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Bringing Delirium to Light

Impact of CAM-ICU Tool to Improve Care Coordination

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ABSTRACT

Background: Delirium is a serious complication in patients in the critical care unit (CCU) that may lead to prolonged hospitalization if left undetected. The CCU at our hospital does not have a framework for determining delirium that could affect patient outcomes and discharge planning.

Primary Practice Setting: CCU in a community hospital.

Method: A posttest-only design was used for this study. We established a framework for the early assessment of delirium, educated and trained nurses to detect delirium, collaborated with the informatics department, intensivist, nursing, respiratory therapy and worked with case management to deploy the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). We used a one-tailed independent *t* test to determine the impact of CAM-ICU on length of stay (LOS). Cross-tabulation and chi-square tests were used to examine the impact of CAM-ICU tool on home care utilization between the intervention and comparison groups.

Results: There was a 3.12% reduction in LOS after implementing the CAM-ICU tool. Also, a reduction in home care service utilization demonstrated statistical significance ($p = .001$) between the intervention group (62.5%; $n = 177$) and the comparison group (37.5%; $n = 106$).

Implications for Case Management Practice: Case managers are essential in improving care transitions. Case managers need to become competent in understanding the implications of the CAM-ICU tool because of their relevant role in the multidisciplinary rounds as advocates to improve care transitions across the continuum of care. Case managers need to have an understanding on how to escalate when changes in the Richmond Agitation-Sedation Scale scores occur during the multidisciplinary rounds because it can affect care coordination throughout the hospital.

Conclusions: Implementing the CAM-ICU decreased LOS, and reduced health care utilization. The early identification of patients with delirium can affect the outcomes of critically ill patients and entails multidisciplinary collaboration.

Key words: *CAM-ICU tool, delirium, length of stay, quality improvement*

Research and literature reviews have demonstrated patients in critical care units (CCUs) are at increased risk of delirium (Abazid et al., 2021; Ramos et al., 2023). Delirium is characterized by disturbance of consciousness and accompanying changes in condition. Patients with delirium are unable to think clearly, may be disoriented, or unable to pay attention, and their level of alertness may fluctuate. Delirium is a serious clinical problem often unrecognized in patients in CCU (Gaete Ortega et al., 2020; Amba, 2014).

Delirium affects 2.6 million adults 65 years and older annually in the United States (Oh et al., 2017). The annual national health care costs for managing patients with delirium range from $38 billion to $152 billion yearly (Health Research & Educational Trust, 2018). For CCU patients, the annual associated health costs in the United States are also staggering between $6.6 and $20.4 billion (Pagad et al., 2020). It is expensive to treat patients with delirium, resulting in higher CCU and hospital costs along with an increased length of stay (LOS).

Studies have suggested that implementing the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) tool in clinical practice may have several benefits in the early detection of delirium in the intensive care settings (Allum et al., 2020). The CAM-ICU is a widely used tool for the early detection and diagnosis of delirium in critically ill patients.

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However, its impact on reducing LOS, health care utilization, and health care costs remains controversial (Miranda et al., 2023). Early detection of delirium using the CAM-ICU can potentially reduce the LOS (Spiegelberg et al., 2020). By promptly identifying delirium using the CAM-ICU tool, health care providers can initiate appropriate interventions and management strategies, potentially reducing the duration of hospitalization. Although early detection and intervention for delirium are important, the effectiveness of the CAM-ICU tool in significantly shortening LOS is undetermined. The direct relationship between CAM-ICU implementation and LOS reduction is not consistently supported by empirical evidence (Ely et al., 2001). Delirium is a complex condition influenced by various factors, and LOS reduction cannot be solely attributed to a single assessment tool. Other factors such as patient comorbidities, severity of illness, and availability of appropriate resources also play a significant role in determining LOS.

Although the CAM-ICU tool has its merits in delirium detection, its influence on reducing LOS and health care costs remains uncertain. The relationship between tool implementation and these outcomes is multifactorial, involving various patient-specific and system-related factors. Prior to this project, the CCU at our local community hospital had yet to use a delirium assessment tool. Upon conducting an exhaustive literature review, we discovered that the CAM for the ICU tool may reduce LOS and early detection of delirium and may reduce the cost of health care (Ho et al., 2021).

Purpose of the Project

The purposes of this project are as follows:

- To determine the impact of the CAM-ICU tool on delirium detection.
- To determine the impact of the CAM-ICU tool on LOS.
- To identify the impact of the CAM-ICU tool on health care utilization.

Design

Method: A posttest-only design was used for this quality improvement (QI) project. The authors used the model for improvement to execute the theory and plan, develop, test, and pilot the project (Institute for Healthcare Improvement, 2021). This model was used to implement and sustain the improvements and spread the use of the CAM-ICU tool (see Figure 1) throughout the CCU. The CAM-ICU tool is valid and demonstrates high interrater reliability with a $\kappa = 0.79–0.96$. Compared with a standard physician diagnosis of delirium, the CAM-ICU tool demonstrates sensitivity of 93% to 100% and specificity of 89% to 100% (Zhang et al., 2023; Miranda et al., 2023). The authors collaborated with the informatics department, intensivist, nursing, respiratory therapy, and worked with case management to deploy the CAM-ICU tool. Prior to project implementation, the authors submitted the proposal to the hospital's institutional review board committee and categorized the project as a QI initiative.

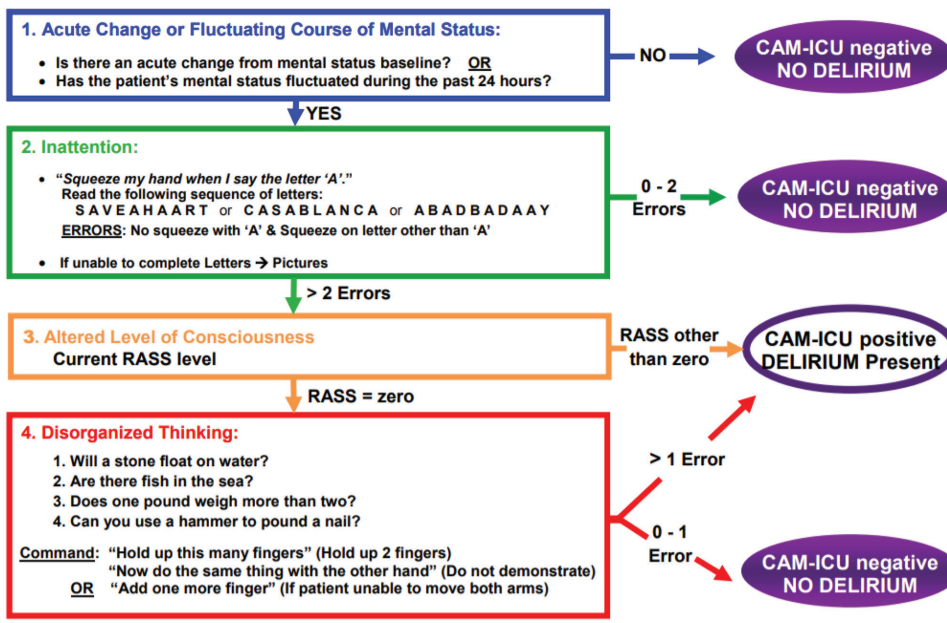

FIGURE 1
CAM-ICU flow sheet. CAM-ICU = Confusion Assessment Method for the Intensive Care Unit; RASS = Richmond Agitation-Sedation Scale. Copyright 2002, E. Wesley Ely, MD, MPH and Vanderbilt University, all rights reserved. Used with Permission.

Settings and sample: The project was implemented in a 24-bed CCU. The registered nurse–patient ratio in the CCU was 2:1. The CCU has an intensivist model, including a pulmonologist and critical care advance practice nurses. The 275-bed acute care community hospital in New England is a Magnet-designated facility. The CCU has a designated case manager for discharge planning and care coordination.

Inclusion and exclusion criteria: The sample population included all patients 18 years or older admitted to the CCU as inpatients. Any patient registered as an observational care patient was included in the intervention. However, observational care patients were excluded from the LOS outcome measures.

Statistical analysis: A one-tailed independent *t* test was used to evaluate whether CCU LOS was affected after implementing the CAM-ICU tool. Cross-tabulation and chi-square tests for independence were used to examine the impact of the CAM-ICU tool on home care service utilization between the intervention and comparison groups. Statistical significance was set at $\alpha = .05$. Statistical Package for Social Sciences (SPSS) Version 27.0 software (SPSS, Inc., Chicago, IL) was used for all statistical analyses.

Intervention: The authors collaborated with the informatics team to develop an electronic template for the CAM-ICU tool (see Figure 2). The CAM-ICU tool evaluates patients based on the following four features:

1. Acute change or fluctuating course of mental status
2. Inattention
3. Altered level of consciousness
4. Disorganized thinking

A CCU nurse completed the CAM-ICU tool twice daily at 8:00 a.m. and 8:00 p.m. The assessments were documented as either CAM-ICU positive or CAM-ICU negative. The first step of the intervention was to assess the level of consciousness using the Richmond Agitation-Sedation Scale (RASS). If the RASS score was greater than –3, the nurse continued to assess delirium using the CAM-ICU tool. If the RASS scores were –4 or –5, the patient would not respond appropriately to the CAM-ICU assessment. A positive screen for delirium using the CAM-ICU evidence-based tool included patients with acute changes, fluctuating mental status, inattention, altered level of consciousness, or disorganized thinking (Ely et al., 2001).

Multidisciplinary rounds were the standard work process in the CCU. The CCU has a designated case manager, and this structure is standard to many health care organizations because the case manager serves as a conduit among the multidisciplinary team (Vergara et al., 2021). Although not a direct utilizer of the CAM-ICU tool, the case manager was also familiar with the CAM-ICU tool and its impact on care coordination, acuity downgrades, unit transfers, and discharge planning. When CAM-ICU screening was positive for delirium, the case manager was essential in the care management, escalation, or de-escalation of care transitions.

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Fidelity of interventions: Nurses served as validators and were required to complete a 20-min PowerPoint presentation with a voice overlay created by the primary investigator. The nurses were then presented with a test with a case scenario in which they completed the CAM-ICU steps in this case scenario. The authors used a case scenario developed by Ely and Vanderbilt University (Ely et al., 2001) with the authors' permission. Seven nurses were trained to validate the results of the CAM-ICU. The validators included the primary investigator, nurse manager, assistant nurse manager, nurse educator, and the three bedside critical care nurses. All the nurses performed and passed the CAM-ICU assessment by using a validator before performing the CAM-ICU independently.

Results

The sample size for this project was 806 adults. There were 413 patients in the baseline period and 393 in the intervention period. The coding of ICD-10 for G93.41 or metabolic encephalopathy, also known as delirium per Centers for Medicare & Medicaid Services. After implementing the CAM-ICU tool, there was a 14.8% increase ($n = 70$) of delirium diagnosis with the intervention group in contrast to the comparison group ($n = 61$).

A one-tailed independent *t* test was used to analyze hourly CCU utilization. The LOS in the CCU was lower after implementation of the CAM-ICU ($M = 66.94$) than the baseline LOS ($M = 69.15$, $t[789] = 0.36$, $p = .35$, 95% CI [–7.81, 12.23]). The authors determined LOS in days and the project demonstrated an overall reduction in LOS from 2.88 (comparison group) to 2.79 days (intervention group). Although the result was not statistically significant, this outcome demonstrated clinical significance in LOS reduction in the CCU (see Figure 3).

The project used cross-tabulations and chi-square tests to determine whether home care service

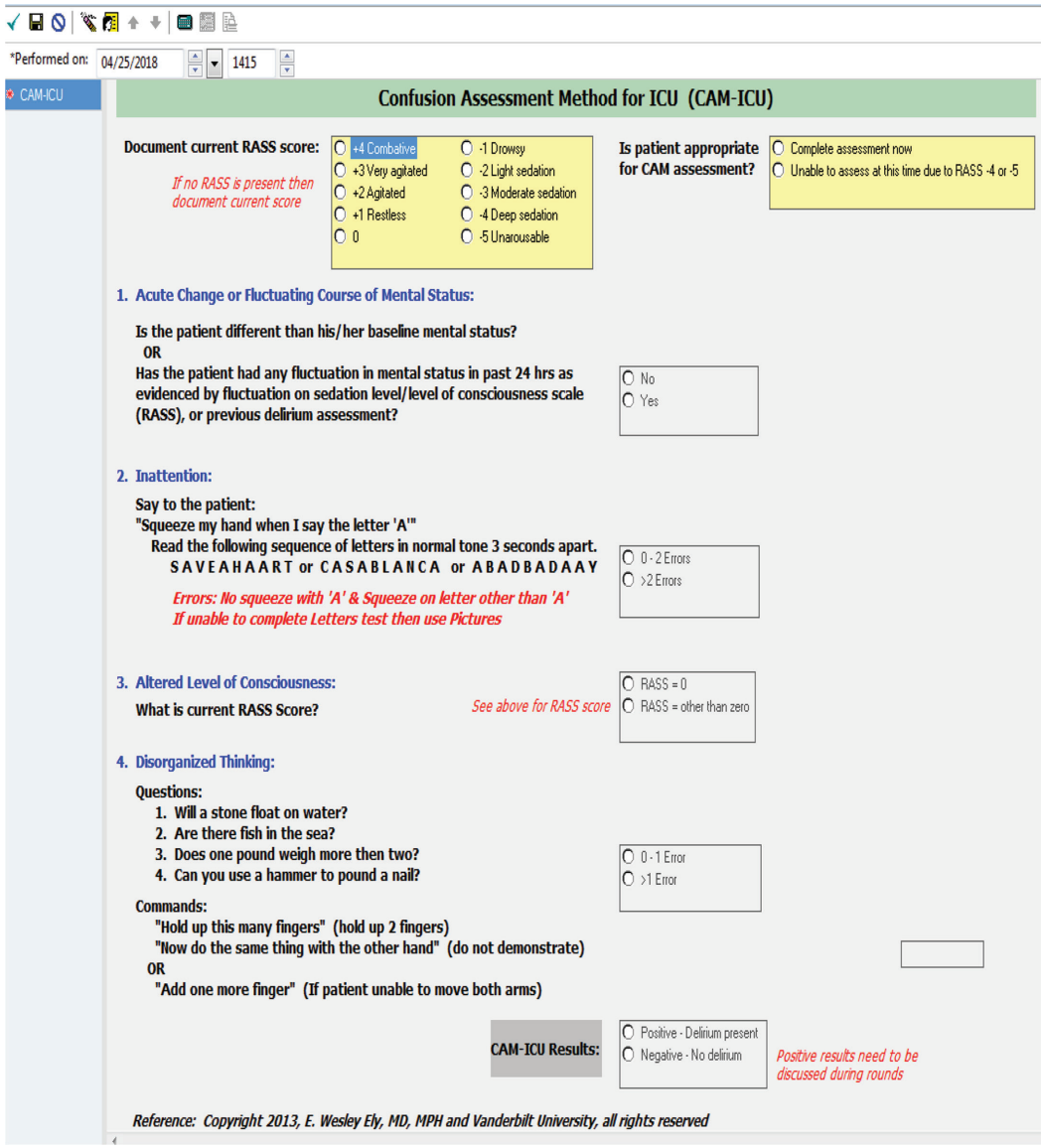

FIGURE 2
CAM-ICU tool electronic documentation. CAM-ICU = Confusion Assessment Method for the Intensive Care Unit; RASS = Richmond Agitation-Sedation Scale.

utilization decreased between the comparison and intervention groups. Of the 413 patients in the intervention group, 62.5% (n = 177) were discharged without the need for home care services. On the other hand, of the 393 patients in the intervention group, 37.5% (n = 106) were discharged to home without the need for home care services (see Figure 4) and demonstrated statistical significance (p = .001). Therefore, patients using the CAM-ICU tool demonstrated less utilization of home care services.

Discussion

Impact of the CAM-ICU tool on delirium detection: The compliance rate for performing CAM-ICU during the intervention period was 98.9%. The nurses received proper training to complete the CAM-ICU tool every 12 hr; this task contributed to a compliance rate of more than 98%, consistent with published studies (Blevins & DeGennaro, 2018; Sutton-Smith, 2021). A total of 28.6% (n = 108) of CCU patients screened positive for delirium at least once during CCU admission. There were 43 patients on a ventilator; 67.4% (n = 29) of those on a ventilator had a positive CAM-ICU result (see Figure 5). The project findings were consistent with several studies where the incidence of delirium was between 55% and 80% after implementing the CAM-ICU tool (Zhang et al., 2021; Pavone et al., 2020; Miranda et al., 2023). Such findings entail that implementing the CAM-ICU tool in the CCU may effectively assess delirium that will be left undetected without a delirium assessment tool.

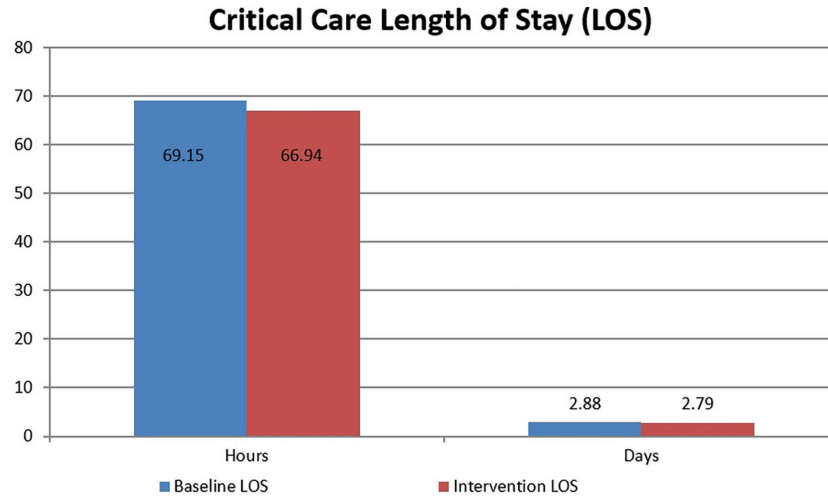

FIGURE 3
The average LOS (in hours) resulted in a 3.12% reduction after implementation of the Confusion Assessment Method for the Intensive Care Unit over an 8-week period. LOS = length of stay.

Impact of the CAM-ICU delirium detection tool on LOS: The patients who received the CAM-ICU tool assessment have decreased their LOS and demonstrated clinical significance in this project. The result is similar to some literature, wherein the CAM-ICU tool was associated with decreased LOS (Spiegelberg et al., 2020). Early detection of delirium may have contributed to the minimal utilization of high-risk medication that can cause delirium. The authors acknowledge several potential confounding variables, such as case mix index, age, gender, medication regimen, and mobility status, all of which can affect the LOS of CCU patients (Lawson et al., 2022). Knowing that a propensity score matching was not used in the project, the result is inconclusive to determine if the CAM-ICU tool may decrease the LOS.

However, seminal and some current studies demonstrate that CAM-ICU tool implementation is associated with increased ICU LOS (Ely et al., 2001; Mitasova et al., 2012; Dubiel et al., 2022). The information is not surprising because once delirium is detected, it is traditionally associated with higher LOS because of prolonged hospitalization and the need for more complex interventions. Nevertheless, the results of this project support the recommendation of implementing the CAM-ICU in the CCU at the community hospital. Proactive surveillance for delirium is recommended in all critically ill patients because the symptoms fluctuate, and there are risks of misdiagnosis with traditional assessments (Ramos et al., 2023).

Such findings entail that implementing the CAM-ICU tool in the CCU may effectively assess delirium that will be left undetected without a delirium assessment tool.

Impact of the CAM-ICU tool on health care utilization: Home health services totaled $123 billion in the United States (National Health Expenditure Accounts, 2020). Posthospital ICU discharge may cost between $9,000 and $66,000 annually per patient (Lone et al., 2016), and the average monthly cost of home health services in New England is approximately $5,500 per patient (Genworth, 2023). Our project potentially reduced posthospital discharge health care utilization because home health services were reduced from 45% to 25%.

The economic impact of delirium on the U.S. health care system underscores the need for effective case management strategies (Zipser et al., 2021). The CAM-ICU emerges as a promising tool for early delirium detection and management, presenting an opportunity to mitigate associated costs (Chen et al., 2021). Furthermore, the link between delirium and complications, such as an increased risk of falls, prolonged mechanical ventilation, and higher mortality rates, highlights the importance of proactive measures. Implementing CAM-ICU for delirium detection empowers health care providers to institute preventive strategies, potentially reducing complications, minimizing the need for additional interventions, and eventually reducing overall costs. Standardized tools such as CAM-ICU tool also play a crucial role for case managers to promote consistent communication among health care teams (Morandi et al., 2019). This consistency fosters effective collaboration and care coordination, ultimately leading to improved patient

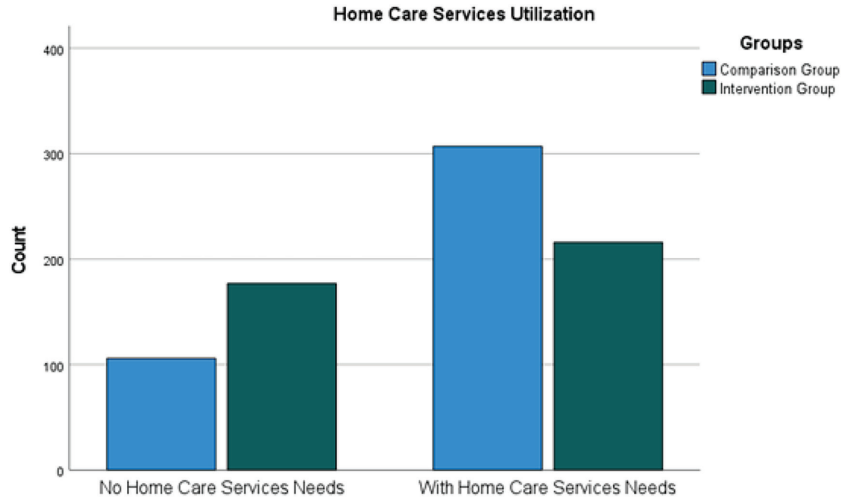

FIGURE 4
Pearson chi-square test: $p = .001$. Many critical care unit patients on the intervention group did not use home care services (62.5%; $n = 177$) compared with the comparison group (37.5%; $n = 106$).

outcomes and a more streamlined approach to health care utilization (Smith et al., 2022).

Delirium management involves a multidisciplinary approach, including pharmacological and nonpharmacological interventions (Smith et al., 2022), collectively contributing to the overall cost of care. Although timely detection and management of delirium may prevent complications and reduce resource utilization, it is challenging to attribute cost savings solely to using the CAM-ICU tool. The direct impact of the CAM-ICU tool on reducing health care costs must be well-established. The tool does not directly address the underlying causes of delirium or provide specific interventions for cost reduction. Moreover, implementing the CAM-ICU tool may introduce additional costs regarding staff training, time allocation for assessments, and potential false-positive results (Leslie et al., 2022). Training health care providers to use the CAM-ICU tool effectively requires resources and dedicated effort. In addition, false-positive results from the tool may lead to unnecessary interventions and increased health care costs associated with further investigations and treatments.

Beyond clinical practice, the widespread use of CAM-ICU tool contributes significantly to data generation (Awan et al., 2021) and case management practice. These data from electronic health records hold immense value for research and QI initiatives that can guide case managers, care coordinators, and utilization resource managers in recommending cost-effective interventions to prevent or case manage a delirium in the CCU. Analyzing the prevalence and outcomes of delirium in the ICU setting informs best practices and further optimizes health care utilization, highlighting the multifaceted benefits of CAM-ICU implementation (Hoch et al., 2022).

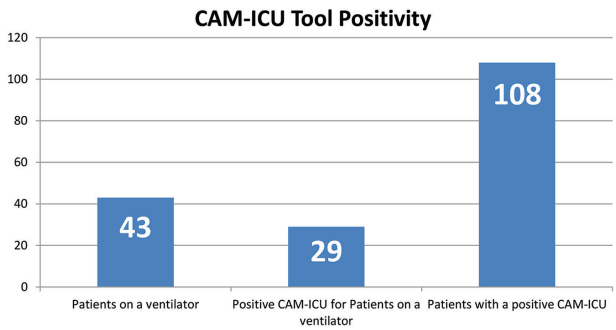

FIGURE 5
The bar graphs demonstrate the number of patients on a ventilator during the intervention period, and the number of patients on a ventilator that screen positive with the CAM-ICU, as well as the total number of patients with a positive CAM-ICU. CAM-ICU = Confusion Assessment Method for the Intensive Care Unit.

Implications for Case Management Practice

The project demonstrated the business and clinical need to utilize the CAM-ICU tool for early assessment of delirium in the CCU, which may lead to early hospital discharge and decreased health care utilization. Critical care patients often require complex case management due to the severity of the disease process. Therefore, case managers are essential in improving care transitions (Vergara et al., 2017) by advocating for consistent discussion of CAM-ICU assessments daily and timely downgrades from the CCU to the step-down and medical–surgical units. Although the end users of the CAM-ICU tool are critical care nurses, it is significant for case managers to become competent in understanding the implica-

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tions of the CAM-ICU tool. Case managers have a relevant role in multidisciplinary rounds by serving as a conduit between nursing and medical providers (Vergara et al., 2020). Case managers need to have an understanding on how to escalate when changes in the RASS scores occur during the multidisciplinary rounds because it can affect care coordination throughout the hospital. Case managers serve as facilitators in the multidisciplinary rounds, and they need to demonstrate effective communication with the health care team to ensure CAM-ICU assessments are shared promptly with the essential health care team members.

Call to Action

Educate case managers, critical care nurses, peers, patients, and their care partners on delirium risk factors, symptoms, and prevention strategies. You can make a difference in their outcomes.

Limitations

The project has several limitations. Although there was sufficient sample, the data collection lasted only 8 weeks. It is recommended that CCU nurse leaders implement the project for a more extended period to evaluate a statistically significant reduction in LOS in a larger sample and in a multisite setting. This study also used a purposive sampling technique and was not randomized. Therefore, unable to control potential confounding variables. Although the patients were admitted to the CCU, whether the demographics were similar between the comparison and intervention groups was unknown.

Conclusion

The project demonstrated that implementing the CAM-ICU reduced the patient CCU LOS and improved the likelihood of patients being discharged without home care services such as rehabilitation therapies and home health aides. The results of this project add to the body of evidence demonstrating that the early assessment of delirium will impact patient outcomes. Interprofessional collaboration with case managers, nursing, physicians, respiratory therapists, nursing informatics, QI, physical therapists, and pharmacists are critical for successfully implementing QI projects. Health care team education on delirium and CAM-ICU tool were important aspects of this initiative's success. Continued education and training of nurses in recognizing delirium will aid in ensuring its sustainability.

When implementing a QI project, it is important to have a sustainability plan to monitor continued compliance with CAM-ICU assessment and outcomes. Mentoring multidisciplinary team members, from CCU nurse clinicians, leaders, and case managers is essential to continue the program's success. It is highly recommended that delirium education and screening tools be implemented in a medical–surgical unit and involve inpatient case managers to determine the consistency of results and the potential impact on non-ICU settings. Nursing education, delirium tips for ongoing education, and engaged CCU nurse leaders and staff nurses contributed to the success of this project.

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