

Impact of Education on ICU Nurses Knowledge and Attitudes toward Cam-ICU Delirium Assessment

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ABSTRACT

OBJECTIVE: This research seeks to assess how an educational intervention influences knowledge and attitudes of intensive care nurses in applying the Confusion Assessment Method-Intensive Care Unit for delirium assessment in a private hospital setting.

METHODOLOGY: A descriptive, quasi-experimental pre-test/post-test design was conducted from February to July 2024 in two private hospitals in Johor Bahru, Malaysia. A total of 50 registered ICU nurses participated. Nurses in management or on probation were excluded. Twenty-five were randomly assigned to the intervention group and received structured education through classroom presentations, demonstrations, and hands-on practice using the CAM-ICU. Data were collected pre- and post-intervention using a validated 36-item questionnaire assessing delirium-related knowledge and attitudes.

RESULTS: Post-intervention analysis demonstrated statistically significant improvements in the intervention group's knowledge and attitude scores ($p < .001$), indicating the program's effectiveness. The intervention group exhibited more substantial gains compared to the control group.

CONCLUSION: This study supports that a structured educational program can effectively enhance ICU nurses' knowledge, attitudes, and confidence in delirium assessment using the CAM-ICU. The findings align with Kolb's Experiential Learning Theory, which emphasizes learning through experience and reflection. Addressing institutional barriers, such as the lack of standardized protocols, remains essential to ensure successful and sustainable implementation.

KEYWORDS: Delirium, CAM-ICU, Education, knowledge, attitudes

INTRODUCTION

Delirium is a severe neurocognitive disorder commonly observed in intensive care units (ICUs), affecting up to 80% of critically ill patients. It involves acute changes in attention, awareness, and cognition, and is associated with adverse outcomes such as prolonged hospitalization, increased mortality, and long-term cognitive impairment¹. Despite its high prevalence, delirium often remains under-recognized and poorly managed². Early detection is crucial to mitigating its negative consequences.

Critically ill patients are particularly susceptible due to factors like underlying illness, medications, and environmental stressors. Clinical guidelines, such as those from the Society of Critical Care Medicine, recommend routine delirium screening for all adult ICU patients³. However, implementation depends on the knowledge and skills of frontline healthcare providers, particularly nurses.

Studies have shown inconsistencies in ICU nurses' knowledge of delirium, its risk factors, and the appropriate use of standardized tools^{4,5}. These gaps hinder timely and accurate detection. This study explores the impact of a targeted educational intervention on ICU nurses' knowledge and attitudes

regarding delirium assessment using the Confusion Assessment Method for the ICU (CAM-ICU).

The intervention aimed to improve nurses' confidence and ability in applying CAM-ICU to identify delirium among critically ill patients. In Malaysian private hospitals, nurses often do not perform delirium assessments, potentially due to limited formal education, time constraints, and low awareness. This study evaluates whether structured education enhances their readiness to screen for delirium effectively.

Understanding current knowledge and attitudes is essential to inform training programs and bridge practice gaps^{6,7}. Targeted education can lead to better clinical decision-making, earlier diagnosis, and improved outcomes for ICU patients.

Theoretical framework (Kolb's ELT)

This study adopted Kolb's Experiential Learning Theory (ELT) as its theoretical framework. ELT conceptualizes learning as a continuous process where knowledge is developed through the transformation of experience. The model consists of four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation. During the intervention, participants engaged in hands-on experiences with the CAM-ICU tool (concrete experience), reflected on its use through guided discussions (reflective observation), conceptualized their understanding of delirium assessment (abstract conceptualization), and were

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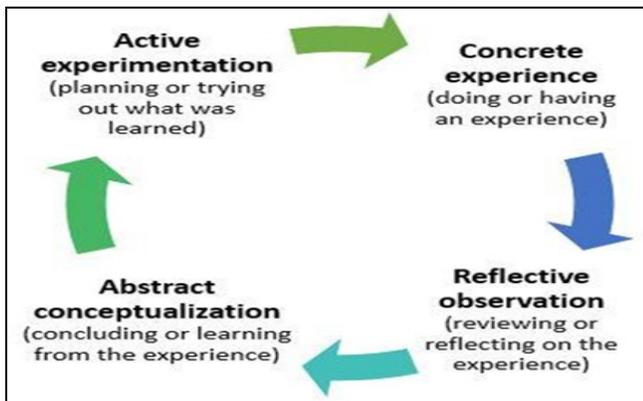
encouraged to apply this knowledge in their clinical settings (active experimentation).

By progressing through Kolb's learning cycle, ICU nurses were supported in deepening their clinical reasoning and enhancing practical skills related to delirium screening. This framework provided a structured basis for delivering the educational content and evaluating changes in knowledge and attitudes.

The application of Kolb's ELT is illustrated in **Figure I**, which outlines the integration of experiential learning stages throughout the intervention process.

Figure I:

Kolb's Experiential Learning Theory (ELT)



METHODOLOGY

Study Design

A descriptive quasi-experimental pre- and post-test design was conducted among ICU nurses. Foundational delirium knowledge was evaluated using a validated questionnaire adapted from prior ICU delirium studies^{18,19}. An educational intervention followed, and post-test data were collected to assess its impact. The study took place from February to July 2024 at two private hospitals in southern Malaysia.

Population and Sample

Among 68 ICU nurses, 50 met the inclusion criteria and were recruited for the study. Due to the small pool, population sampling was used. Following the pre-test, 26 nurses were randomly selected to undergo the structured educational intervention on delirium assessment using CAM-ICU. One nurse later withdrew, leaving 25 in the Intervention Group. The remaining 25 formed the Control Group.

Instrument

The intervention consisted of twice-weekly 2-hour sessions over one month. The program included presentations on ICU delirium, CAM-ICU training, demonstration videos, roleplay, and simulation-based competency assessments. Two 5-minute videos from the ICU Delirium website illustrated CAM-ICU use. A tailored case study from the CAM-ICU Training Manual assessed participants' understanding. Training materials provided included the Richmond Agitation-Sedation Scale (RASS), CAM-ICU tool, assessment forms, and case scenarios. RASS was

included due to its routine use in the study setting to determine readiness for CAM-ICU screening. A post-test was completed two months after the intervention.

Data Analysis

Descriptive statistics were used. Mean and standard deviation (SD) summarized continuous variables. Cohen's *d* was calculated to determine effect size and assess the practical impact of the intervention. A paired t-test evaluated changes in participants' knowledge and attitudes before and after the educational program.

Ethical Statement

The study was conducted at two private hospitals in southern Malaysia. Ethical approval was obtained from the KPJUC Research Ethics Committee (KPJUC/RMC/SON/EC/COC4/495). Formal permission was granted by the Directors of Nursing. Written informed consent was obtained from all participants prior to data collection.

RESULTS

Demographic data:

A total of 50 ICU nurses participated, all of whom completed the pre-test questionnaire (100% response rate). The majority were female (88%), with most aged between 26–35 years (48%) and 36–40 years (18%). Approximately 36% had 1–5 years of ICU experience, while 22% had between 11 and 15 years. Most participants (96%) worked rotating shifts, with only a small number assigned to fixed day shifts and none to permanent night duty. **Table I**

Table I: Description of participants

Variable	Category	Total n	%
Gender	Male	6	12
	Female	44	88
Age	20-25	9	18
	26-30	12	24
	31-35	12	24
	36-40	9	18
	>40	8	16
Experience	Less than 5 years	18	36
	5-10 years	18	36
	11-15 years	11	22
	15-25 years	3	6
ICU trained	Yes	38	76
	No	16	24
Shifts	Day only	2	4
	Night Only	0	0
	Day and Night	48	96

Table II Delirium Knowledge Questionnaire Results
Questionnaire 6 consists of 37 items, with accurate

and false answers.

The table below presents nurses' performance on the Delirium Knowledge Questionnaire before and after the educational intervention. Pre-test scores reflect

baseline knowledge, while post-test scores indicate knowledge following the training. A marked increase in correct responses was observed across most items, demonstrating the effectiveness of the intervention in enhancing delirium-related knowledge. **Table II**

Table II: Delirium Knowledge Questionnaire

Delirium Knowledge Questionnaire		
Statement	Pre-Test %	Post-Test %
Restless, agitation – Hyperactive delirium	76	100
Inactivity, sluggishness, drowsiness, apathy – Hypoactive delirium	69	92
Mini-Mental State Examination (MMSE)	28	88
Glasgow Coma Scale (GCS)	63	92
Delirium Rating Scale (DRS)	84	80
Alcohol Withdrawal Scale (AWS)	67	84
Confusion Assessment Method (CAM)	84	100
Beck's Depression Inventory	53	88
Braden Scale	67	92
Fluctuation that happens between disorientation and orientation is not typical of delirium	48	100
Depression symptoms may mimic delirium	84	100
Delirium treatment always includes sedation	40	84
Patients seldomly remember delirium episodes	9	88
A MMSE is an excellent way in diagnosing delirium	26	92
A patient who have repaired a fractured neck or femur has similar risk for delirium as a patient having an elective hip replacement	61	100
Delirium typically resolves within a few hours.	61	92
The likelihood of developing delirium rises with increasing age.	84	96
Patients with vision impairments face a heightened risk of experiencing delirium.	44	96
The risk of delirium increases proportionally with the number of medications a patient is taking.	67	92
A urinary catheter in situ reduces the risk of delirium	78	96
Gender does not affect the development of delirium	48	92
Poor nutrition increases the risk of delirium	65	92
Dementia is the most significant risk factor for delirium	94	92
Males have a higher risk of developing delirium compared to females.	53	88
Diabetes is a significant risk factor for delirium	34	88
Dehydration may contribute to an increased risk of delirium	67	100
Hearing impairment elevates the likelihood of experiencing delirium	57	96
Obesity is a risk factor for delirium	71	96
A patient who is lethargic and difficult to rouse does not have delirium	65	96
Patients with delirium are always verbally and physically aggressive	26	84
Delirium is generally caused by alcohol withdrawal	57	92
Patients with delirium have a greater mortality rate	51	100
A family history of dementia predisposes a patient to delirium	15	96
Behavioral fluctuations throughout the day are common in individuals with delirium	84	100
A patient with delirium tends to be easily distracted and may struggle to follow conversations	98	96
Perceptual disturbances are frequently experienced by patients with delirium	90	100
Altered sleep/wake cycle may be a symptom of delirium	94	92

Pre-test and post-test data

The table above presents nurses' performance on the Delirium Knowledge Questionnaire administered before and after the educational intervention. Pre-test scores represent baseline knowledge, while post-test scores indicate knowledge following the program. The results demonstrate substantial improvement across most items, supporting the intervention's effectiveness in enhancing delirium awareness.

For example, 76% of participants correctly identified "Restlessness and agitation indicate hyperactive delirium" in the pre-test, increasing to 100% post-intervention.

Knowledge Improvement:

The improvement in post-test scores across multiple statements reflects enhanced understanding of key delirium concepts. Notably, recognition of hypoactive delirium symptoms—"Inactivity, sluggishness, drowsiness, and apathy"—increased from 69% to 92%. This suggests a notable gain in nurses' ability to differentiate delirium subtypes.

Overall, the results suggest the educational intervention was effective in bridging knowledge gaps. Participants demonstrated increased accuracy in identifying delirium-related symptoms, indicating successful knowledge acquisition and recall following the structured program.

Areas of Significant Change:

Several statements show an intense improvement in correct responses. For example, questionnaire number 10, "Fluctuation between orientation and disorientation is not typical of delirium," rose from 48% to 100%, demonstrating a significant improvement in recognising this mistaken belief.

Likewise, "Depression symptoms can resemble delirium," question number 11, increased from 84% to 100%, showing that the educational intervention assisted in clarifying this critical feature.

Statements maintained high pre-test scores or improved slightly in the post-test. For example, statement 23, "Dementia is the greatest risk factor for delirium" received a pre-test score of 94% and a post-test score of 92%, indicating that the nurses knew about this aspect before the educational intervention program.

Table III-1: Descriptive Statistic

Group	N	Mean	Variance	Std. Deviation	Std. Error Mean
Control Pre-test	25	62.7	60.94302	7.81	1.56
Control Post-test	25	70.05	31.68	5.63	1.13
Intervention Pre-test	25	63.2	81.44	9.02	1.77
Intervention Post-test	25	88.76	33.29	5.77	1.15

Table III-2: t-Test result

Comparison	t-value	df	p-value	95% CI (Lower)	95% CI (Upper)
Control Pre vs Post	3.18	48	<0.001	4	10.7
Intervention Pre vs Post	11.87	48	<0.001	21	30.11

Discussion for data in Table III-1 Descriptive Statistic:
Control Pre-test: The mean score was 62.70, with a standard deviation 7.81. This indicates moderate variability in the pre-test scores.

Control Post-test: The mean score increased to 70.05, with a lower standard deviation of 5.63. This shows improvement and less variability in post-test scores.

Intervention Pre-test: The Mean score of the intervention pre-test was 63.2. This mean score indicates the average performance of participants before the intervention. The standard deviation was calculated to be 9.02. This value signifies the amount of variation or dispersion from the mean.

Intervention Post-test: The mean score increased to 88.76 with a similar standard deviation, showing a significant improvement after the intervention.

Discussion for data in Table III-2**t-Test results – paired t-test**

The paired t-test in this study aimed to examine the impact of the educational intervention on nurses' knowledge of delirium. It was used to compare pre-test as well as post-test scores within both the control and intervention groups. This statistical method is appropriate for evaluating the existence of a significant difference between the means of two related samples. By analyzing the pre-test as well as post-test scores, the researcher sought to determine whether the intervention yield a statistically significant enhancement in knowledge.

Comparison of two group**Control Group:**

The control group showed a statistically significant improvement in knowledge scores from the pre-test (M = 62.70, SD = 7.81) to the post-test (M = 70.05, SD = 5.63), $t(24) = 3.81$, $p < 0.001$. This indicates that the control group experienced a notable increase in knowledge about delirium, even without the targeted educational intervention.

Intervention Group:

The intervention group demonstrated a highly significant improvement in knowledge scores from the pre-test (M = 63.20, SD = 5.77) to the post-test (M = 88.76, SD = 5.77), $t(24) = 11.87$, $p < 0.001$. The analysis indicates a significant difference in the intervention group's scores between the pre-test as well as post-test phases. The t-statistic (t) was calculated to be 11.87 with 24 degrees of freedom, highlighting a substantial score change. The p-value was below 0.001, which indicate that the difference is statistically significant.

In practical terms, this result implies that the observed change in scores is uncertain and may have occurred

by chance, thereby supporting the alternative hypothesis that the intervention significantly affected the outcomes assessed.

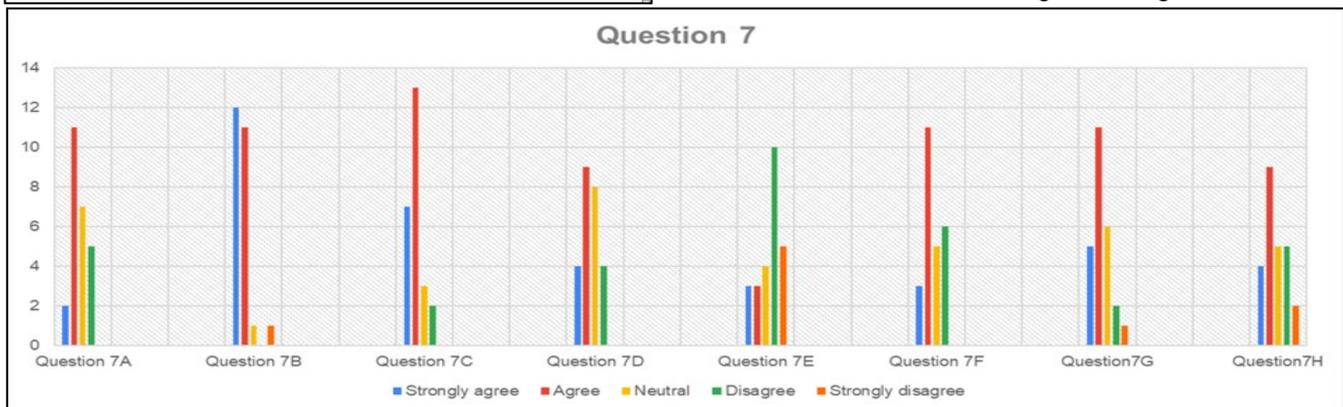
Results of the paired t-tests indicate that both the control as well as intervention groups demonstrated notable enhancements in their knowledge scores. However, the intervention group demonstrated a more noticeable increase, emphasizing the effectiveness of the educational program in enhancing nurses' knowledge of delirium.

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Table IV: Questionnaire using Likert scale:

Questionnaire number 7 has eight (8) components. The participant was given a choice of Strongly agree, Agree, Neutral, Disagree, or Strongly disagree.

Table 4: Questionnaire using Likert scale	
1	Delirium is underdiagnosed (7A)
2	Delirium is a common response to the ICU environment (7B)
3	Delirium is a problem that requires active interventions on the part of caregivers (7C)
4	Delirium is associated with higher patient mortality (7D)
5	ICU patients with delirium are rarely agitated (7E)
6	Initiation of antipsychotic therapy (e.g., Haloperidol) should be the initial intervention for all patients with delirium (7F)
7	Delirium is challenging to assessment in ICU patients (7G)
8	Patients with delirium usually have symptoms that are consistent over the entire nursing shift (7H)



For Question 7A, most respondents either “Agree” or “Strongly agree” with this statement, showing a common perception that delirium is often missed in ICU settings. Most respondents “Agree” or “Strongly agree,” suggesting that nurses recognize the ICU environment as a significant factor in developing delirium for question 7B. Many respondents “Agree” or “Strongly agree,” showing an understanding that proactive measures are necessary to manage delirium effectively for question 7C.

The majority of respondents “Agree” or “Strongly agree,” indicating awareness of the severe implications of delirium on patient outcomes for the statement that delirium is linked to an increased mortality rate (Question 7D). Participants' responses are more varied, with a mix of “Agree,” “Neutral,” and “Disagree,” reflecting differing views on the presentation of delirium symptoms for question 7E.

For question 7F, Respondents more “Disagree” or

“Strongly disagree,” suggesting that nurses are aware that antipsychotics are not always the first line of treatment for delirium. In question 7G, the participant responded with a significant number of “Agree” or “Strongly agree,” highlighting the perceived assessment that delirium is challenging in the ICU. In question H, participants responded “Disagree” or “Strongly disagree,” demonstrating an understanding that delirium symptoms can fluctuate throughout the day.

The participants' responses revealed attitudes with common awareness and knowledge gaps among ICU nurses regarding delirium, which is valuable for shaping future educational interventions focusing on delirium assessment using CAM-ICU as a standard tool.

DISCUSSION

Delirium is a common yet often underestimated issue in intensive care units (ICUs), with serious implications for patient outcomes and healthcare costs. Undiagnosed delirium contributes to longer hospital stays, prolonged mechanical ventilation, and increased mortality. The CAM-ICU is a widely validated tool for delirium detection in critically ill patients. This study addressed the lack of recognition and foundational knowledge among ICU nurses

regarding delirium. Similar interventions have shown positive outcomes, including improved detection, greater adherence to guidelines, and enhanced clinical understanding¹⁹. However, the sustainability of such improvements remains a concern, as some studies report variable long-term outcomes.

In our study, the mean knowledge score in the intervention group was 88.76 (SD = 5.78) at baseline, increasing to 92.76 post-intervention, reflecting significant improvement. These results suggest that the educational program successfully enhanced knowledge and fostered positive attitudes toward delirium assessment. This aligns with Sinvani et al.¹⁶, who also reported increased CAM-ICU competency following a multicomponent intervention.

Unlike Sinvani's Train-the-Trainer model, our program employed a blended approach combining lectures and simulations. This design allowed for deeper

engagement and targeted improvements in knowledge areas, such as interpreting CAM-ICU scores and recognizing fluctuating symptoms. Before the intervention, many nurses struggled to identify that “fluctuation between orientation and disorientation is typical of delirium,” with only 48% responding correctly. Post-intervention, this improved to 100%, suggesting enhanced symptom recognition and confidence.

Our findings also reflect the limited practice of delirium assessment prior to the program. No formal tools were available in the ICUs, and nurses had not previously been assessed on delirium screening. This gap underscores a systemic issue: without standardized tools and proper training, delirium may remain overlooked, echoing findings by Xing et al.²¹, who noted similar under-recognition in ICU settings.

Survey responses revealed baseline awareness of delirium risks. For example, most participants agreed that “delirium often goes unnoticed” and that the “ICU environment contributes to delirium.” However, uncertainty persisted around specific symptoms (e.g., Q7E). Notably, nurses understood that antipsychotics are not first-line treatment and that symptoms can fluctuate, indicating selective knowledge gaps rather than a total lack of understanding.

These findings reinforce the importance of targeted education. Structured programs can address specific deficiencies and promote the consistent use of validated tools like CAM-ICU. Similar to Ramoo et al.⁷, our study found that education significantly improved nurses’ ability to assess delirium. While Ramoo’s study was conducted in a university hospital, ours focused on a private hospital setting where routine delirium screening was not previously established. Despite these differences, both studies affirm the value of structured CAM-ICU training in enhancing ICU nursing practice and patient safety.

CONCLUSION

This study provides compelling evidence that targeted educational intervention can significantly enhance ICU nurses’ knowledge and attitudes toward using CAM-ICU for delirium assessment. By equipping nurses with essential knowledge and fostering positive attitudes, such interventions can potentially improve patient outcomes in the ICU setting. While the inclusion of two private hospital ICUs strengthens the study’s relevance to this specific context, the small sample size and the inherent characteristics of the private healthcare setting may limit the generalizability of the findings. Furthermore, the persistence of knowledge gaps related to delirium risk factors underscores the need for ongoing education and reinforcement.

Future research should prioritize exploring the long-term impact of such interventions on both nurses’ practices and, crucially, patient outcomes. Investigating strategies to address specific knowledge gaps, such as those related to delirium risk factors, is

critical. Additionally, developing mechanisms to ensure the sustainability of educational benefits, potentially through integrated professional development programs or readily accessible online resources, will be essential to maximize the impact of such interventions on delirium assessment and management in the ICU.

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Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

AUTHOR CONTRIBUTION

Hamdin N: Conceived and designed the study and analyzed data, contributed to data interpretation, made revisions

Ahmad A: Contributed to data interpretation, made revisions

Yusof P: Made revisions

All authors read and approved the final manuscript.

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