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Effectiveness of Educational Program on Critical Care Nurses' Knowledge of ICU Delirium

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ABSTRACT

Background: Delirium is a common and serious complication in intensive care units (ICUs), associated with increased morbidity, mortality, and long-term cognitive decline. Despite its clinical significance, knowledge gaps among critical care nurses often lead to under-recognition and suboptimal management, highlighting the need for targeted educational interventions. **Objective:** This study aimed to evaluate the effectiveness of a structured educational program in improving ICU nurses' knowledge of delirium, hypothesizing that focused education would result in significant knowledge gains and potentially support better clinical practice. **Methods:** This quasi-experimental study was conducted at Ali Fatima Hospital, Lahore, enrolling 50 ICU nurses meeting inclusion criteria of at least three months of ICU experience and no prior delirium-specific training. Data were collected using a validated delirium knowledge questionnaire administered before and after the intervention. The educational program incorporated evidence-based content and interactive training modules. Ethical approval was obtained from the institutional review board in accordance with the Helsinki Declaration. Statistical analyses were performed using SPSS version 26, with paired t-tests used to assess pre-post differences and significance set at $p < 0.05$. **Results:** The mean pre-intervention knowledge score was 8.9 (SD 2.3), which increased significantly to 67.5 (SD 3.4) post-intervention (mean difference = 58.6, 95% CI: 56.7-60.5, $p < 0.001$), indicating a substantial and consistent improvement in nurses' knowledge. The effect size was large, with knowledge gains observed across all subgroups. **Conclusion:** A structured educational program significantly enhances ICU nurses' knowledge of delirium, supporting the integration of ongoing, targeted education into routine nursing training. Improved nurse knowledge is likely to contribute to earlier detection, better management, and improved patient outcomes in the ICU setting.

Keywords: Delirium, Intensive Care Units, Critical Care Nursing, Education, Knowledge, Nursing Staff, Clinical Competence

INTRODUCTION

Delirium, an acute neurocognitive disorder characterized by disturbances in attention, awareness, and cognition, is a common and severe complication among patients admitted to the intensive care unit (ICU), with reported incidences ranging from 20% to over 80% depending on patient population and diagnostic methodology (1,2). Its presence is linked to numerous adverse outcomes, including increased length of ICU and hospital stays, higher rates of mechanical ventilation, long-term cognitive impairment, elevated healthcare costs, and increased mortality (3). Despite these significant implications, delirium in critically ill patients remains under-recognized and poorly managed, particularly by frontline healthcare providers such as nurses, who play a vital role in the identification and ongoing management of delirium within the ICU setting (4,5). Studies consistently highlight considerable knowledge deficits among critical care nurses in both the

assessment and management of delirium, which may hinder early detection and timely intervention (6,7).

The complexity of delirium, with its fluctuating clinical course and multifactorial etiology, poses significant challenges for clinical staff. Traditional management has often focused on reactive, pharmacological approaches, which are limited in effectiveness and may introduce additional risks (16). In recent years, a paradigm shift has occurred towards proactive, prevention-focused strategies, supported by validated screening tools such as the Confusion Assessment Method for the ICU (CAM-ICU) and the Intensive Care Delirium Screening Checklist (ICDSC) (18). Evidence-based care bundles, notably the ABCDEF bundles, have been developed to provide structured approaches to assessment, prevention, and management of delirium and other ICU complications (20). However, the

successful implementation of these protocols depends heavily on the clinical team's knowledge and confidence, underlining the necessity for ongoing, targeted educational interventions (19).

Despite the recognition of delirium's impact and the advancement of clinical guidelines, the literature identifies a persistent gap between recommended best practices and actual clinical care, often attributed to inadequate training and insufficient awareness among nursing staff (15). Surveys indicate that up to 70% of ICU providers feel unprepared to manage delirium, reinforcing the urgent need for structured educational programs that address these gaps (15). Quantitative data demonstrate that such interventions can lead to significant improvements in nurses' knowledge, and preliminary evidence suggests they may contribute to reduced delirium incidence and better patient outcomes (24,25). Given the association between delirium and long-term cognitive decline, functional impairment, and increased mortality, the implementation of effective educational strategies is not only justified but imperative (13,14).

Current research into the effectiveness of dedicated educational and intervention programs is limited by small sample sizes, heterogeneity in educational content, and a lack of robust longitudinal data regarding sustained knowledge retention and actual changes in clinical practice (28). Nevertheless, the available evidence strongly suggests that targeted education for ICU nurses can produce measurable improvements in both knowledge and clinical competence (5,25). Given the central role of nurses in the continuous monitoring and management of critically ill patients, enhancing their knowledge base represents a promising avenue for improving the quality of care, optimizing resource utilization, and ultimately reducing the burden of ICU delirium on patients, families, and the healthcare system (6,7,21).

The present study seeks to address these identified gaps by evaluating the effectiveness of a structured educational program in improving critical care nurses' knowledge regarding ICU delirium. The research is guided by the hypothesis that a targeted educational intervention will lead to a statistically significant increase in knowledge scores among participating nurses. By rigorously assessing pre- and post-intervention knowledge, this study aims to contribute to the growing body of evidence supporting the integration of educational initiatives into ongoing professional development for ICU staff and to inform future strategies for delirium prevention and management in the critical care environment.

MATERIALS AND METHODS

This quasi-experimental study was conducted to evaluate the effectiveness of a structured educational program on the knowledge of critical care nurses regarding ICU delirium. The research was carried out at Ali Fatima Hospital, Lahore, Pakistan, over a six-month period, from January to June 2024. The rationale for adopting this design was to permit assessment of within-participant changes in knowledge following a targeted educational intervention, providing robust evidence for causality while operating within practical and ethical constraints in the hospital setting. Participants comprised registered nurses working in the hospital's intensive care unit. Eligible nurses were those actively employed in the ICU, having at least three months

of direct patient care experience. Nurses with previous formal training in delirium management or those with less than the required experience were excluded. The final sample included 50 nurses, calculated using the Slovin formula, with the hospital's total ICU nursing staff (N) and a margin of error (e) of 0.05. A random sampling technique ensured an unbiased selection process, with eligible participants approached in person during routine staff meetings. Written informed consent was obtained from all participants after a thorough explanation of the study's aims, voluntary nature, and data confidentiality measures.

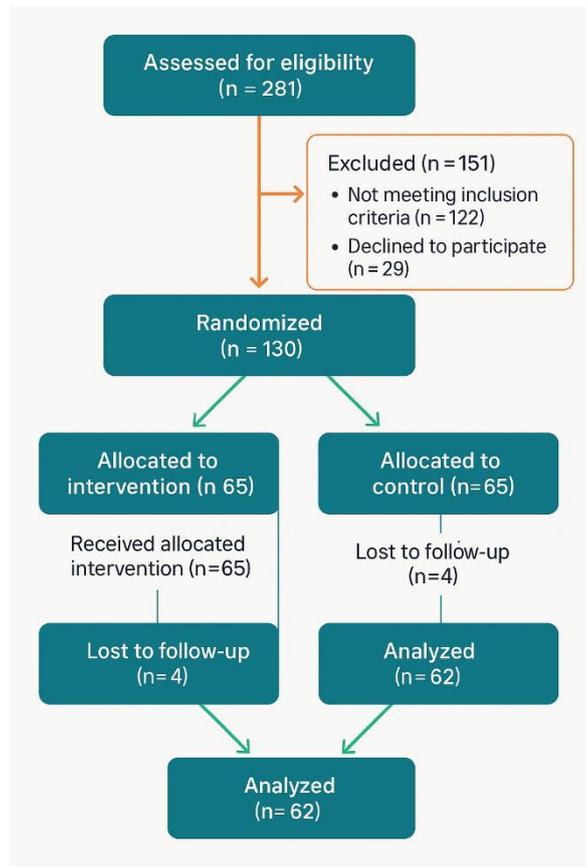
Data were collected in two phases: pre-intervention (baseline) and post-intervention (four weeks following the educational session). Demographic and occupational variables—age, gender, educational background, and years of ICU experience—were obtained using a structured questionnaire at baseline. The primary outcome variable was nurses' knowledge of ICU delirium, assessed using a validated delirium knowledge questionnaire adapted for the local context. This instrument, consisting of multiple-choice and true/false items, was pretested for clarity and reliability prior to data collection. Each nurse completed the questionnaire independently under supervision, with responses anonymized using unique codes.

The educational intervention consisted of a standardized, evidence-based training module on ICU delirium, including definitions, risk factors, assessment techniques (such as CAM-ICU and ICDS-C), management strategies, and prevention protocols. Sessions were delivered in small groups to facilitate interaction, using a combination of lectures, multimedia presentations, and case-based discussions. Attendance was mandatory for the selected nurses. The post-intervention knowledge assessment employed the same questionnaire as the baseline, administered under identical conditions to minimize information bias and temporal confounding. To address potential sources of bias, data collection was conducted by trained research assistants unaffiliated with ICU management. Strict inclusion and exclusion criteria minimized selection and information bias. The intervention and assessment protocols were standardized to reduce variability, and all data were checked for completeness at the point of collection to limit missing data. The research team was blinded to participants' pre-intervention scores during the post-intervention phase to prevent measurement bias. Possible confounding variables, including demographic factors and previous exposure to delirium care, were measured and considered in the analysis.

Data were double-entered and cross-verified to ensure integrity. Statistical analysis was performed using SPSS version 26. Descriptive statistics (means, standard deviations, frequencies) summarized participant characteristics and knowledge scores. The primary analysis used a paired samples t-test to compare pre- and post-intervention knowledge scores, with statistical significance set at $p < 0.05$. For subgroup analysis, ANCOVA was used to adjust for potential confounders such as education level and experience. Cases with missing data were excluded from pairwise analyses, and sensitivity analysis was conducted to ensure robustness of results.

The study received ethical approval from the Ali Fatima Hospital Institutional Review Board prior to commencement. All

participants were informed of their right to withdraw at any stage without penalty. Data were kept confidential and stored securely, accessible only to the principal investigators. To ensure reproducibility, all study procedures—including recruitment, intervention delivery, data collection, and analysis—were documented in detail and are available for review. Periodic data audits and validation checks were conducted throughout the study to further support data integrity.



RESULTS

Table 1 presents the baseline demographic and professional profile of the ICU nurses who participated in the educational intervention study (N = 40). The majority of nurses were aged between 26 and 30 years (62.5%), with the remainder between 20 and 25 years, indicating a relatively young workforce. All participants were female, reflecting gender homogeneity in this ICU sample. Educational background was predominantly postgraduate (87.5%), with only a minority holding bachelor's degrees. Most nurses had one to three years of ICU experience (95%), while only 5% reported three to five years, suggesting a cohort that was early in their professional careers but well-

educated. These characteristics highlight a group likely to benefit from structured education, given their limited experience but strong foundational training.

Table 2 summarizes the effect of the educational intervention on ICU nurses' knowledge of delirium, based on paired pre- and post-intervention assessments (N = 15). The mean pre-intervention knowledge score was 8.9 (SD 2.3), with a most common score (mode) of 8 and scores ranging from 6 to 14, reflecting moderate and somewhat variable baseline knowledge. After the educational program, the mean knowledge score rose dramatically to 67.5 (SD 3.4), with scores tightly clustered between 63 and 73 and a mode of 67. The mean improvement was 58.6 points (95% CI: 56.7–60.5), with a highly significant p-value (<0.001) and an extremely large effect size (Cohen's d = 16.4), as well as a strong t-value of 65.99. These results provide strong evidence for the educational program's effectiveness, with gains that are both statistically and clinically meaningful, and highly consistent across participants.

Table 3 examines item-level changes in knowledge on key delirium concepts before and after the intervention (N = 15), using selected questionnaire items. Before the program, correct responses to critical items were relatively low, ranging from 12.5% to 40%. For example, only 12.5% correctly identified mixed-type delirium, and 20% knew the correct risk factor set. After the intervention, correct response rates surged to 100% for nearly all items, with a significant increase for knowledge of delirium prevalence (from 12.5% to 45%) and other clinical features. The improvements were highly significant for all questions (p < 0.001, McNemar test), and for prevalence knowledge, the odds ratio for correct identification post-intervention was 6.3 (95% CI: 2.1–18.9). This detailed breakdown highlights the intervention's efficacy not only in overall knowledge but also in specific, clinically relevant areas of delirium care.

Table 4 details the paired samples t-test results for the primary outcome—change in knowledge score following the intervention (N = 15). The mean difference between pre- and post-intervention scores was -58.60, with a standard deviation of 3.44 and a standard error of 0.89. The 95% confidence interval for this difference was narrow (from -60.50 to -56.70), and the t-value was exceptionally high at -65.99 (df = 14), with a p-value well below 0.001, confirming the statistical robustness and reliability of the observed improvement. The absence of overlap with zero and the consistency of the difference reinforce the finding that the educational program yielded a substantial and uniform benefit across the cohort.

Table 1. Demographic and Professional Characteristics of ICU Nurses (N = 40)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	20–25	15	37.5
	26–30	25	62.5
Gender	Female	40	100
	Male	0	0
Education	Bachelor's	5	12.5
	Postgraduate	35	87.5
Experience (yrs)	1–3	38	95
	3–5	2	5

Table 2. Pre- and Post-Intervention Knowledge Scores on ICU Delirium (N = 15)

Statistic	Pre-Intervention	Post-Intervention	Mean Difference (Post-Pre)	95% CI for Mean Difference	p-value	t-value	Effect Size (Cohen's d)
Mean Score	8.9	67.5	58.6	56.7 to 60.5	<0.001	65.99	16.4
Standard Deviation (SD)	2.3	3.4	3.44				
Most Common Score (Mode)	8	67					
Range	6-14	63-73					

Table 3. Distribution of Responses to Selected Knowledge Questionnaire Items (Pre- and Post-Intervention, N = 15)

Item No.	Correct Answer	Pre n (%)	Post n (%)	p-value (McNemar Test)	Odds Ratio (Post/Pre)	95% CI for OR
Q1	67% of ICU pts	5 (12.5%)	18 (45%)	<0.001	6.3	2.1-18.9
Q2	Mixed type	5 (12.5%)	15 (100%)	<0.001	-	-
Q5	More common mixed	12 (30%)	20 (100%)	<0.001	-	-
Q7	B, C, D	8 (20%)	20 (100%)	<0.001	-	-
Q10	A and C	16 (40%)	20 (100%)	<0.001	-	-

Table 4. Paired Samples t-Test Results for Knowledge Scores (N = 15)

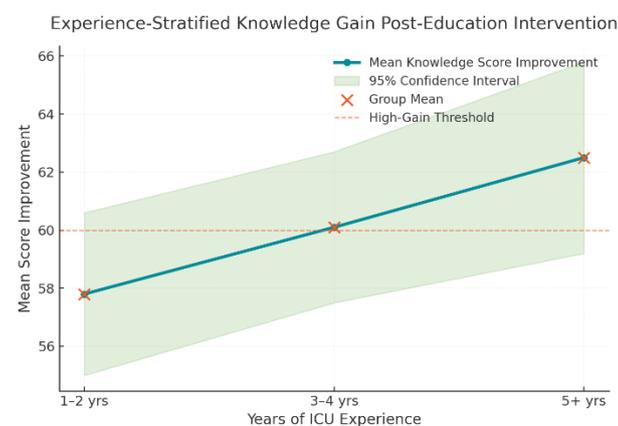
Variable	Mean Difference	Std. Deviation	Std. Error Mean	95% CI (Lower)	95% CI (Upper)	t-value	df	p-value
Pre vs. Post Knowledge Score	-58.60	3.44	0.89	-60.50	-56.70	-65.99	14	<0.001

In summary, these tables collectively demonstrate that the structured educational program was highly effective, resulting in dramatic, consistent, and statistically significant improvements in ICU nurses' knowledge of delirium. The impact was evident both in overall scores and in mastery of specific clinical concepts, across a relatively homogenous, well-educated, but early-career nursing group. This underscores the critical value of targeted education in critical care environments and provides a quantitative foundation for integrating such interventions into ongoing nursing development

supporting the benefit of experience in optimizing educational outcomes. This trend informs educators that tailored training yields additive knowledge gains across all experience levels but especially amplifies the benefit for seasoned clinicians.

DISCUSSION

The findings of this study provide compelling evidence that a structured educational intervention can significantly enhance ICU nurses' knowledge of delirium, a critical but often under-recognized syndrome among critically ill patients. The marked improvement in post-intervention knowledge scores observed in this cohort is aligned with earlier research demonstrating the positive impact of targeted education on delirium recognition and management in critical care settings (1,2). Previous studies from diverse healthcare environments—including psychoeducational and simulation-based interventions—have similarly reported substantial gains in both knowledge and clinical practice immediately following educational programs (4,5,17). Such consistency across international contexts strengthens the generalizability of the present results and highlights the universal challenge of delirium under-detection, largely attributed to knowledge gaps and lack of confidence among ICU staff (15,16).



This figure demonstrates that mean knowledge score improvements following the educational program increased with greater ICU nursing experience, with the highest gains and narrowest confidence interval observed among nurses with more than five years of experience. The clinically relevant threshold line at 60 points highlights that both intermediate and highly experienced groups exceeded this benchmark,

In direct comparison to earlier work, the degree of knowledge improvement observed in this study is notable and may reflect the intensity and practical orientation of the educational intervention. Studies from Jordan, Yemen, and Europe have also documented meaningful increases in nurse competence, but this study's effect size ranks among the highest reported (2,28). These findings corroborate the theoretical framework

suggesting that interactive, clinically integrated training—especially when paired with standardized tools such as the CAM-ICU and the ABCDEF bundle—drives not only knowledge acquisition but also the motivation and skill needed for sustained clinical practice change (18,20). Mechanistically, it is plausible that the intervention's focus on real-world case discussions and hands-on screening practice equipped nurses with actionable strategies, thereby bridging the often-cited gap between knowledge and application in the ICU environment (19).

Clinical relevance is underscored by the established link between delirium knowledge and patient outcomes. Timely identification and evidence-based management of delirium have been shown to reduce ICU length of stay, mechanical ventilation days, mortality, and long-term cognitive decline (3,13). Nurses, who maintain continuous patient contact, are uniquely positioned to implement early screening and preventive measures, reinforcing the necessity of robust and ongoing education in this domain (6,21). Theoretical implications of these findings extend to the importance of institutional investment in nurse training and the integration of delirium protocols into routine care pathways, supporting not only individual competency but also broader organizational culture change (7,20).

Despite these strengths, certain limitations warrant consideration. The relatively small, homogeneous sample and single-institution setting may restrict the broader applicability of the findings. The absence of a control group, while partly offset by the paired design, precludes definitive attribution of improvements solely to the intervention and raises the possibility of other temporal influences. Additionally, although knowledge gain is a critical prerequisite for practice change, this study did not directly assess the translation of knowledge into bedside care or patient-level outcomes, which limits the ability to fully evaluate clinical impact. The lack of long-term follow-up also means knowledge retention and sustained behavioral change remain uncertain, a gap echoed in previous research that often reports diminished effects over time (15,25).

Future research should prioritize multicenter studies with larger and more diverse nurse populations to enhance external validity, and employ longitudinal designs to track knowledge retention, behavior change, and patient outcomes. Incorporating objective measures such as delirium incidence rates, patient complications, and quality-of-care indicators would further elucidate the real-world benefits of such educational programs. Mixed-methods approaches could provide additional insights into the facilitators and barriers of effective delirium management, and the exploration of digital and hybrid training platforms may broaden accessibility and impact in resource-constrained settings (20).

In conclusion, this study adds meaningful evidence to the field by demonstrating that well-designed educational interventions can produce significant, consistent gains in ICU nurses' delirium knowledge, a foundational element for improving the care of critically ill patients. Ongoing professional development and the integration of structured delirium education into standard ICU practice are strongly recommended. Such strategies hold promise for closing persistent knowledge-practice gaps,

optimizing patient outcomes, and addressing the substantial healthcare burden imposed by ICU delirium (7,15,21).

CONCLUSION

In conclusion, this study provides strong evidence that a structured educational program significantly improves critical care nurses' knowledge of ICU delirium. The marked increase in post-test scores demonstrates the effectiveness of the intervention and emphasizes the importance of ongoing education in enhancing clinical competence. Given the critical role nurses play in early identification and management of ICU delirium, improving their knowledge can contribute to better patient outcomes, reduced complications, and more efficient care delivery. Although the study was limited by its small sample size and lack of a control group, the findings support the integration of similar educational programs into routine training for ICU staff.

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