Exploring the role of the clinical decision support system in delivering multimodal interventions in delirium care for ICU adults: a scoping review protocol.

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Abstract

Introduction Delirium is a frequently reported significant complication in acute and critically ill patients. Multimodal interventions can potentially decrease delirium incidence and severity by reducing predisposing factors. Previous research has documented the efficacy of delirium assessment and management interventions. However, the heterogeneity and complexity of these multimodal interventions make them challenging to disseminate and integrate into clinical practice. To support nurses in decision-making for delirium care, a clinical decision support system (CDSS) can increase situational awareness by reducing the cognitive load and facilitating relevant clinical information gathering. It can have a positive impact on nursing efficacy as well as on patient outcomes. This scoping review aims to map the existing literature on the use of CDSS to deliver multimodal interventions in delirium care for ICU adults, explore how it has been applied in this context, and identify gaps in the existing literature.

Methods and Analysis This scoping review protocol will employ the Joanna Briggs Institute (JBI) framework. The preferred Reporting Items for Systematic Reviews and Mata-Analysis extension for Scoping Reviews (PRISMA-ScR) guidelines will be used for reporting. This scoping review primarily aims to identify existing literature findings on implementing CDSSs to deliver multimodal interventions for delirium care in adults in acute settings. Therefore, academic and grey literature from the following international bibliographic databases will be used. The search strategies will be tailored to these databases: CINAHL via EBSCOhost, Ovid Emcare, MEDLINE via PubMed, PsycINFO, and ProQuest. The literature search will be conducted in December 2024 and the findings will be concluded in September 2025. Two primary reviewers will independently screen the identified studies. The extracted qualitative data will be analysed thematically in a narrative format and presented in tabular form while the quantitative data will be presented with descriptive statistics.

Ethics and dissemination Ethical approval is not needed as primary data will not be collected in this review. The author aims to register this scoping review protocol in the Open Science Framework (OSF) platform. The findings of the complete scoping review will be disseminated through peer-reviewed publications and conferences.

Background

Delirium is a severe neuropsychiatric syndrome manifest with an acute onset of impaired attention and disruptions in various cognitive functions(1). It is often accompanied by an altered level of arousal ranging from a near comatose state (hypoactive) to hypervigilance and severe agitation (hyperactive)(1). Delirium can disproportionately affect up to 60%-80% of ventilated patients and 40% of non-ventilated critically ill patients in the Intensive Care Units (ICUs)(2). Additionally, it impacts, 10% - 31% of adult patients in other acute care settings outside the ICUs(3). Delirium is an independent predictor of mortality and long-term cognitive impairment associated with increased days of mechanical ventilation, extended ICU and hospital stays, and increased healthcare costs up to 40% higher compared to patients without delirium(3–8). Therefore, early identification and prompt management of ICU delirium is crucial for better patient outcomes and to reduce national healthcare service costs(9).

Although the mechanism of the underlying cause of ICU delirium is not fully understood, it is believed to result from a combination of multiple predisposing risk factors including age and gender (older men), prolonged use of benzodiazepine, single relationship status, living alone, lower educational status, previous history of delirium and cognitive impairment, and clinical factors such as low haemoglobin, HIV positive, hepatic encephalopathy, sepsis, multi-organ failure, and abnormal renal markers(1,8,10–12).

Several methods have been developed and validated to diagnose delirium in general acute settings and ICUs. For example, an Assessment and Test for Delirium and Cognitive Impairment (4AT) tool was developed and employed for rapid delirium screening in acute medical settings and the emergency departments(13). Similarly, the Confusion Assessment Method (CAM)-ICU is the tool globally used to assess and diagnose delirium in ICUs(14). The CAM-ICU consists of four features: 1) acute onset of changes or fluctuations of mental status, 2) inattention, 3) disorganised thinking, and 4) an altered level of consciousness during the past 24 hours(15,16). An ICU patient is diagnosed with delirium i.e., CAM-ICU positive if they manifest both features 1 and 2, plus either feature 3 or 4(16,17) with a corresponding Richmond Agitation Sedation Scale (RASS) Score(18,19) **(Appendix 1)**.

The Pain, Agitation, Delirium, Immobility, and Sleep (PADIS) guidelines recommend multimodal interventions, such as the ABCDEF bundle, to assess, prevent, and manage ICU delirium(20). The ABCDEF bundle includes A - assess, prevent, and manage pain, B - use both spontaneous awakening and breathing trials, C – choice of analgesia and sedation, D – delirium assessment, prevention and management, E – early mobility and exercise, and F – family involvement and empowerment(20). Although some studies reported that implementing the A-F bundle reduced hospital deaths within 7 days by 68%(21,22), others claimed that adherence to the bundle intervention is far from universal(23). The prevalence of delirium remains high due to the inconsistent implementation of the A-F bundle(24). Implementing this bundle is resource intensive and it involves coordinating with a multidisciplinary team, continuous education, and information processing which has the potential to have a cognitive overload in ICU nurses(25,26). Cognitive overload, the complex nature of the algorithm of the assessment and intervention tools, the burden of maintaining nursing care records, and heavy workload are some reported barriers that may hinder adherence to bundle implementation(2,26–28).

Cognitive overload is the excess cognitive load capacity one requires to process cognitive resources in working memory which has been identified as the most concerning in providing care among nurses in the ICU(29). When the working memory has limited capacity, learning is impaired as an experience overloads its capacity to process and transfer knowledge to long-term memory(29,30). Evidence shows that cognitive overload negatively impacts nurses' work performance and the care quality provided to ICU patients which often leads to poor patient health outcomes(31).

Several studies reported that Clinical Decision Support Systems (CDSSs) can help nursing staff by reducing the amount of clinical information required to recall which leads to a significant reduction in cognitive load(32,33). The CDSSs are a health information technology in a software system(34). The CDSSs are widely used in healthcare systems globally for storing and retrieving individualised information from a health system data repository, and then directly feeding this information into the decision-making process to support the monitoring, assessment, and treatment of patients(8,34,35). It is designed to improve healthcare delivery by suggesting optimal decisions with targeted clinical knowledge based on patient-specific assessment and

clinical health data(34). CDSS can also increase situational awareness by applying research-based information from local and national guidance for patient assessment with consistent judgment, adherence to guideline recommendations, and reducing variation(36). CDSSs can be used similarly in the ICU to enhance the early recognition and management of delirium, which merits the application of clinical guidelines with diagnostic suggestions and treatment reminders based on patient data(37). Therefore, the purpose of this scoping review is to identify and synthesise existing literature on the role of CDSSs, the types of designed CDSSs, and identify barriers and facilitators of CDSSs for multimodal interventions in delirium care for ICU adults.

Review Objectives

This protocol for scoping review aims to explicitly document what is planned before starting the review which makes the research objectives, methods, reporting, and process more transparent(38). The objectives of this protocol are listed below:

1) To map existing literature on the use of CDSSs in delivering multi-modal interventions for delirium care in ICU adults.
2) To identify the various types and methods of CDSSs for delivering multi-modal interventions for delirium care in ICU adults.
3) To explore the role of CDSSs in delivering multi-modal interventions for delirium care in ICU adults.
4) To assess the impact of CDSSs on patient outcomes in ICU delirium care.
5) To examine the barriers and facilitators to implement CDSSs for multimodal delirium care interventions in ICU adults.
6) To identify gaps in the existing literature regarding the use of CDSSs in multimodal interventions for delirium care in ICU adults and to suggest areas for future research.

Review question

The review question should be articulated and explicitly aligned with the review objectives, allowing for an assessment of how well the review has achieved its intended goals based on the responses to this question(39). The inclusion of specific

questions enables the authors to move beyond the general objectives statement, offering precise details about the review's focus and the aspects that will be examined and mapped(39). The Population, Concept, and Context (PCC) framework is considered an appropriate approach when developing a scoping review research question(40). Additionally, as the scoping review concludes the breadth of evidence on the topic, the research question can be broad(41,42). An iterative approach was developed through the preliminary literature review on the topic and consultation with the research team for this scoping review question:

How are clinical decision support systems (CDSSs) utilised to deliver multi-modal interventions in delirium care for ICU adults?

After discussing with a professional subject librarian from the University of Edinburgh, the following (table 1) search terms. The PCC framework will be used to collect specific literature to meet the objectives of this proposed review(43). This process will help the authors develop precise inclusion criteria and shape a data extraction tool.

Table 1: PCC terms

	Item	Search Term
Population	Delirium	Deliri*
Concept	Clinical Decision Support System (CDSS)	"Clinical Decision Support Systems" OR "CDSS" OR "decision support system" OR "decision support tools"
Context	Intensive care unit	"Intensive Care Unit" OR ICU OR "Critical Care" OR "Intensive Therapy Unit" OR ITU OR "acute care"

Inclusion and exclusion criteria

This scoping review will consider primary research papers of qualitative, quantitative, or mixed-method designs published in English in peer-reviewed journals. A time filter will be applied, specifically set to the year 2013, to incorporate a 13-year limit in the scoping review to strike a balance between comprehensiveness and relevance. This approach ensures that the included studies adhere to more rigorous and modern research standards, allowing the scoping review to capture the most current, reliable, and applicable evidence(44). By limiting the review to the past 13 years, the volume

of studies can be managed effectively by avoiding overwhelming data while still covering the most important and relevant research (42). The reference list of the identified papers will be reviewed for any additional relevant articles.

The following types of publications will be excluded: case reports, systematic reviews, meta-analyses, scoping reviews, and opinion papers in the research area as the review seeks to find synthesised evidence-based multimodal interventions currently being delivered using CDSS in adult ICUs. Articles for which full-text access is unavailable or not written in English will also be excluded. The criteria for selecting papers will be based on the PCC mnemonics recommended by JBI methods.

Population: Articles will be selected that include participants comprised of delirium care where healthcare professionals work with adult patients in ICUs. Adult patients would be the indirect secondary population focused on the review through their care. Literature that includes populations other than adult patients will be excluded.

Concept: This review's main concept of interest is using CDSS to deliver multi-modal interventions utilised in delirium care. Studies that reported detailed aspects of the development, application, and outcomes of CDSSs for delirium care will be included. Papers focusing on other conditions other than delirium will be excluded. CDSSs targeted in conditions other than delirium care will also be excluded.

Context: The review will include studies conducted in various geographical locations, spanning high, middle, and low-income countries. Articles that report the use of CDSSs in adult ICUs for delirium care will be included. CDSSs used for delirium care in rehabilitation and community settings will be excluded.

By structuring the inclusion and exclusion criteria using the PCC framework, scoping reviews can systematically identify and analyse relevant evidence, ensuring that the research is focused, rigorous, and applicable to the real-world clinical context(43).

Methods

Scoping reviews are a commonly used evidence-synthesis approach for investigating current knowledge, mapping relevant literature in the field of interest, and providing an overview of evidence gaps across a variety of fields(39,40). Furthermore, scoping reviews offer a thorough overview of existing evidence, adapting to the field's evolving nature and addressing the diversity found across

different settings(45). Since applying CDSS in delirium care for adults in ICU settings is a relatively recent development, and variability in its implementation across the field, a scoping review is more appropriate than any other types of reviews such as a systematic literature review.

This protocol will follow the JBI scoping review protocol framework which includes the following steps: (a) search strategy (b) source of evidence selection (c) data extraction, and (d) data analysis and presentation of the evidence(39,40). Before conducting the searches, the protocol will be pre-registered on the Open Science Framework (https://osf.io/uwv5r). Reporting of the results will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR) checklist(46). A software system for managing scoping review, Covidence, will be used to support screening, data extraction, and monitoring of the review process.

A) Search strategy

The search strategy will aim to locate both published and unpublished studies using each of these databases: CINAHL via EBSCOhost, Ovid Emcare, MEDLINE via PubMed, PsycINFO, and ProQuest. The search terms are tailored to each database. A professional librarian will be consulted to plan a search strategy and to identify a comprehensive list of relevant literature to our subject area. Further, searching will be undertaken in Google Scholar and Overton, checking further publications of lead authors, lists of included studies in similar reviews, and both backward and forward citation searching of papers selected for inclusion via all other search methods. To ensure the capture of all relevant information, grey literature sources will be searched to identify studies, reports, and conference abstracts pertinent to this review.

B) Source of evidence selection

Following the search, all identified citations will be collated and uploaded into the bibliographic software e.g. EndNote (version 20; Clarivate Analytics, Boston Massachusetts). The search results will then be uploaded to Covidence to remove duplicates and to complete the screening of titles, abstracts, and full-text articles. Two reviews will independently screen the titles and abstract of all identified articles against the inclusion criteria. Full-text articles of selected citations will then be

assessed in detail against the inclusion criteria by two or more independent reviewers. Reasons for the exclusion of articles during the full-text review will be recorded and reported in the PRISMA-ScR flow diagram. Any disagreements that arise between the reviewers at any stage of the selection process will be resolved through discussion, or by consulting an additional reviewer. The search results and the study inclusion process will be reported in full in the final scoping review and presented in a PRISMA-ScR flow diagram(46).

C) Data extraction

Microsoft Excel will be used to chart the results of the studies. Two or more reviewers will independently extract the study characteristics by adopting the JBI-recommended data extraction tool to reflect the aim of this scoping review (39). The extraction tool will include specific details about the participants and the concept along with data including author/s, year of publication, country of origin, study aims/purpose, population, sample size, methodology/methods, intervention type (including comparator and details such as duration), data collection methods, data analysis, key findings relevant to the review and limitations(40). Furthermore, the characteristics of the CDSSs including the types, modes of delivery, barriers and facilitators while using it, the outcome and limitations, and settings will be considered during the data extraction process. Disagreements will be resolved through consensus or by involving a third review author.

D) Analysis of the evidence and presentation of the results

The purpose of charting the data is to identify, characterise, and summarise research evidence on a topic including the identification of research gaps(44). According to JBI guidelines, the evidence that is presented and should directly respond to the review objectives and questions(43). Therefore, the author will use an iterative process to identify similarities and dissimilarities in the included studies, map key findings, and develop themes. Findings will be presented using a narrative synthesis approach(47). The extracted qualitative data will be analysed thematically in a narrative format and presented in tabular form while the quantitative data will be presented with descriptive statistics. A narrative summary will accompany the tabulated results and describe how the results relate to the review's objectives and

questions. The results will be synthesised and reported according to the concepts of multimodal interventions aimed at delirium care in adult ICU in tabular form.

Discussion

The summary of this review will offer insight into useful techniques to integrate CDSSs into adult ICU settings for delirium care by highlighting the results of previous studies. This work is particularly timely, as it aligns with the ongoing push toward digital transformation in healthcare and the need for innovative solutions to complex clinical challenges. The findings will be used to guide a three-year co-designing study to look at the use of CDSSs in delirium care for ICU adults. We will adopt a collaborative approach to engage with stakeholders in our research area. The results will inform our research design and provide potential barriers and facilitators as well as possible mitigation strategies.

Strengths and limitations of this study

This scoping review will adhere to established methodological guidelines for scoping reviews and will be reported in accordance with systematic reporting standards. The review comprises both academic databases and grey literature. One of the limitations of this review will be the absence of quality appraisal as it is not required to be considered in the scoping review context.

Summary

This scoping review will summarise the evidence on the role of CDSSs, the types of designed CDSSs, and identify barriers and facilitators of CDSSs for multimodal interventions in delirium care for ICU adults. CDSSs have been used in various healthcare systems including ICUs to store, collect, classify, and establish patients' conditions to then use these data to assess, diagnose, and manage accordingly(34). It allows health alerts and provides feedback to assist with disease diagnosis, treatment, and nursing tasks which then reduces cognitive overload and improves adherence in implementing multimodal intervention i.e. ABCDEF bundle in delirium care for ICU adults(8,48–50).

Quality assessment of included studies

Formal critical appraisal of individual sources of evidence will not be conducted as it is not part of the scoping review methodology(43).

Ethics statements

Not applicable for review protocol.

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Appendix 1: Richmond Agitation Scale (RASS)(18,19)

+4	COMBATIVE	Combative, violent, immediate danger to staff	
+3	VERY AGITATED	Pulls to remove tubes or catheters; aggressive	
+2	AGITATED	Frequent non-purposeful movement, fights ventilator	
+1	RESTLESS	Anxious, apprehensive, movements not aggressive	
0	ALERT & CALM	Spontaneously pays attention to caregiver	
–1	DROWSY	Not fully alert, but has sustained awakening to voice (eye opening & contact >10 sec)	Verbal Stimulation
–2	LIGHT SEDATION	Briefly awakens to voice (eyes open & contact <10 sec)	Verbal Stimulation
–3	MODERATE SEDATION	Movement or eye opening to voice (no eye contact)	Verbal Stimulation
–4	DEEP SEDATION	No response to voice, but movement or eye opening to physical stimulation	Physical Stimulation
–5	UNAROUSEABLE	No response to voice or physical stimulation	Physical Stimulation

Procedure for RASS Assessment

1. Observe patient
   a. Patient is alert, restless, or agitated. **(score 0 to +4)**

2. If not alert, state patient's name and ***say*** to open eyes and look at speaker.
   b. Patient awakens with sustained eye opening and eye contact. **(score –1)**
   c. Patient awakens with eye opening and eye contact, but not sustained. **(score –2)**
   d. Patient has any movement in response to voice but no eye contact. **(score –3)**

3. When no response to verbal stimulation, physically stimulate patient by shaking shoulder and/or rubbing sternum.
   e. Patient has any movement to physical stimulation. **(score –4)**
   f. Patient has no response to any stimulation. **(score –5)**