of 145 responses were analyzed. Most respondents were aged 21–30 years (40%) and 31–40 years (36.6%). Females constituted 77.2%, and 71% were married. More than half held a Bachelor's degree (52.4%), while 30.3% had a diploma and 17.3% a Master's degree. Half of the participants (50.3%) had 16–20 years of professional experience, followed by 26.2% with 11–15 years. Respondents were distributed across medical (26.2%), surgical (22.1%), maternity (19.3%), pediatric (18.6%), emergency (8.3%), and other departments (5.5%).

Table 1: Socio-Demographic Data of the Respondents

		n	%
Age	21–30 years	58	40.0
	31–40 years	53	36.6
	41–50 years	29	20.0
	51–60 years	5	3.4
Gender	Male	33	22.8
	Female	112	77.2

Marital Status	Single	42	29.0
	Married	103	71.0
Highest Level of Education	Diploma	44	30.3
	Bachelor's Degree	76	52.4
	Master's Degree	25	17.3
	Doctoral Degree	0	0.0
Years of Experience as a Nurse	1–5 years	12	8.3
	6–10 years	22	15.2
	11–15 years	38	26.2
	16–20 years	73	50.3
Department	Medical	38	26.2
	Surgical	32	22.1
	Pediatric	27	18.6
	Maternity	28	19.3
	Emergency	12	8.3
	Others	8	5.5

3.2. Knowledge of filter-needle use

Most nurses demonstrated strong theoretical knowledge of filter-needle use. Nearly all (95.9%) recognized its importance in preventing particulate contamination, and 91.7% understood its clinical indications. A majority (79.3%) knew the correct procedure and specifications, though only 57.2% expressed confidence in practical handling. Furthermore, 81.4% recognized the risks of nonuse, and 87.6% agreed that filter needles enhance patient safety. Overall, 81.4% demonstrated good knowledge, while 18.6% showed poor knowledge.

Table 2: Knowledge of filter needle use

	Yes (%)	No (%)
knowledge of the correct procedure	115 (79.3%)	30 (20.7%)
Importance in preventing contamination.	139 (95.9%)	6 (4.1%)
Awareness of clinical indications.	133 (91.7%)	12 (8.3%)
Confidence in handling	83 (57.2%)	62 (42.8%)
Awareness of health risks	118 (81.4%)	27 (18.6%)
Knowledge of types/specifications	115 (79.3%)	30 (20.7%)
Belief in safety benefits.	127 (87.6%)	18 (12.4%)
Overall Knowledge	Good Knowledge	Poor Knowledge
	118(81.4%)	27(18.6%)

3.3. Institutional and practice-related barriers

All respondents (100%) reported the unavailability of filter needles, lack of management support, and absence of policy guidance. Only 12.4% had ever received training, mainly from external sources. High workload (93.1%) and lack of peer encouragement (91.7%) were additional barriers, while 81.4% cited financial constraints. These findings reveal systemic and institutional challenges to implementation.

Table 3: Institutional and Practice-Related Barriers

Barrier	Yes (%)	No (%)
Availability of filter needles is adequate	0 (0.0%)	145 (100%)
Management prioritizes filter-needle use	0 (0.0%)	145 (100%)
Workload allows consistent use.	10 (6.9%)	135 (93.1%)
Received sufficient training.	18 (12.4%)	127 (87.6%)
Policy or guideline support.	0 (0.0%)	145 (100%)
Colleague/supervisor encouragement	12 (8.3%)	133 (91.7%)
Financial constraints affect use.	118 (81.4%)	27 (18.6%)

3.4. Strategies and interventions to enhance usage

Respondents supported several measures to improve filter-needle use. All (100%) agreed on the need for increased availability and management resource allocation. Most (95.2%) endorsed regular training, while 91.7% favored monitoring systems. Additionally, 75.2% supported mandatory policies, and 95.9% valued nurse feedback.

Table 4: Strategies and Interventions to Enhance Usage

Strategy	Yes (%)	No (%)
Regular training programs	138 (95.2%)	7 (4.8%)
Increasing availability	145 (100%)	0 (0.0%)
Mandatory policy implementation.	109 (75.2%)	36 (24.8%)
Incentives encourage adherence.	124 (85.5%)	21 (14.5%)
Management should allocate more resources for availability.	145 (100%)	0 (0.0%)
The monitoring system improves compliance.	133 (91.7%)	12 (8.3%)
Nurse feedback improves outcomes	139 (95.9%)	6 (4.1%)

3.5. Relationship between nurses' knowledge of filter-needle use and barriers

Chi-square analysis revealed significant relationships between nurses' knowledge of filter-needle use and availability ($\chi^2 = 91.1$, $p < 0.001$), management prioritization ($\chi^2 = 0.768$, $p < 0.001$), and financial constraints ($\chi^2 = 98.044$, $p < 0.001$). No significant association was found with workload ($\chi^2 = 1.841$, $p = 0.175$), training ($\chi^2 = 0.860$, $p = 0.354$), or peer encouragement ($\chi^2 = 0.665$, $p = 0.415$). Policy and guideline support were universally absent.

Table 5: Relationship between Nurses' Knowledge of Filter-Needle Use and Barriers

		Good Knowledge	Poor Knowledge	χ^2	df	p-value
Availability of filter needles	Yes	0	0	91.1	1	< 0.001
	No	101	27			
Management prioritizes use	Yes	0	0	0.768	1	< 0.001
	No	101	27			
Workload allows consistent use	Yes	5	5	1.841	1	0.175
	No	96	22			
Received sufficient training	Yes	11	7	0.860	1	0.354
	No	90	20			
Policy or guideline support	Yes	0	0			
	No	101	27			
Encouragement from colleagues/supervisors	Yes	8	4	0.663	1	0.415
	No	93	23			
Financial constraints affect use	Yes	26	92	98.044	1	< 0.001
	No	75	1			

3.6. Relationship between nurses' knowledge of filter-needle use and their professional years of experience and departments

No significant associations were observed between nurses' knowledge of filter-needle use and professional experience ($\chi^2 = 0.213$, df = 3, p = 0.975) or department of practice ($\chi^2 = 0.887$, df = 5, p = 0.971).

Table 6: Relationship between Nurses' Knowledge of Filter-Needle Use, Years of Experience, and Department

Variable	Good Knowledge	Poor Knowledge	χ^2	df	p-value
Years of experience			0.213	3	0.975
1–5	10	2			
6–10	18	4			
11–15	30	8			
16–20	60	13			
Department			0.887	5	0.971
Medical	30	8			
Surgical	26	6			
Pediatric	21	6			
Maternity	22	6			
Emergency	10	2			
Others	9	1			

4. Discussion

This study assessed nurses' knowledge of filter-needle use, identified barriers to its implementation, explored strategies for improvement, and proposed evidence-based recommendations at LAUTECH Teaching Hospital, Ogbomoso, Nigeria.

4.1. Socio-demographic characteristics

Most respondents were aged 21–30 years, indicating a relatively young and mid-career workforce, consistent with sub-Saharan trends where most nurses are under 40 years (15). The profession remains female-dominated (77.2%), aligning with global data showing women constitute 76.9 % of nurses (16). The predominance of married participants (71 %) may reflect social stability that supports professional performance.

Over half of respondents held a Bachelor's degree (52.4 %), indicating a strong educational foundation. Higher education has been shown to enhance safety awareness; Osuchukwu et al. (2024) found that educational attainment correlated with adherence to safe clinical practices (12). Experience levels were high, with 50.3 % reporting 16–20 years in practice, a factor associated with receptiveness to innovations when institutional support exists (17). Diverse departmental participation further strengthens the generalizability of findings (6).

Globally, the nursing workforce is slightly older, concentrated in the 35–44 age range (16), while specialized fields such as health informatics skew even older (18). Thus, Nigeria's relatively young workforce may offer adaptability but also highlights succession and retention challenges. Demographic effects on safety practices remain inconsistent: some studies link lower education and limited tenure to higher occupational risk (19, 20), whereas others report minimal demographic influence (21). Overall, LAUTECH nurses appear young, educated, and experienced, yet structural disparities in workforce distribution persist across the region.

4.2. Knowledge of filter-needle use

The study reveals a high level of awareness among nurses regarding the purpose and clinical significance of filter-needle use. Most respondents (95.9 %) recognized its importance in preventing particulate contamination, and 91.7 % understood the clinical situations requiring its application. However, only 57.2 % expressed confidence in handling filter needles, indicating a considerable gap between theoretical knowledge and practical competence.

This knowledge–practice discrepancy reflects a global challenge. Söğüt and Erkoç (2024) reported that although most healthcare professionals recognized the risks of glass-particle contamination, few had adequate training to integrate filter-needle use into daily routines (3). Likewise, Hut and Yazici (2021) found glass fragments in 94 % of ampoule samples; filtration reduced contamination by 85 %, yet its use remained inconsistent due to limited training and institutional support (5). These findings suggest that awareness alone does not guarantee safe clinical behavior.

Comparable evidence from other regions reinforces this pattern. Ayyad et al. (2024) observed that Jordanian primary-care nurses possessed strong safety knowledge and attitudes but inconsistent practices (22). In Nigeria, Oladosu et al. (2021) reported that only about 60 % of

nurses practiced safe injections consistently, with deficiencies in equipment, guidelines, and continuing education constraining competence (23).

Overall, this study demonstrates that while nurses at LAUTECH possess substantial theoretical understanding (≥ 90 %), practical readiness remains limited (< 60 %). Sustained improvement, therefore, requires not only education but also policy enforcement, continuous professional training, and reliable supply systems to translate knowledge into consistent, safe medication practices.

4.3. Institutional and practice-related barriers

All respondents cited the non-availability of filter needles and lack of institutional policy; only 12.4 % had received any training. Heavy workload (93.1 %) and financial constraints (81.4 %) were also prominent barriers, indicating that organizational limitations outweigh individual factors.

These findings align with Cassista et al. (2014) and Kgadima et al. (2024), who stressed that knowledge rarely translates into practice without organizational commitment (9, 24). Nayak et al. (2022) described similar institutional inertia (25). Workload and managerial neglect mirror patterns reported by Jain et al. (2024) and Gqaleni and Mkhize (2024) (26, 27). Globally, studies cite supply shortages, weak policy enforcement, and logistical failures as persistent obstacles (28–30). Nigerian evidence also points to poor infrastructure and managerial deficiencies as key safety barriers (11, 31–33).

Limited training (12.4 %) remains worrisome. Although Osuchukwu et al. (2025) recorded improved pharmacovigilance knowledge post-training, institutional weaknesses hindered practical adoption (12). Anwar et al. (2019) likewise reported that awareness could not overcome unsafe practice without management support (34). Financial constraints reflect the broader LMIC context, where resource scarcity and fragile supply chains impede preventive safety (33).

Although the universal reporting of certain barriers, such as 100% unavailability of filter needles and the complete absence of institutional policy, may reflect shared workplace experiences, it also raises the possibility of response clustering or social desirability bias. Nevertheless, similar near-universal patterns have been consistently documented across African and other LMIC settings, suggesting that these findings are more indicative of genuine systemic deficiencies than overgeneralization. For instance, Jafaru and Abubakar (2022) reported that nearly all nurses in Northern Nigeria identified supply shortages, inadequate facilities, and weak policy structures as major impediments to safe medication administration (31). Kalule et al. (2025) likewise found that Ugandan healthcare workers overwhelmingly cited institutional gaps and inconsistent infection-prevention support as primary barriers to compliance (30). In South Africa, Gqaleni and Mkhize (2024) documented widespread managerial weaknesses, poor safety governance, and structural challenges that hindered adherence to patient-safety guidelines (27).

Collectively, this evidence demonstrates that the barriers observed in the present study reflect well-documented, system-wide challenges across LMICs and beyond, underscoring the urgent need for non-punitive safety cultures, strengthened policy frameworks, improved coordination, and consistent managerial support.

4.4. Strategies and interventions to enhance usage

Respondents strongly supported measures to promote filter-needle use: 100 % endorsed improved availability and resourcing, 95.2 % favored regular training, 91.7 % supported monitoring systems, and 95.9 % advocated feedback integration. This reflects readiness to embrace change when institutional backing exists.

Komatsu et al. (2025) emphasized that standardized procedures, communication, and safety culture underpin reliable care (35). Dardas and Al-Hussami (2024) confirmed that education is the most common and effective strategy for strengthening safety culture (36), while Lee et al. (2022) demonstrated the superiority of interactive, structured curricula (37). Similarly, Vaismoradi et al. (2020) identified resource adequacy, feedback, and collaboration as enablers of safety compliance (38). Collectively, these findings affirm that improving filter-needle use requires not only training and equipment but also leadership engagement and continuous feedback mechanisms.

4.5. Relationship between knowledge and barriers

Chi-square analysis (Table 5) revealed significant relationships between knowledge level and financial constraints ($p < 0.001$), with cost barriers disproportionately affecting nurses with poor knowledge. Workload, training, and peer support were not significant predictors, suggesting that systemic limitations, particularly financing and supply, have stronger effects than personal attributes.

Moreover, Zuma (2024) noted that limited financial management skills among nurse leaders impede the implementation of safety initiatives (39). Similarly, Aregay et al. (2023) identified systemic shortages and poor curriculum integration as barriers to practice (40). Furuki et al. (2022) and Berthelsen and Hølge-Hazelton (2021) further showed that inadequate resources and weak institutional support are the most persistent impediments to evidence-based practice (41, 42). The current findings corroborate this broader consensus: systemic and financial constraints remain the dominant factors restricting safety compliance.

However, because this study employed a cross-sectional design, these associations cannot be interpreted as causal. The findings demonstrate correlation rather than directionality, and it remains unclear whether financial limitations reduce knowledge or whether nurses with lower knowledge perceive cost as a bigger barrier. This limitation is important for intervention planning, as it indicates that the development of effective strategies, such as policy changes, training, or resource allocation, should be guided by future studies capable of assessing causal pathways, including longitudinal or interventional designs.

4.6. Relationship between nurses' knowledge of filter-needle use and their professional years of experience and departments

As shown in Table 6, there were no statistically significant associations between nurses' knowledge of filter-needle use and sociodemographic factors, including age, gender, education, years of experience, or department. This indicates that within this study population, knowledge of safe filter-needle use was not strongly influenced by individual characteristics, suggesting that institutional and systemic factors may play a more critical role.

Previous studies have reported mixed results. Ali (2024) found that age, education, and specialization significantly influenced MRI safety knowledge, while gender had no effect (43). Similarly, Akram et al. (2024) reported that age, qualification, and work experience were associated with higher patient safety knowledge and more positive safety attitudes (44). These findings contrast with the present study's results, where demographic variables showed no significant correlation. As with all cross-sectional analyses, these non-significant

associations reflect relationships at one point in time and do not imply the absence of causal effects, which future longitudinal or interventional studies may clarify.
Other studies align more closely with this outcome. Hridoy et al. (2025) observed that education, but not age or gender, influenced food safety attitudes in Bangladesh (45). Likewise, Ibrahim et al. (2021) found that only education predicted safety risk assessments among fieldworkers (46). Together, these findings imply that knowledge of filter-needle use is shaped less by personal demographics and more by organizational support, training, and policy reinforcement.

5. Conclusion

This study shows that nurses at LAUTECH Teaching Hospital possess strong theoretical knowledge, which contrasts with limited practical application due to systemic barriers, including equipment unavailability, lack of institutional policy, insufficient training, and financial constraints. Despite these challenges, nurses expressed a clear readiness to integrate filter needles into routine practice when adequate institutional support is provided.
Strengthening patient safety will therefore require establishing explicit policy guidelines, ensuring reliable procurement, and delivering regular skills-based training. Although this study did not assess clinical outcomes, future research should quantify the measurable benefits of filter-needle adoption, such as reductions in particulate contamination, infusion-related complications, and medication-preparation errors, as well as operational outcomes, including workflow efficiency, adherence to safety protocols, and cost-effectiveness. Such evidence will provide a solid foundation for data-driven policy decisions and sustainable improvements in medication-safety practices.

List of Abbreviations

LAUTECH- Ladoke Akintola University of Technology

Declarations

Ethics Approval and Consent to Participate

Ethical approval for this study was obtained from the Health Research Ethics Committee of Ladoke Akintola University of Technology (LAUTECH) Teaching Hospital, Oyo State, Nigeria (Protocol Number: LTH/OGB/2024/548). Verbal informed consent was obtained from all participants before data collection.

Consent for Publication

Not applicable, as no personal identifying information is included in this manuscript.

Availability of Data and Materials

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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Authors' Contributions

Conceptualization: Q.B.O.
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Data Collection: Q.B.O, J.O.A, O.A.O., M.A.E, P.O.A., and H.A.S.
Data Analysis and Interpretation: O.Q.B. and A.O.J.
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References

[1] Unahalekhaka A, Nuthong P. Glass particulate adulterated in single-dose ampoules: A patient safety concern. J Clin Nurs. 2023 Apr;32(7–8):1135–9. https://doi.org/10.1111/jocn.16336.

[2] Lee KR, Chae YJ, Cho SE, Chung SJ. A strategy for reducing particulate contamination on opening glass ampoules and development of evaluation methods for its application. Drug Dev Ind Pharm. 2011 Dec;37(12):1394–401. https://doi.org/10.3109/03639045.2011.580349.

[3] Söğüt NN, Erkoç A. Glass Particle Contamination and Using the Filter Needle: A Cross-sectional Study. Turk J Sci Health [Internet]. 2024 Feb 16 [cited 2024 Dec 27]; Available from: https://doi.org/10.51972/tfsd.1387537.

[4] Yorioka K, Oie S, Kamiya A. Comparison of particulate contamination in glass and plastic ampoules of glycyrrhizin injections after ampoule cutting. J Food Drug Anal [Internet]. 2020 Jul 14 [cited 2025 Jun 14];17(3). Available from: https://www.jfda-online.com/journal/vol17/iss3/3. https://doi.org/10.38212/2224-6614.2606.

[5] Erkoc Hut A, Yazici ZA. Glass particle contamination threat in nursing practice: A pilot study. J Adv Nurs. 2021 Jul;77(7):3189–91. https://doi.org/10.1111/jan.14847.

[6] Chiannilkulchai N, Kejkornkaew S. Safety concerns with glass particle contamination: improving the standard guidelines for preparing medication injections. Int J Qual Health Care. 2021 Jun 23;33(2):mzab091. https://doi.org/10.1093/intqhc/mzab091.

[7] Perera S, Kumar S, Zadow S, Lim W. Addressing Glass Contamination in Radiology: What Can We Do to Minimize Its Impact? J Clin Interv Radiol ISVIR. 2024 Dec;08(03):144–8. https://doi.org/10.1055/s-0044-1786995.

[8] Foster JP, Richards R, Showell MG, Jones LJ. Intravenous in-line filters for preventing morbidity and mortality in neonates. Cochrane Neonatal Group, editor. Cochrane Database Syst Rev [Internet]. 2015 Aug 6 [cited 2025 Sep 11];2015(8). Available from: https://doi.org/10.1002/14651858.CD005248.pub3.

[9] Cassista J, Payne-Gagnon J, Martel B, Gagnon MP. Applying Theory to Understand and Modify Nurse Intention to Adhere to Recommendations regarding the Use of Filter Needles: An Intervention Mapping Approach. Nurs Res Pract. 2014;2014:1–8. https://doi.org/10.1155/2014/356153.

[10] Harmon DL. Anesthesia Safety: Filter Needle Use With Glass Ampules.

[11] Lawal BK, Mohammed S, Alhaji AA, Maiha BB, Ladan MA, Ibrahim UI. Barriers and enablers of medication safety: A qualitative study from public hospitals in Kaduna State, Nigeria. Pharm Educ. 2024 May 30;24(1):322–31. https://doi.org/10.46542/pe.2024.241.322331.

[12] Osuchukwu EC, Agba M, Osuchukwu NC. Medication safety knowledge and practice among nursing students: A parallel-group randomized controlled trial at the University of Calabar Teaching Hospital. J Educ Health Promot [Internet]. 2024 Oct [cited 2025 Jun 14];13(1). Available from: https://journals.lww.com/10.4103/jehp.jehp_1615_23. https://doi.org/10.4103/jehp.jehp_1615_23.

[13] Adejumo PO, Olatunji BT. Exposure to work-related sharp injuries among nurses in Nigeria. J Nurs Educ Pract. 2013 Dec 10;4(1):p229. https://doi.org/10.5430/jnep.v4n1p229.

[14] Oyekale AS, Oyekale TO. Healthcare waste management practices and safety indicators in Nigeria. BMC Public Health. 2017 Dec;17(1):740. https://doi.org/10.1186/s12889-017-4794-6.

[15] World Health Organization. State of the world's nursing 2020: investing in education, jobs and leadership [Internet]. Geneva: World Health Organization; 2020 [cited 2025 Sep 14]. Available from: https://iris.who.int/handle/10665/331677.

[16] Kharazmi E, Bordbar N, Bordbar S. Distribution of nursing workforce in the world using Gini coefficient. BMC Nurs. 2023 May 5;22(1):151. https://doi.org/10.1186/s12912-023-01313-w.

[17] Kottapalli P, Podduturi NCR, Aswini G, Jyothi S, Naveen A. Safe injection, infusion and medication-vial practices at a tertiary care centre: a quality improvement initiative. GMS Hyg Infect Control [Internet]. 2023 [cited 2025 Jun 14];18. Available from: https://www.egms.de/en/journals/dgkh/2023-18/dgkh000429.shtml.

[18] Butler-Henderson K, Arabi S, Gray K. Generational and Gender Differences in the Health Informatics Workforce. In: Househ MS, Tariq ZUA, Al-Zubaidi M, Shah U, Huesing E, editors. Studies in Health Technology and Informatics [Internet]. IOS Press; 2025 [cited 2025 Sep 14]. Available from: https://ebooks.iospress.nl/doi/10.3233/SHTI251081. https://doi.org/10.3233/SHTI251081.

[19] Askari Majdabadi M, Mousavi SM, Yazdanirad S, Pirhadi S, Hosseini SS, Beiruti M, et al. The Effects of Nurses' Personal and Professional Characteristics on Needle Stick Injuries. Arch Occup Health [Internet]. 2021 Dec 8 [cited 2025 Sep 13]; Available from: https://publish.kne-publishing.com/index.php/AOH/article/view/7976. https://doi.org/10.18502/aoh.v5i4.7976.

[20] Van Belle TA, King EC, Roy M, Michener M, Hung V, Zagrodney KAP, et al. Factors influencing nursing professionals' adherence to facial protective equipment usage: A comprehensive review. Am J Infect Control. 2024 Aug;52(8):964–73. https://doi.org/10.1016/j.ajic.2024.04.006.

[21] Wagle N, Neupane D, Nyaupane NP, Timalsena C. Compassionate Care: Exploration of the Nurse-Patient Relationship and Behavioral Dynamics in Healthcare Settings. Int J Atharva. 2024 Mar 12;2(1):65–77. https://doi.org/10.3126/ija.v2i1.63476.

[22] Ayyad A, Baker NA, Oweidat I, Al-Mugheed K, Alsenany SA, Abdelaliem SMF. Knowledge, attitudes, and practices toward Patient Safety among nurses in health centers. BMC Nurs. 2024 Mar 14;23(1):171. https://doi.org/10.1186/s12912-024-01831-1.

[23] Timothy Olatunji Oladosu, Aderonke Bosede Awoseemo, Aduragbemi Timothy Olawumi, Janet Oluseun Oladosu. Assessment of Practice of Injection Safety among Nurses in a Tertiary Hospital in Osun State, Nigeria. UMYU J Microbiol Res UJMR. 2021 Dec 30;6(2):1–6. https://doi.org/10.47430/ujmr.2162.001.

[24] Kgadima MR, Coetzee IM, Heyns T. Factors influencing knowledge translation into critical care practice: The reality facing intensive care nurses in Limpopo Province. South Afr J Crit Care. 2024 Jul 17;e1282. https://doi.org/10.7196/SAJCC.2024.v40i2.1282.

[25] Nayak SS, Kaur U, Sharma AG. Entrapment of ampoule fragments into gloves: A potential threat to patient's safety. Indian J Anaesth. 2022 Jun;66(6):472–3. https://doi.org/10.4103/ija.ija_1037_21.

[26] Jain A, Singh S, Hussain S, Jain A, Vyas N, Fatima A. Attitude and Practice of Universal Healthcare Precautions (UHPs) among Healthcare Workers in Healthcare facilities of Jaipur, Rajasthan. Indian J Community Health. 2024 Oct 31;36(5):654–60. https://doi.org/10.47203/IJCH.2024.v36i05.006.

[27] Gqaleni TMH, Mkhize SW. Barriers to implementing patient safety incident reporting and learning guidelines in specialised care units, KwaZulu-Natal: A qualitative study. Yakob B, editor. PLOS ONE. 2024 Mar 8;19(3):e0289857. https://doi.org/10.1371/journal.pone.0289857.

[28] Cordeiro L, Gnatta JR, Ciofi-Silva CL, Price A, De Oliveira NA, Almeida RMA, et al. Personal protective equipment implementation in healthcare: A scoping review. Am J Infect Control. 2022 Aug;50(8):898–905. https://doi.org/10.1016/j.ajic.2022.01.013.

[29] Rezaee N, Sartipi M, Jahantigh M, Pezaro S, Mardani-Hamooleh M. Barriers to the prevention and control of healthcare-associated infections in public hospitals: a qualitative study of Sistan and Baluchistan province, Iran. BMC Nurs. 2025 Jul 25;24(1):972. https://doi.org/10.1186/s12912-025-03650-4.

[30] Kalule AO, Currie K, Price L. Barriers and enablers to the implementation of infection prevention and control guidance in a Ugandan healthcare facility – a theory-informed qualitative study to guide intervention design. Int J Infect Control [Internet]. 2025 Jun 24 [cited 2025 Sep 12];21. Available from: https://ijic.info/article/view/23768. https://doi.org/10.3396/ijic.v21.23768.

[31] Jafaru Y, Abubakar D. Medication Administration Safety Practices and Perceived Barriers Among Nurses: A Cross-Sectional Study in Northern Nigeria. Glob J Qual Saf Healthc. 2022 Feb 1;5(1):10–7. https://doi.org/10.36401/JQSH-21-11.

[32] Tamuno-opubo AT, Uthman TJ, Ojuope AV, Adeleke AB, Oluwasegun JO, Tuwleh L. Patient safety initiatives and practices in Nigerian healthcare settings: A comprehensive analysis of current knowledge, challenges, and barriers. Glob J Health Sci Res. 2024 Aug 26;2:70–81. https://doi.org/10.25259/GJHSR_75_2023.

[33] Hajizadeh A, Amini Kordkandi B, Sadeghpour S, Khodavandi M, Saeidpour J, Kakemam E. Nurses' perception of patient safety culture using the Hospital Survey on Patient Safety Culture tool and its association with nursing-patient outcomes: a systematic review in Iranian hospitals. BMC Nurs. 2025 Jul 1;24(1):774. https://doi.org/10.1186/s12912-025-03305-4.

[34] Anwar MM, Mohamed Lotfy AA, Alrashidy AA. Safe injection awareness and practices among nursing staff in an Egyptian and a Saudi hospital. J Egypt Public Health Assoc. 2019 Dec;94(1):21. https://doi.org/10.1186/s42506-019-0018-5.
[35] Komatsu H, Hara A, Koyama F, Komatsu Y. Enhancing High Reliability in Oncology Care: The Critical Role of Nurses—A Systematic Review and Thematic Analysis. Healthcare. 2025 Jan 31;13(3):283. https://doi.org/10.3390/healthcare13030283.
[36] Dardas L, Al-Hussami M. Cultivating a Culture of Patient Safety in Healthcare Settings: A Systematic Review of Evidence-Based Interventions. South East Eur J Public Health. 2024 Oct 19;351–61. https://doi.org/10.70135/seejph.vi.1710.
[37] Lee SE, Morse BL, Kim NW. Patient safety educational interventions: A systematic review with recommendations for nurse educators. Nurs Open. 2022 Jul;9(4):1967–79. https://doi.org/10.1002/nop2.955.
[38] Vaismoradi M, Tella S, A. Logan P, Khakurel J, Vizcaya-Moreno F. Nurses' Adherence to Patient Safety Principles: A Systematic Review. Int J Environ Res Public Health. 2020 Mar 19;17(6):2028. https://doi.org/10.3390/ijerph17062028.
[39] Zuma N. P-061 KNOWLEDGE AND PRACTICE OF FINANCIAL MANAGEMENT AMONGST NURSE MANAGERS IN TWO SELECTED DISTRICTS IN KWA-ZULU NATAL, SOUTH AFRICA. Occup Med. 2024 Jul 5;74(Supplement_1):0–0. https://doi.org/10.1093/occmed/kqae023.0530.
[40] Aregay A, O'Connor M, Stow J, Ayers N, Lee S. Measuring and exploring the barriers to translating palliative care knowledge into clinical practice in rural and regional health-care settings. Palliat Support Care. 2024 Dec;22(6):1605–14. https://doi.org/10.1017/S1478951523000755.
[41] Furuki H, Sonoda N, Morimoto A. Factors related to the knowledge and skills of evidence-based practice among nurses worldwide: A scoping review. Worldviews Evid Based Nurs. 2023 Feb;20(1):16–26. https://doi.org/10.1111/wvn.12623.
[42] Berthelsen C, Hølge-Hazelton B. The Importance of Context and Organization Culture in the Understanding of Nurses' Barriers Against Research Utilization: A Systematic Review. Worldviews Evid Based Nurs. 2021 Apr;18(2):111–7. https://doi.org/10.1111/wvn.12488.
[43] Ali S. Assessment of Healthcare Professionals Knowledge Level Towards MRI Safety - Jazan - Saudi Arabia. Int J Med Dev Ctries. 2024;566–70. https://doi.org/10.24911/IJMDC.51-1701338038.
[44] Akram S, Bibi F, Parveen N. NURSES' KNOWLEDGE AND ATTITUDES REGARDING PATIENT SAFETY AND FACTORS ASSOCIATED TO IT. Biol Clin Sci Res J. 2024 Jul 2;2024(1):952. https://doi.org/10.54112/bcsrj.v2024i1.952.
[45] Hridoy Md, Islam Md, Masood A, Sa'adi Z, Bohora N, Islam Md, et al. Investigating the Role of Socio-Demographic Factors in Shaping Consumer Attitudes Towards Food Safety in Bangladesh: A Cross-Sectional Study. World J Public Health. 2025 Mar 21;10(2):77–87. https://doi.org/10.11648/j.wjph.20251002.11.
[46] Ibrahim A, Nnaji C, Shakouri M. Influence of Sociodemographic Factors on Construction Fieldworkers' Safety Risk Assessments. Sustainability. 2021 Dec 23;14(1):111. https://doi.org/10.3390/su14010111.