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Impact of an educational intervention on nurses' perception of handoff process in public hospitals in Katsina, Nigeria: a cluster-randomized trial



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Abstract

Background Effective patient handoffs are critical for maintaining patient safety and care continuity in healthcare settings. This quasi-experimental study aimed to assess the impact of an educational intervention on improving nursing handoffs in Katsina State Public Hospitals.

Methods Conducted over 13 months, the study targeted registered nurses at General Hospital Katsina, comparing outcomes with those from General Hospital Funtua. A six-session educational program was implemented, and participants' perceptions were assessed before, immediately after, and during follow-up using the "Hospital Staff Views of Patient Handoffs" questionnaire.

Results The facilitator-led intervention group, predominantly female (75.5%) and mostly aged 30–39 and married (86.7%), demonstrated a significant improvement in mean scores across three time points: pre-intervention (3.05 ± 0.32), immediately post-intervention (3.43 ± 0.45), and at follow-up (3.34 ± 0.40), with p < 0.001. Between-group analyses indicated a significant difference in outcomes (p < 0.001), with the facilitator-led intervention group consistently achieving higher scores than the self-directed education group. Post-hoc comparisons revealed significant mean differences between pre- and post-intervention assessments (-0.38, p < 0.001) and between pre-intervention and follow-up assessments (-0.29, p < 0.001). Despite a slight decline at follow-up, the positive impact of the educational intervention remained statistically significant.

Conclusion This study highlights the enduring positive effects of educational interventions on nursing handoffs and patient safety perceptions. It underscores the importance of ongoing education in cultivating a culture of safety within hospitals, emphasizing the need for sustained efforts to enhance patient handoff practices and improve overall patient care.

Keywords Patient handoffs, Nursing education, Healthcare quality, Patient safety, Quasi-experimental study

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Background

Patient handoff represents a critical element within healthcare facilities, pivotal for seamless patient care delivery. This process, recognized by various terms such as patient handover, sign-out, sign-over, cross-coverage, and shift report [1, 2], involves the transfer of patient-related information and responsibilities between health-care professionals, units, or facilities [3, 4]. Its primary objective is to ensure continuity in the care plan, patient safety, foster teamwork, and provide educational opportunities for healthcare workers [5]. The efficiency of handoffs significantly influences continuity of care and treatment [1].

Inadequately conducted handoffs have been linked to various failures in patient care, including inaccurate assessments, delayed treatment, medical errors, and subsequent adverse effects on patient outcomes such as increased morbidity and mortality rates, prolonged hospital stays, and reduced patient satisfaction [4]. Beyond clinical consequences, poor handoffs may also result in legal repercussions, including malpractice litigation, due to errors of omission or miscommunication during transitions of care [4]. Recognizing these implications, the World Health Organization and the Joint Commission have issued directives mandating standardized approaches to handovers and the inclusion of handover education in employee training to ensure consistency and reduce errors [4].

The Joint Commission established a national patient safety goal for handoffs, effective from January 2006, highlighting the importance of standardized handover procedures [1, 2]. Nursing handovers, occurring between shifts, among part-time nurses, and as part of their role in maintaining continuity of care, are critical in healthcare settings [6]. Alarmingly, investigation of over 4,000 adverse events revealed that 70% of sentinel incidents resulted from communication disruptions, with handoff issues contributing significantly [7, 8].

Effective handoff communication encompasses both verbal and written aspects, incorporating critical patient information such as status, treatment plan, medications, test results, and relevant social or cultural factors, conveyed accurately, concisely, and relevantly [9]. Strategies and tools facilitating effective handoff communication encompass standardized protocols, checklists, electronic medical records, and face-to-face interaction [10]. Verbal communication, considered optimal for information transfer due to direct contact between parties and the allowance for immediate clarification, stands in contrast to written communication's advantage of information organization and future reference, albeit lacking the interpersonal aspects of verbal exchanges [5, 11].

Nurses, representing a significant portion of healthcare staff involved in direct patient care, hold the potential to significantly impact patient safety. Errors in nursing handoffs often stem from individual or system-related factors, emphasizing the importance of robust educational qualifications, adequate training, and continuous professional development [12]. Interrupted communication during handoffs can result in inadequate or ineffective transfers, subsequently elevating the risk of errors and negative patient outcomes [13]. To ensure safe, highquality patient care, ongoing education, training, and professional development remain imperative [6, 12, 14].

Education interventions among nurses play a pivotal role in enhancing patient safety and care quality by addressing knowledge and skill gaps, reducing errors, and fostering a culture of safety within healthcare systems [14]. It is crucial to equip nursing leaders and managers with skills to reorganize health systems and promote a culture of safety, especially in contexts with communication errors and information technology issues [14]. Additionally, professionals should be educated not only in excellent patient communication but also in effective communication among diverse professional specialties.

Interventions in healthcare involve deliberate actions or strategies aimed at improving patient outcomes, enhancing care quality, and addressing specific challenges. These interventions can range from clinical interventions targeting diseases to organizational or system-level improvements in healthcare delivery. Their effectiveness varies based on the intervention, implementation context, and target population [15, 16].

Patient engagement interventions have shown promise in enhancing patient satisfaction, treatment adherence, and health outcomes. Actively involving patients in their care decision-making process leads to improved patient experience, reduced hospital readmissions, and better chronic disease management [17, 18].

Education interventions in healthcare are targeted programs or initiatives designed to improve knowledge, skills, and competencies of healthcare professionals, patients, and stakeholders. These interventions are crucial for promoting evidence-based practices, enhancing patient outcomes, and addressing healthcare challenges. Educational programs for healthcare professionals have significantly improved knowledge acquisition, clinical skills, and adherence to best practices [19, 20]. Similarly, patient education interventions focusing on disease management and lifestyle modifications have led to improved patient outcomes [21, 22]. They can be delivered through various methods, including traditional didactic lectures, workshops, and face-to-face training, as well as modern e-learning platforms. These methods significantly impact knowledge acquisition, behaviour change, and patient outcomes in healthcare settings [23, 24].

Interventions targeting patient handoffs have demonstrated effectiveness in improving communication, standardizing procedures, and reducing adverse events. Educational programs, communication skills training, standardized protocols, technological tools, and interprofessional education have positively impacted hand-off processes, communication, and patient outcomes [25–27].

Moreover, best practices for developing education intervention modules on patient handoffs include active learning strategies, interactive sessions, assessment techniques, and integration into professional development programs [28–30]. These elements significantly contribute to the success and sustainability of educational interventions in improving patient handoff practices. The study was aimed at testing an effectiveness of education intervention among nurses in Katsina public hospitals, North-west Nigeria.

Methodology

Study design

The study design adopted a quasi-experimental approach utilizing a pre- and post-test design. It included both a facilitator-led intervention group, which underwent the educational program, and a self-directed education group that did not receive the intervention. This design allowed for the comparison of changes in perceptions regarding patient handoff and safety between the two groups before and after the intervention.

The interventional study was carried out based on the "Situated Learning Theory" which posited a belief that "receiving doses of the intervention lectures from teachers accompanied by assigned reading, and teacher-led discussions in a prescribed series (the curriculum) would produce uniform, mechanistic "changes in behaviour" that could be tested with standardized testing" [31]. Another theory adopted for use in this research is the Theory of Planned Behavior (TPB), which suggests that the likelihood of an individual engaging in health behaviour is associated with the degree of his or her intention to perform the behaviour [32].

Study location

The research was conducted in two secondary health facilities governed by the Katsina State Ministry of Health. The selection of General Hospital Katsina for the facilitator-led intervention group and General Hospital Funtua for the self-directed education group was strategic, considering their representation of different senatorial districts and their similarities in terms of healthcare challenges and opportunities. The two hospitals were separated by a distance of approximately 198.2 km apart.

Study duration

The study spanned a duration of 13 months, starting from January 2022 to February 2023. This timeline encompassed the implementation of the educational intervention, as well as pre-intervention, post-intervention, and follow-up assessments.

Study population

Target population

The study targeted nurses employed in Katsina State Public Hospitals. According to the Katsina State Hospital Services Management Board, the total number of nurses employed in public hospitals across the state during the study period was approximately 1,152.

Source population

The sample population was sourced from General Hospital Katsina and General Hospital Funtua.

Sampling frame

The sampling frame comprised the master register of nurses maintained by each hospital, providing a comprehensive roster of potential study participants.

Selection criteria

Inclusion criteria

All nurses working in any department of the hospitals during the study period, irrespective of gender, were included, provided they voluntarily consented to participate.

Exclusion criteria

Nurses on leave or unavailable due to shifting duties during the study tenure were excluded from participation.

Sample size Estimation

The sample size of 106 participants (53 from each group) was determined using G*Power software. This calculation accounted for the effect size of 0.25, α error probability of 0.05, and a desired power of 0.95. An anticipated 20% dropout rate was factored in, ensuring the study maintained an adequate sample size for robust analysis.

Facilitator-led intervention group

The facilitator-led intervention group consisted of 53 registered nurses from General Hospital Katsina who participated in a comprehensive educational training program. This structured program involved six facilitator-led sessions, incorporating interactive discussions, role-play, and hands-on practice. Participants underwent assessments at three time points namely pre-intervention, post-intervention, and follow-up to measure the immediate, short-term, and long-term effects of the intervention.

Self-directed education group

The self-directed education group included 53 registered nurses from General Hospital Funtua. Unlike the facilitator-led intervention group, these nurses did not attend the educational sessions. Instead, they continued their routine work and were provided with printed educational materials for self-paced study. These materials served as static information resources without any guided instruction, interactive components, or reinforcement activities. Similar to the facilitator-led intervention group, the self-directed education group completed pre-intervention, post-intervention, and follow-up assessments.

This arrangement was designed to distinguish between the two groups, with the facilitator-led intervention group experiencing an active, instructor-led educational program, while the self-directed education group received only a passive, self-study resource.

Educational intervention

The educational intervention consisted of six structured sessions conducted over three days, with each session lasting approximately 1.5 hours. To minimize disruption to participants', work schedules sessions were spaced one week apart. Each session was designed to address a specific aspect of patient safety and handoff practices, tailored to reinforce learning and foster active engagement.

Session content

Session 1: Introduced core concepts of patient safety culture, defining patient safety, its significance, and factors that affect safety in healthcare settings.

Content: Defined patient safety, discussed its importance, and identified factors impacting safety culture in healthcare.

Method: Lecture and group discussion.

Materials: PowerPoint presentation and printed handouts.

Session 2: Focused on medical errors, discussing their types, causes, and specific relevance to patient handoff communication errors.

Content: Covered types of medical errors and their consequences, with a focus on errors related to patient handoff communication.

Method: Case study analysis and interactive discussion. Materials: Case study examples, PowerPoint slides, and printed case handouts.

Sessions 3 & 4: Provided an in-depth exploration of patient handoffs, covering types of handoffs, optimal timing, and strategies for preventing common handoff errors. These sessions incorporated short videos to demonstrate effective handoff techniques.

Content: Explored types and timing of handoffs, common errors, and the importance of effective communication during handoffs. Included examples of both successful and unsuccessful handoffs. Page 4 of 10

Method: Demonstrations, interactive activities, and video demonstrations of handoff scenarios.

Materials: Videos, posters summarizing key handoff steps, and role-playing handoff scenarios.

Sessions 5 & 6: Introduced standardized tools such as the I-PASS mnemonic, explaining each component to enhance clear and concise communication during handoffs. Participants were encouraged to discuss and apply the tool in practice scenarios to improve understanding and retention.

Content: Introduced the I-PASS mnemonic (Illness severity, Patient summary, Action items, Situation awareness and contingency planning, and Synthesis by the receiver) as a standardized tool for patient handoff.

Method: Interactive lecture with hands-on practice and role-play using the I-PASS model in simulated scenarios.

Materials: PowerPoint slides on I-PASS, printed mnemonic guides, and practice worksheets.

Throughout the educational intervention, a diverse range of instructional techniques was employed to facilitate active learning, including lectures, group discussions, case studies, demonstrations, interactive activities, and multimedia presentations. These methods were selected to engage participants meaningfully and accommodate various learning preferences, ensuring that key concepts were well understood and retained.

Educational resources provided to participants included PowerPoint presentations, printed handouts, posters, and demonstration videos, with visual aids such as posters displayed prominently during sessions. These resources reinforced critical patient safety and handoff practices, enhancing sustained engagement and supporting the application of skills in real-world settings.

An immediate post-intervention assessment was conducted to evaluate the short-term impact of the educational program. Additionally, a follow-up assessment was carried out three months post-intervention to gauge the retention of the knowledge and skills acquired.

Session setup

All 53 participants in the facilitator-led intervention group attended each session together in a single group setting. This approach was designed to promote interactive and collaborative learning, allowing participants to discuss and reflect on patient handoff practices collectively.

Sampling method and subject recruitment

The sampling method was adjusted to reflect cluster sampling, where hospitals were chosen randomly from different senatorial districts. Katsina State comprises three senatorial districts: Katsina, Daura, and Funtua. For this study, hospitals were selected from two of these districts namely General Hospital Katsina (Katsina Senatorial District) and General Hospital Funtua (Funtua Senatorial District) to ensure geographical representation. All eligible nurses within these selected hospitals were invited to participate. This approach allowed for practical and representative sampling across regions while maintaining randomization at the cluster level. Collaborative meetings with hospital managers ensured mutual understanding and support for the research objectives. The recruitment process involved identifying eligible participants from the staff register and obtaining informed consent before data collection.

Study tool

The questionnaire employed for the assessment before and after the intervention was the "Hospital Staff Views of Patient Handoffs" questionnaire, developed and validated by Gu, Itoh, and Matsui (2012). This comprehensive questionnaire comprises two distinct sections, labelled Section A and Section B. Section A focuses on gathering information regarding the sociodemographic characteristics of the respondents, while Section B is designed to capture the nurses' perspectives on patient handoffs [5].

Section B of the questionnaire includes a total of 34 questions, specifically addressing patient handoffs between hospital departments/wards (questions 1–26) and shift handoffs between nurses (questions 27–34). These questions have been carefully crafted to cover various aspects related to patient handoffs and encompass different dimensions of the handoff process. The questionnaire has undergone thorough pretesting and validation conducted by the original developers [5], ensuring its reliability and validity in assessing nurses' views on patient handoffs.

To assess the respondents' views, each item in the questionnaire utilizes a five-point Likert-type scale, ranging from "strongly disagree" (1) to "strongly agree" (5). This response scale allows participants to express their level of agreement or disagreement with the statements presented in the questionnaire. It is important to note that for negatively worded questions, such as questions 2, 4, and 9, response numbers were reverse-coded. This means that the ranking of responses was reversed, such that a response of "1" was changed to "5" and vice versa. This coding adjustment ensures that a higher score consistently reflects a more positive view of each item.

Data collection methods

Research assistants were employed for each of the intervention and self-directed education groups. They were assigned to facilitate the distribution of the surveys and the educational materials. Also, they collected back the completed surveys. Prior to data collection, all research assistants received standardized training on survey administration procedures, participant confidentiality, and ethical handling of data to ensure accuracy and consistency across sites. A systematic tracking system was implemented to link pre-test and post-test responses while maintaining participant confidentiality and ensuring data accuracy. Figure 1 summaries the flow of the intervention activities.

Data processing and analysis

The collected data underwent analysis through repeatedmeasures ANOVA using SPSS ver23. This statistical technique allowed for an examination of changes in perceptions across multiple time points within and between the intervention and self-directed education groups.

Ethical consideration

Ethical approval was obtained from the Universiti Sains Malaysia Human Etiquette Committee with reference number: USM/JEPeM/20,010,001 and Katsina State Ministry Health Nigeria with reference number: MOH/ ADM/SUB/1152/1/358. The data were strictly limited, and access was only given to the author and supervisor. Analyzes and publications were consequently rendered without the identities of the selected participants.

Results

The results of this study are presented in two main parts: an overview of the participants' demographic characteristics and an analysis of the intervention's impact on nurses' perception of handoff practices.

In total, four participants from the facilitator-led intervention group and two from the self-directed education group did not complete the study. The attrition was due to participants being on study leave and transferred to other locations, as clearly depicted in Fig. 1. Despite these losses, the final sample size remained sufficient for analysis, and the reasons for attrition were unrelated to the intervention itself, minimizing the risk of attrition bias.

Demographic characteristics of participants

The demographic characteristics of the intervention and self-directed education groups were broadly similar, with both groups predominantly female and most participants falling within the 30–39 age range. The majority of participants in both groups were married, and educational qualifications varied from Certificate to Bachelor of Nursing Science (BNS). A full summary of these characteristics is provided in Table 1.

Assumptions of analysis

Before conducting the main analyses, assumptions for repeated-measures ANOVA were assessed, including normality, sphericity, and homogeneity of variance. All



Fig. 1 Consort flowchart of the Intervention activities

assumptions were met, indicating that the analysis results are robust and valid.

Effectiveness of the educational intervention

Analysis of mean perception scores revealed significant improvements in the facilitator-led intervention group's scores across all three assessment points namely pre-intervention, immediately post-intervention, and at follow-up. Compared to the self-directed education group, the facilitator-led intervention group consistently scored higher, demonstrating the positive impact of the educational program on enhancing nurses' perception of patient handoff practices. Statistical analysis confirmed that these improvements were significant (p < 0.001). The magnitude of improvement from pre-intervention to immediate post-intervention was 0.38 points, while the gain from pre-intervention to three-month follow-up was 0.29 points, demonstrating a meaningful and sustained impact of the educational program.

 Table 1
 Sociodemographic characteristics of participants in both intervention and Self-directed education groups

Variables	Options	Intervention (n=53) n (%)	Control (n=53) n (%)	P-value*
Gender	Male	13(24.5)	18(34.0)	0.589
	Female	40(75.5)	35(66.0)	
Age	20–29	13(24.5)	10(18.9)	0.976
	30–39	28(52.8)	22(41.5)	
	40–49	9(17.0)	15(28.3)	
	50-59	3(5.7)	6(11.3)	
Marital Status	Married	47(88.7)	35(66.0)	0.012
	Unmarried	6(11.3)	18(34.0)	
Educational Qualification	Certificate	23(43.4)	27(50.9)	0.050
	Diploma	19(35.8)	22(41.5)	
	BNS	11(20.8)	4(7.5)	

Keys: n = number of participants BNS = Bachelor of Nursing Science * = Chi square test

Between-group comparisons further supported these findings, indicating that the structured, facilitator-led sessions contributed to sustained improvements over time in the facilitator-led intervention group. A detailed breakdown of the statistical results is available in Table 2.

Impact of the educational intervention

The results from Table 3 shows that there was a significant improvement in the facilitator-led intervention group's mean perception scores across time points. Pairwise comparisons highlight statistically significant differences between pre-intervention and post-intervention scores as well as between pre-intervention and follow-up scores (both with p < 0.001). These findings confirm that the educational intervention had a positive and sustained effect on nurses' perceptions of the handoff process.

Discussion

This research was aimed to assess the impact of an educational intervention among nurses within Katsina State public hospitals, employing quasi experimental design. A repeated-measures ANOVA was utilized in the analysis

Table 3 Pairwise comparison of within-subject effect for facilitator-led intervention group

Time Points		Mean difference	<i>p-</i> value
Pre-intervention	Immediate post intervention	-0.38	< 0.001
	3 months post intervention	-0.29	< 0.001
Immediate post intervention	Pre-intervention	0.38	< 0.001
	3 months post intervention	0.09	0.069
3 months post intervention	Pre-intervention	0.29	< 0.001
	Immediate post intervention	-0.09	0.069

of data. This analysis evaluated both within-subject and between-subject effects, providing valuable insights into the intervention's impact over time and across the intervention and self-directed education groups. Furthermore, post-hoc pairwise comparisons, employing the Bonferroni correction, were employed to delve deeper into the mean differences observed in patient handoffs and safety perception scores throughout the study period. The results affirm a significant and consistent enhancement in scores post-intervention, with the facilitator-led intervention group consistently exhibiting superior performance compared to the self-directed education group.

The within-subject analysis revealed substantial improvements in intervention scores across the three assessment points. This aligns with previous research in teaching hospitals, which highlights the positive effects of educational interventions on healthcare practices [33]. The analysis confirmed a significant increase in scores from the baseline assessment to post-intervention, indicating an immediate positive effect of the intervention. Although there was a slight decline in scores at the follow-up, the intervention's impact remained durable over time, with scores still notably higher than at baseline.

The between-subject analysis showed a consistent difference in performance between the intervention and self-directed education groups throughout the

 Table 2
 Summary of the tests of within and between-subject effects analysis

Categories	Group	Mean (SD)	F (<i>df</i>)	<i>p</i> -value
Pre-intervention		3.05 (0.32)	67.582(2, 132)	< 0.001*
Immediate post intervention		3.43 (0.45)		
3 months post intervention		3.34 (0.40)		
Preintervention	Facilitator-led intervention group	3.06 (0.43)	14.364(1,66)	< 0.001*
	Self-directed education group	3.05 (0.18)		
Immediate post intervention	Facilitator-led intervention group	3.68 (0.46)		
	Self-directed education group	3.18 (0.27)		
3 months post intervention	Facilitator-led intervention group	3.52 (0.47)		
	Self-directed education group	3.12 (0.19)		
Interaction between Intervention a	nd Groups		27.777(2, 132)	< 0.001

Keys: SD = Standard Deviation, * = Repeated Measure ANOVA, df = degree of Freedom

assessment period. This finding supports existing literature that emphasizes the effectiveness of educational interventions in creating meaningful group differences [34, 35]. The consistent superior performance of the facilitator-led intervention group reflects the intervention's strong impact, echoing studies on the benefits of health education programs [36].

Post-hoc pairwise comparisons, adjusted for multiple comparisons, further confirmed significant improvements from pre-intervention to post-intervention, as well as sustained improvements at follow-up. These results reinforce the immediate and enduring effectiveness of the educational intervention. Importantly, the lack of a significant decline between post-intervention and follow-up assessments suggests that the positive changes achieved through the intervention were largely maintained over time.

The sustained impact of the intervention is remarkable, despite a slight decline in scores during the follow-up assessment, signifying lasting effects on the facilitator-led intervention group's practices and attitudes. The sustained improvements indicate that educational interventions have the potential to initiate cultural shifts within hospitals, promoting commitment to patient safety and best practices [37, 38]. However, the observed decline during the follow-up could be attributed to factors such as workload, time constraints, and organizational culture, impacting healthcare providers' ability to effectively implement new practices [39].

The findings align with extensive literature emphasizing the critical role of effective handoff communication in patient safety and quality healthcare. Numerous studies highlight the association between suboptimal handoffs and adverse events, emphasizing the significance of interventions aimed at improving communication during care transitions [40, 41]. Additionally, poorly conducted handoffs pose risks to patient safety, compromising healthcare quality and continuity [4].

The positive impact of educational intervention on patient handoffs and safety perceptions aligns with the effectiveness of standardized handoff protocols. Research indicates that adopting such protocols improves communication, information transfer, and reduces errors [25, 34]. These protocols provide a structured framework aligning with effective handoff communication principles, ensuring consistent conveyance of critical information.

The success of the educational intervention aligns with broader research on the effectiveness of educational interventions in healthcare. Evidence suggests that educational programs targeting healthcare professionals enhance knowledge acquisition, clinical skills, and adherence to best practices [6, 19, 20, 42–44]. Moreover, patient education interventions improve patient knowledge, self-management skills, and health outcomes [21, 22].

Effective communication of patient information is crucial for patient safety. The improvements observed in communication align with research indicating that enhanced communication reduces medical errors, enhances understanding of patient conditions, and increases awareness of potential risks or concerns [45, 46].

Implementation of standardized handoff protocols significantly reduces medical errors and adverse events. The findings further endorse the effectiveness of such protocols in enhancing patient safety by reducing medication errors, decreasing treatment delays, and improving patient satisfaction following educational interventions [47, 48].

Limitations

The study utilized a quasi-experimental design, which inherently lacks randomization, thereby limiting the ability to establish a causal relationship between the intervention and the observed outcomes. A more robust study design, such as a randomized controlled trial (RCT), could help to strengthen the evidence base by minimizing potential biases.

Another limitation lies in the relatively small sample size, particularly regarding participants holding a Bachelor of Nursing Science (BNS) degree. The small number of BNS participants restricts the ability to draw definitive conclusions about the relationship between educational attainment and nurses' perceptions of patient safety and handoff practices. Future research should aim to include a larger and more diverse cohort of nurses with varying educational backgrounds to allow for subgroup analyses and a more comprehensive understanding of this potential association.

Additionally, while participant attrition was minimal, with two participants lost from the self-directed education group and four from the facilitator-led intervention group, the reasons for attrition were unrelated to the intervention (i.e., study leave or transfers). Nevertheless, future studies should consider strategies to minimize attrition and assess its potential impact on study outcomes.

On top of that, the study employed voluntary participation within the selected hospitals, which may introduce self-selection bias. While nurses from all departments were eligible, not all of them may have been actively involved in patient handoffs or shift-based duties, potentially limiting the generalizability of findings related to handoff practices. Furthermore, we did not control for prior training in patient handoff communication, which could have influenced participants' baseline perceptions and response to the intervention. Lastly, the use of self-administered questionnaires may introduce response bias. Although efforts were made to ensure participant confidentiality and understanding of the survey, self-reported data are subject to social desirability bias and personal interpretation. Future research could incorporate qualitative interviews or direct observation to complement self-reported data and provide a more holistic understanding of handoff practices.

Conclusion

In conclusion, this study demonstrated that an educational intervention focused on nursing handoffs significantly improved nurses' perceptions of patient safety and handoff practices in Katsina State Public Hospitals. The facilitator-led intervention group showed marked improvement in mean perception scores across the three assessment points: pre-intervention, immediately postintervention, and at the three-month follow-up. These findings underscore the value of targeted educational programs in fostering a culture of safety within healthcare settings. By standardizing handoff practices and enhancing communication skills, such interventions have the potential to reduce medical errors and improve patient outcomes. Further studies could explore longterm impacts and potential applications in other healthcare settings.

Abbreviations

 BNS
 Bachelor of Nursing Science

 ANOVA
 Analysis of Variance

 SPSS
 Statistical Package for Social Sciences

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Author contributions

M.S.K carried out the study, M.S.K, A.U.A, participated in data collection, and drafted the manuscript. M.S.K, S.M.H involved in statistical analysis, and interpretation of data, M.I.I, M.N.S, contributed to the conceptualization of the study, and approved the final manuscript. All authors have read and approved the manuscript.

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Data availability

The datasets generated and/or analyzed during the current study are not publicly available due to the need to maintain the anonymity of participants and the confidentiality of the data. However, the datasets are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was performed in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Universiti Sains Malaysia Human Etiquette Committee with reference number: USM/JEPeM/20010001 and from the Katsina State Ministry Health Nigeria with reference number: MOH/ADM/ SUB/1152/1/358. Written consent for was obtained from all the participants who participated in the survey. All data collected were confidential and used only by this study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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