14. Delirium

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Introduction

Patient safety research and quality improvement efforts have been underway in the delirium harm area for many years, but clear and consistent recommendations regarding best practices have proven elusive. Studies have been conducted, including rigorously designed systematic reviews, but they have reached conclusions that have been contradictory and difficult to apply across settings.

One example of ongoing work to clarify practices that should be recommended is a planned Cochrane systematic review of nonpharmacological interventions for preventing delirium in hospitalized non-intensive care unit (ICU) patients.[1] A 2019 systematic review that focused on the effectiveness of nonpharmacological interventions in reducing the incidence and duration of delirium in critically ill patients concluded that "current evidence does not support the use of non-pharmacological interventions in reducing incidence and duration of delirium in critically ill patients" and recommended further research with clearly defined outcomes.[2] A 2019 Cochrane systematic review that targeted older adults in institutional long-term care (LTC) found only limited evidence on interventions for preventing delirium in the LTC setting.[3] However, a 2016 Cochrane systematic review including hospitalized non-ICU patients found moderate to strong evidence that "multicomponent interventions can prevent delirium in both medical and surgical settings and less robust evidence that they reduce the severity of delirium."[4] Hshieh and colleagues (2015) performed a meta-analysis to evaluate effectiveness of multicomponent nonpharmacological interventions in the acute care setting and found that such interventions could reduce delirium by 53 percent.[5]

Importantly, too, another recent Cochrane systematic review, which focused on pharmacological interventions for the treatment of delirium in critically ill adults, did not reach conclusions supporting the prescription of any medications to seek to avoid delirium-associated harms.[6] In recent systematic reviews examining antipsychotics for treating and preventing delirium in hospitalized adults, researchers found that current evidence does not support routine use of haloperidol or second-generation antipsychotics for prevention or treatment of delirium.[7,8] There is limited evidence that second-generation antipsychotics may lower the incidence of delirium in postoperative patients, but more research is needed. Future trials should use standardized outcome measures.

This chapter discusses three patient safety practices (PSPs) focused on delirium: use of screening and assessment tools for recognition of patients with delirium; training and education of staff to recognize signs and symptoms of delirium; and nonpharmacological interventions aimed at prevention or reduction of delirium among critically ill patients in intensive care.

Background

Delirium is the term used to refer to an acute decline in attention and cognition that constitutes a serious problem for older hospitalized patients and many residents in LTC facilities. Precipitating risk factors for delirium include acute illness, surgery, pain, dehydration, sepsis, electrolyte disturbance, urinary retention, fecal impaction, and exposure to high-risk medications. It is the most common complication among hospitalized individuals 65 years and over. Delirium in older hospitalized patients

ranges from 14 to 56 percent, with hospital mortality rates ranging from 25 to 33 percent.[9,10] Adults over 65 years of age account for 48 percent of all delirium-associated hospital days. Delirium is associated with increased mortality, postoperative complications, longer lengths of stay, functional decline, and significant financial costs.[11]

One study estimated that delirium is unrecognized in about 60 percent of all cases.[12] This statistic is particularly troubling, as early detection of delirium has been demonstrated to improve health outcomes. However, to recognize delirium, it is necessary to know the older adult's baseline health status so that any changes—which can occur within hours—can be quickly identified. Therefore, older adults should be assessed frequently using standardized tools so that up-to-date baseline information is readily available. Further, appropriate training and education for staff in recognizing and treating delirium should be provided.

Importance of Harm Area

With a longstanding and still-growing body of evidence pointing to significant health and financial impacts of delirium on hospitalization and other healthcare costs,[9-11] it is clear that individuals at risk for delirium should be identified as quickly as possible and preventive strategies should be implemented early in an encounter with the healthcare system. Affected individuals should be followed after discharge to mitigate any long-term effects of delirium after a hospital stay or other medical treatment.

Focusing patient safety efforts on delirium is appropriate, given that the problem is common and associated with serious complications, and is increasing in magnitude as the population ages. Delirium may be preventable in certain circumstances—with some estimates finding delirium preventable in 30 to 40 percent of cases[13]—thereby increasing quality and safety of care, as well as reducing costs to the healthcare system. Awareness of these costs can drive improvement in screening and assessment of individuals at risk for onset of delirium, and in further study of treatment strategies that both reduce costs of care and improve quality of life. Healthcare professionals need adequate training and education to be vigilant and effective in assessing their patients for delirium in all healthcare settings.[12,13]

Methods for Selecting Patient Safety Practices

Initial literature searches for PSPs in the delirium harm area were conducted, focusing on systematic reviews and guidelines. Results of these searches were reviewed by harm-area task leads to identify PSPs, iterate on searches as needed, and refine lists of potential PSPs on which to focus this chapter of the report. Afterward, the project Technical Expert Panel and Advisory Group were engaged via a survey to prioritize PSPs for inclusion in the report. These survey results, along with refined recommendations for PSP inclusion, were submitted to the Agency for Healthcare Research and Quality (AHRQ) for review. After several rounds of review with AHRQ, three delirium PSPs were selected.

What's New/Different Since the Last Report

The previous Making Healthcare Safer reports focused on the prevention of delirium in older hospitalized patients and the effectiveness and safety of in-facility multicomponent delirium prevention programs. This review focuses on evidence regarding the use of delirium screening tools to aid in the identification of individuals at risk for the development of delirium, and on education and training of staff in the identification of individuals at risk for developing delirium. In addition, this review looks at the contributing factors to delirium in a variety of care settings and strategies to appropriately manage

delirium as well, as nonpharmacological interventions aimed at prevention or reduction of delirium among critically ill patients in intensive care.

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14.1 PSP 1: Delirium Screening and Assessment

14.1.1 Practice Description

Key Findings:

- The tools most frequently used and evaluated in this review were the Confusion Assessment Method (CAM) and the Confusion Assessment Method-Intensive Care Unit (CAM-ICU).
- These tools have been tested singly and in comparison with other tools to determine concordance.

Delirium, a clinical diagnosis, is often unrecognized and easily overlooked.[1] Recognition requires brief cognitive screening and astute clinical observation. Key diagnostic features include an acute onset and fluctuating course of symptoms, inattention, impaired level of consciousness, and disturbance of cognition (e.g., disorientation, memory impairment, alteration in language).[2] Supportive features include disturbance in sleep-wake cycle, perceptual disturbances (hallucinations or illusions), delusions, psychomotor disturbance (hypo- or hyper-activity), inappropriate behavior, and emotional lability.

There is no widely accepted pharmacological means of preventing delirium in the at-risk population over 65 years of age. Consequently, multicomponent approaches for primary prevention of delirium have gained widespread acceptance as the most effective strategies for addressing delirium.

While a single factor may put a patient at high risk for developing delirium, it is more likely that a combination of risk factors, including multimorbidity, dementia, certain medications, and isolation, place an individual at a much higher risk, especially if he or she is over 65 years of age. The leading risk factors of delirium consistently reported at hospital admission are dementia or cognitive impairment, functional impairment, vision impairment, history of alcohol abuse, and advanced age (> 70 years). Comorbidity burden or presence of specific comorbidities (e.g., stroke, depression) are associated with an increased risk of delirium in all patient populations.

14.1.2 Methods

This review sought to identify evidence regarding performance properties of screening and assessment tests for delirium. Two databases (CINAHL® and PubMed/MEDLINE®) were searched using Boolean operators for terms including “delirium/prevention AND control,” “delirium/diagnosis,” “diagnostic techniques and procedures,” “structured approach,” “screening,” “assessment,” and “confusion assessment model.” The search was restricted to articles published from 2008 to 2018. The initial search yielded 331 results. Once duplicates were removed and relevant articles from reference lists returned in the search were added, a total of 274 articles were screened for inclusion, and a subset of full-text articles were retrieved and reviewed. Of those, 28 were selected for inclusion in this review. Articles were excluded if the outcomes were not directly relevant to the PSP addressed in this review. The search was designed to exclude literature related to alcohol-withdrawal delirium.

General methods for this report are described in the Methods section of the full report.

For this patient safety practice, a PRISMA flow diagram and evidence table, along with literature-search strategy and search-term details, are included in the report appendixes A through C.

14.1.3 Review of Evidence

Key findings are highlighted in the Key Findings box above.

The tools most frequently used and evaluated in this review were the Confusion Assessment Method (CAM)[3] and the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). In the studies reviewed, these are tested singly and in comparison with other tools to determine concordance.

Other tools tested include the emergency department (ED) screening form,[4] selected International Classification of Diseases-Clinical Modification (ICD-CM) Version 9 tools, Memorial Delirium Assessment Scale (MDAS),[5,6] short- and long-delirium severity forms, Richmond Agitation Sedation Scale (RASS),[7] three-minute diagnostic interview (3D)-CAM,[8,9] Delirium Rating Scale (DRS)-R98,[10-12] Diagnostic and Statistical Manual of Mental Disorders (DSM) tools, Nursing Delirium Screening Checklist/Scale (NuDESC),[13-15] Intensive Care Delirium Screening Checklist (ICDSC),[16-18] Delirium Detection Score (DDS),[13] Mini-Mental State Examination (MMSE),[19] Delirium Early Monitoring System (DEMS),[20] the Sour Seven Questionnaire,[21] the Neelon and Champagne (NEECHAM),[5] and the family version of the CAM (Family-CAM).[22,23] In the majority of the studies, the CAM tool was evaluated as the most useful.

In their review, Adamis and colleagues (2010) found that the evidence-based screening tools CAM, DRS, MDAS, and NEECHAM were all sufficiently validated "robust and useable."[5]

The following studies examined performance properties of available tools, typically comparing CAM to another tool: Adamis et al., 2010, Adamis et al., 2015, De and Wand, 2015, Gelinas et al., 2018, and Kuczmarska et al., 2016.[5,9,10,13,24]

Most of the other studies reviewed involved assessment of performance at the bedside in various settings:

- In acute care: Khan et al., 2012, Kuczmarska et al., 2016, Adamis et al., 2016, Neufeld et al., 2013, Radtke et al., 2008, Neufeld et al., 2011, Ringdal et al., 2011, Rippon et al., 2016, Shulman et al., 2016, O'Regan et al., 2014, and Rice et al., 2011.[7,9,11,14,15,18-21,25,26]
- In ICU: Khan et al., 2012, Boettger et al., 2017, van Eijk et al., 2009, Mistarz et al., 2011, Moon et al., 2018, and Vasilevskis et al., 2011.[7,16,17,27-29]
- In palliative care: Rainsford et al., 2014, and Ryan et al., 2009.[12, 30]
- In the ED: Arendts et al., 2017, and Frisch et al., 2013.[4,31]
- With family/caregivers: Bull et al., 2017, Steis et al., 2012, and Flanagan et al., 2016.[22,23,32]

Marcantonio (2014) used the 3D-CAM to evaluate 201 patients aged 75 and older, who had been admitted to general medicine or geriatric medicine services. Compared with the reference standard delirium diagnosis, the 3D-CAM had a sensitivity of 95 percent (confidence interval [CI], 90 to 97%) resulting in a positive likelihood ratio of 16.8 (95% CI, 8.9 to 31.9) and a negative likelihood ratio of 0.05 (CI, 0.01 to .20). In followup analyses, the sensitivity of the 3D-CAM improved to 96 percent and specificity to 98 percent.[8]

The CAM has also expanded into communities with its FAM-CAM version. Steis (2012) did an exploratory analysis of agreement between two primary studies: the eCare for Eldercare pilot study and the Hospital to Home: Cognitively Impaired Elders/Caregivers study. Researchers found that overall agreement between the CAM and FAM-CAM was 96 percent. Compared with the original CAM, the FAM-CAM had a sensitivity of 88 percent (95% CI, 47 to 99) and specificity of 98 percent (95% CI, 86 to 100).[23]

As part of its "Try This" series, the Hartford Institute for Geriatric Nursing has produced a two-page fact sheet on the CAM tool. It can be accessed at https://consultgeri.org/try-this/general-assessment/issue-13.pdf.

In the intensive-care setting, van Eijk (2009) compared a variety of screening tools and found that the CAM-ICU showed superior sensitivity and negative predictive value (64% and 83%, respectively) compared with the ICDSC (43% and 75%, respectively). The ICDSC showed higher specificity and positive predictive value (95% and 92% vs. 88% and 72%).[17] Neufeld (2013) compared the CAM-ICU with the NuDESC tool. The CAM-ICU had a sensitivity of 28 percent and a specificity of 98 percent. The NuDESC (using a threshold of >/- 2) had similarly high specificity of 92 percent and low sensitivity of 32 percent. If the threshold was >/-1, the sensitivity improved but the specificity was reduced.[14]

Arendts (2017) developed an ED delirium screening form and tested it in two tertiary hospitals. There was an absolute increase in delirium diagnosis of 2 percent across the study phases, but it was statistically insignificant (Pearson chi-square = 2.49, p=0.29).[4]

Mistarz and colleagues (2011) demonstrated the importance of using a structured assessment tool in the ICU rather than relying on routine nurse-patient interactions. The presence of delirium was identified by nurses in routine care in only 27 percent of CAM-ICU delirium-positive assessments in this study.[27] In their small, convenience-sample hospital study, Rice et al. (2011) documented a significant rate of nurse under-recognition of delirium in using the CAM in comparison with researcher results, pointing to a need for more research into clinical decision-making processes that nurses use in assessing acute cognitive changes and in identifying strategies to improve delirium recognition.[26] Vasilevskis and colleagues (2011) made similar observations in their ICU-focused study.[29]

Most of the studies reviewed found that the CAM or one of its variations and associated tools was reliable in identifying delirium patients. More studies comparing CAM tools to others available, such as the NuDESC, are needed in real-world practice and in a wide variety of settings other than hospitals and the ICU. New tools need to be evaluated and compared to the CAM as they are developed, especially in settings other than acute care. Attention will have to be paid to how long it takes to assess patients using these tools and the ability of clinicians to accurately use them.

14.1.4 Resources

There are many resources available on how to implement assessment and screening on all patients who are deemed at risk for developing delirium while hospitalized, including the following:

- Hartford Institute for Geriatric Nursing: https://consultgeri.org/try-this/general-assessment/issue-13.pdf
- Hospital Elder Life Program (HELP): https://www.hospitalelderlifeprogram.org/
- American Nurses Association: https://www.nursingworld.org/practice-policy/work-environment/health-safety/delirium/
- American Academy of Family Physicians: https://www.aafp.org/afp/2014/0801/p150.html

- Fong TG, Tulebaev SR, Inouye SK. Delirium in elderly adults: Diagnosis, prevention and treatment. Nat Rev Neurol. 2009;5(4):210-20. doi: 10.1038/nrneurol.2009.24.[33]

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14.2 PSP 2: Staff Education and Training

14.2.1 Practice Description

Given the significant impact of delirium on the well-being, safety, and morbidity/mortality of impacted individuals, it is of increasing importance for clinicians to be better educated and trained on how to perform delirium assessments and develop plans of care for those with delirium that focus on maintaining their safety and quality of care after discharge.

Key Findings:

- Studies find a need for more education and training to identify individuals at risk for developing delirium, the contributing factors for delirium in a variety of care settings, and strategies to appropriately manage delirium.
- Consideration should be given to implementing the Acute Care for the Elderly (ACE) model.
- Education and training using a variety of modalities—e-learning, partnering ACE units with non-ACE units, combining didactic course work with simulation or supervised clinical practice with feedback from experts—has shown promise.

14.2.2 Methods

This review sought to identify evidence regarding education and training of staff in the identification of individuals at risk for delirium and in appropriate delirium management. Two databases (CINAHL® and PubMed/MEDLINE®) were searched using Boolean operators for combinations of terms, including "delirium," "education," "in-service," "staff training," "physician," "nurse," "physical therapist," "social worker," and similar words. Selected articles were published from 2008 to 2018, and the initial search yielded 436 results. Once duplicates were removed and relevant articles from reference lists returned in the search were added, a total of 384 articles were screened for inclusion, and a subset of full-text articles were retrieved and reviewed. Of those, 27 were selected for inclusion in this review. Articles were excluded if the outcomes were not directly relevant to the PSP addressed in this review. The search excluded literature related to alcohol-withdrawal delirium.

General methods for this report are described in the Methods section of the full report.

For this patient safety practice, a PRISMA flow diagram and evidence table, along with literature-search strategy and search-term details, are included in the report appendixes A through C.

14.2.3 Review of Evidence

Key findings are highlighted in the Key Findings box above.

Reviewed studies identified a need for more education and training in the identification of individuals at risk for developing delirium, the contributing factors to delirium in a variety of care settings, and strategies to appropriately manage delirium. Healthcare providers and institutions should evaluate their training requirements in this area, and their specific patient populations, to plan appropriate education and training for their staff. Consideration should also be given to identifying a nursing unit where the Acute Care for the Elderly (ACE) model can be implemented if patient volume is high enough to warrant this. Some hospitals are using ACE resource nurses to support staff on other units where patients at risk for delirium are receiving care.

14.2.3.1 Improving Providers' Use of Screening and Assessment Tools

Many reviewed studies focused on improving providers' use of delirium screening and assessment tools, such as the CAM and the ICDSC. Babine and colleagues (2018) used the CAM in their study of the impact of delirium education efforts on falls and length of stay in the acute care setting, and their results suggest that interprofessional education can improve both of these outcomes.[1] Sockalingam and colleagues performed a systematic review in 2014 that suggested that interprofessional education programs may positively influence team and patient outcomes in delirium care and noted that more studies are needed.[2] Sockalingam et al. (2016) implemented a novel "flipped classroom" and train-the-trainer approach to interprofessional education in hospitals and found that this improved participants' perceived delirium care skills and confidence, as well as delirium knowledge. [3] Gordon and colleagues (2013) used didactic sessions and expert coaching at the bedside to improve nurses' ability to correctly use evidence-based delirium assessment tools for patients in a neuroscience intermediate care unit.[4] In a 2018 study conducted by Wong et al. in two academic hospitals in Canada, orthopedic-unit nurses who used the CAM daily participated in one of eight focus group sessions. While this group had mixed feelings about the CAM itself, only 35 percent of participants recalled receiving training on the tool in the past.[5] Young et al. (2012) assessed hospitalists' knowledge of the CAM and found that 82 percent had never used or heard of it, and only three respondents in this study felt proficient in its use.[6]

In the ICU setting, Devlin et al. (2008) found that use of both didactic and clinical reasoning–based educational efforts significantly improved nurses' ability to identify delirium using standardized tools. After the educational intervention in this study, the number of nurses able to evaluate delirium using any scale improved from 12 percent to 82 percent. Compliance with performing at least one delirium assessment every shift improved from 85 percent to 99 percent during the post-intervention period in this study.[7] DiLibero and colleagues (2016) made similar observations in their study in the ICU and a cardiac care unit, and they used a feedback loop, real-time auditing, and just-in-time learning techniques in their work.[8] Using the ICDSC and a multifaceted education program in the ICU setting, Gesin and colleagues (2012) found that these efforts resulted in the ability of nurses to evaluate delirium correctly.[9] Marino et al. (2015) found an increase in nurses' awareness and knowledge of ICU delirium following a formal didactic training program in the use of the ICDSC and better staff preparation for how to properly screen and manage patients.[10] In an effort to teach ICU nursing staff how to use the CAM-ICU to best effect, Nelson (2009) observed that assisting nurses with embracing the tool as part of their routine assessment activities, rather than as something added on, is essential to making improvements in this important screening and assessment step in the care of their patients.[11]

In 2017, in a Scottish study Baird and Spiller compared the CAM to the Four As Test (4AT) for assessing cognition in admitted hospice patients, with staff preferring the 4AT and the perception generally being that this tool can easily be incorporated into the admission process.[12]

Horvath and colleagues (2011) found that a low-tech, easy-to-use pocket card and assessment guide to evaluate delirium received favorable reception from an interdisciplinary group of clinical providers. This effort was disseminated systemwide in the U.S. Veterans Health Administration (VHA) primary care system.[13]

14.2.3.2 Improving Education and Training for Providers

Several researchers have examined how to better educate nurses and physicians on the care of the patient with delirium, utilizing a variety of modalities, including e-learning and partnering ACE units with non-ACE units. Detroyer (2018) developed an e-learning tool and found it to be a relatively easy and cost-effective way to educate nurses on delirium screening and management. However, no significant difference was found between the intervention cohort and the non-intervention cohort for in-hospital prevalence and duration of delirium in this study.[14]

In their study focusing on a narrative-based educational intervention for nurses in hospital units with a high incidence of delirium, Belanger and Ducharme (2015) found the intervention promising upon an initial qualitative assessment.[15] DiLibero et al. (2018) found that a nurse-led multifaceted intervention at a hospital trauma center was effective, with demonstrated improvement in delirium assessment accuracy, from 56.82 percent to 95.07 percent for all patients and 29.79 percent to 92.98 percent for sedated or agitated patients. This team called for more research of this intervention in other institutions and settings.[16] In an inpatient medical-surgical oncology unit, LaFever and colleagues (2015) implemented a delirium education program and found that it increased the nursing staff's delirium knowledge from 69 percent to 86 percent, and their overall confidence about managing delirium patients from 47 percent to 66 percent.[17] Meako et al. (2011) used a curriculum based on the Hartford Institute for Geriatric Nursing's resources and observed that a 1-hour educational intervention improved nurses knowledge; their baseline assessment had confirmed these orthopedic nurses' lack of understanding of delirium best practices.[18]

Focusing on a trauma intensive care unit (TICU), Johnson and colleagues concluded that education provided on causes of delirium, risk factors, strategies to prevent delirium, and routine screening can improve identifying and correctly treating delirium in a critical care setting. Further, their educational program had concrete results in respondents' knowledge about delirium. Changes in staff understanding that ''delirium is largely preventable'' were statistically significant ($p = 0.035$).[19]

Brooke et al. (2018) conducted a phenomenological study of cardiology, elderly care, renal, and respiratory hospital nurses using semi-structured interviews. Themes identified were that sometimes delirium is confusing, there is difficulty distinguishing between delirium and dementia, there is a need for collaborative working among providers, and patient aggression is a significant challenge. These researchers concluded there was a need for education across specialties with a combination of classroom and simulation activities.[20]

Coyle et al. (2017) explored current practices in assessing and identifying delirium in hospitalized older adults with nurses to inform educational initiatives. Themes that emerged in this work showed mixed opinions: assessing and identifying delirium is not my job; assessing and identifying delirium is my job; and assessing and identifying delirium is [too] complex.[21]

With colleagues, Godfrey (2013) developed an educational intervention implementation process aimed at embedding practice change that took a "participatory action research approach" (page 3). As part of this work, they explored knowledge and practices on delirium and delirium prevention, and found that awareness of delirium was variable, with no attention being given to prevention at any staffing level. Delirium prevention was "typically neither understood nor perceived as meaningful" (page 1).[22]

14.2.3.3 Surveying Providers About Educational Needs

Surveys and questionnaires of providers in various settings and types of units indicate that nurses and physicians feel they need more information and education about delirium.

Kennelly et al. (2013) surveyed medical, surgical, and emergency room physicians caring for older patients in the emergency room. This survey was completed by 76/97 (78%) of eligible respondents. About one-third felt they lacked the relevant expertise to perform cognitive screening; those with training in geriatrics were less likely to cite lack of experience as a factor. Seventy-eight percent of respondents felt that screening is important but identified limiting factors, including the following: lack of appropriate screening tools, lack of privacy, too much noise, and time constraints. No consensus emerged on who, ideally, should perform delirium screening.[23]

Nydahl et al. (2018) surveyed critical care nurses and physicians about delirium management in ICUs in Germany. More nurses than physicians reported screening for delirium. A majority reported screening when delirium was suspected, and more than 50 percent used validated instruments. Half of the clinicians surveyed had structures in place, such as a delirium-related process of care. This study's authors concluded that both nurses and physicians need more knowledge and training on when and how to use validated assessment instruments for identifying and managing delirium to improve safety and quality of care.[24]

In 2010, Forsgren and Erikkson conducted a survey of head nurses in Swedish ICUs. They found that assessment of delirium was performed by just 62 percent of these ICUs—commonly by observing symptoms versus using standardized tools. These authors concluded that educational efforts, including use of standardized tools, is necessary.[25]

Some researchers have reported on the provision of delirium training programs, but outcomes about participants' confidence, knowledge, and attitudes and/or clinical outcomes are not measured. Kubota et al. (2016) delivered a 16-hour program (including role-play exercises, group work, and didactic lectures) in a randomized trial for oncology nurses, with content focused on four issues: normal reactions, clinically significant distress, suicidal thoughts, and delirium. Confidence and knowledge (but not attitudes) were significantly improved in the intervention versus the control group. No significant intervention effects were found for job-related stress or burnout. Ninety-eight percent of participants considered this program useful in clinical practice.[26]

Many acute care hospitals have implemented ACE units over the past 20 years.[27] The primary purpose of the ACE model is to reduce adverse outcomes in older adults with frequent interdisciplinary team rounds. During these rounds, geriatric syndromes are recognized and managed, while transition planning is initiated from the day of admission. In previous studies, ACE units have been shown to improve processes of care, prescribing practices, physical functioning, and patient and provider satisfaction. These analyses have also suggested that ACE units help reduce rates of restraint use and institutionalization.

Booth et al. (2019) described a "Virtual ACE intervention" on two medical/surgical units in an academic medical center setting. The Virtual ACE Intervention standardizes care processes for cognition and function without daily geriatrician oversight on two non-ACE units. The Virtual ACE Intervention includes staff training on geriatric assessments for cognition and function and on nurse-driven care algorithms.

Post-intervention, the completion of the assessments for current functional status and delirium had improved from before the intervention (62.5% vs. 88.5%, p .001; 4.2% vs. 96.5%, p 001).[28]

14.2.4 Gaps and Future Directions

The studies reviewed indicated gaps in the education and training of healthcare professionals in the identification and management of individuals with delirium in all care settings. This is important because these patients are a growing population at significant risk for adverse safety events, such as falls. While no particular educational strategy was identified as a best practice, in general the reviewed articles found that a combination of didactic course work combined with either simulation or supervised clinical practice with feedback from experts improved both identification of patients and the ability of staff to implement appropriate strategies to minimize patient harms.

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14.3 PSP3: Nonpharmacological Interventions To Prevent Intensive Care Unit Delirium

14.3.1 Practice Description

The focus of this review is nonpharmacological interventions aimed at prevention or reduction of delirium among critically ill patients in intensive care. Nonpharmacological interventions aimed at prevention or reduction of delirium fall into several domains, including mobility (early mobilization, physical, occupational therapy), environmental (noise reduction, music, light adjustment, ear plugs, eye shades, avoidance of physical restraints), cognitive (reorientation, cognitive activities), and therapeutic (sleep promotion, attention to hearing or vision deficits, nutrition and hydration, minimization of indwelling urinary catheter use).

Key Findings:

- Studies have shown multicomponent nonpharmacological interventions to be effective for reduction of delirium among intensive care patients, although the quality of the evidence is low to moderate.
- Reproducibility and scalability are hindered by a lack of evidence regarding which components of many are required to achieve the desired effect.
- In addition, specific details of implementation required for replication and level of adherence to protocols are not often reported.

14.3.2 Methods

Two databases (CINAHL® and PubMed/MEDLINE®) were searched using Boolean operators for combinations of terms including “delirium/prevention AND control,” “postoperative complications/prevention and control,” “nonpharmacological,” “intensive care unit(s),” “geriatrics,” and “aged.” Articles included were published from 2008 to 2018. The search aimed to retrieve intervention or patient safety practice papers related to nonpharmacological interventions to prevent or manage delirium among older adults in intensive care settings. The search excluded literature related to alcohol-withdrawal delirium, as this particular type of delirium substantively differs from postoperative or intensive care delirium.

A total of 409 records were identified with this strategy. Titles and abstracts were screened, and 76 full-text papers were acquired for more in-depth screening for eligibility for inclusion in this review. Sixty-three articles were excluded for the following reasons: out of scope (n=51); no delirium outcome measured (n=5); clinical, epidemiological, or commentary paper (n=3); only abstract available from conference presentation, with information too limited to summarize (n=3); and a dissertation, not peer-reviewed publication (n=1). Papers were deemed out of scope if the intervention or practice approach included a pharmacological component, such as administration of a medication to prevent or manage delirium, or discontinuation of medications that placed patients at higher risk for experiencing intensive care delirium (e.g., benzodiazepines). Any paper reporting an intervention conducted in a non-intensive care setting was also excluded. These two issues comprised a majority of exclusions since a combination of nonpharmacological and pharmacological interventions is the most common approach to prevention and management of delirium among older adults in intensive care; the incidence of delirium in regular medical or surgical hospital units is high; and research and quality improvement projects focused on prevention are common. This process resulted in inclusion of 13 articles in this review.

General methods for this report are described in the Methods section of the full report.

For this patient safety practice, a PRISMA flow diagram and evidence table, along with literature-search strategy and search-term details, are included in the report appendixes A through C.

14.3.3 Review of Evidence

Key findings are highlighted in the Key Findings box above.

Thirteen manuscripts were included in this review: eight research studies [1-8] and five reviews.[9-13] Of the research studies, four were randomized controlled trials,[1,5,6,8] one a controlled trial,[4] one a cohort study,[2] and two a pre/post quality improvement design study.[3,7] Four of the review papers were systematic reviews,[9,11-13] and one was a narrative review.[10] Studies were heterogeneous in terms of design, interventions, samples, measurement, and outcomes, limiting our ability to quantitatively summarize the evidence.

Nonpharmacological interventions are described in terms of domains, such as cognition, sensorium, function, sleep, or environment. The specific activities that comprise each domain are not consistently described across studies. For example, music therapy may be described as part of a sensory or sleep domain. As another example, light therapy is variously defined as an activity to promote sleep or an environmental intervention. For clarity in this review, specific activities or components of interventions are described to the extent possible.

In the reviewed articles, both single and multiple component interventions were tested, however, no studies examined exactly the same intervention. The setting, as mentioned in the Methods section, was intensive care. The interventions tested varied across studies, with most including multiple components. However, combinations of components differed across studies, further limiting comparability. Seven of the papers in this review reported on a single intervention: three in single studies [2,6,8] and four in systematic reviews.[9,11-13] Three studies reported interventions comprising four components.[1,3,7] Two studies tested interventions with more components, one with six[5] and the other with eight.[4]

Sleep is the focus of most interventions tested, including specific components, such as using eye masks and/or earplugs,[5,11,13] reducing light, reducing noise, clustering care,[4,5,7] and listening to patients.[3-5,7] Four studies provided sensory stimulation and ensured that patients who needed them used eyeglasses and hearing aids.[1,3,5,7] Reorientation activities and/or cognitive exercises were tested in three studies.[1,5,7] Mobility interventions, including early mobilization and other specific physical and occupational therapy activities, were tested in three studies.[1,2,8] Family involvement was mentioned in three studies,[1,2,4] although the exact type of involvement was not described in enough detail to determine the nature of the involvement. Only two studies[4,5] included pre-operative visits to the ICU as a component in their multicomponent interventions. Finally, four components identified in the reviewed papers were noted only once: social/emotional/informational support,[4] placing patients in a single room versus a group ward,[4] supportive nutrition, [5] and avoidance of physical restraints.[5]

14.3.3.1 Clinical Outcomes

The most common clinical outcomes reported were delirium incidence,[2,4,5,7,9,12,13] followed by duration of delirium.[5,7,8,9,12,13] Three papers reported relative risk for development of delirium.[1,6,11] One study reported delirium prevalence.[3] In another, outcomes were not clearly described;[10] the authors made recommendations for practice based on their analysis of the evidence reviewed.

Results related to effectiveness of nonpharmacological interventions are mixed. Nonpharmacological interventions significantly reduced delirium incidence in four trials,[4,5,7,12] while two reported

nonsignificant results [2,12] and one a nonsignificant increase.[12] Statistically significant reduction in duration of delirium was reported in four studies;[5,7-9] one study recorded a nonsignificant reduction. Significant reduction in prevalence of delirium was demonstrated in one study,[9] while a nonsignificant increase was reported in another.[3] Statistically significant reductions in risk of delirium were reported in three studies;[1,7,11] two studies demonstrated nonsignificant reduction.

14.3.3.2 Process Outcomes

As this review focused on the outcome of delirium, process outcomes were typically not considered in the reviewed studies. One study examined adherence to assessment for delirium pre- and post-intervention. Foster and Kelly reviewed 216 assessments pre-intervention, identifying missing data for delirium status in 52 records (24.07%), and reviewed 92 assessments post-intervention, finding missing data in only 8 records (8.69%). Statistical significance of the difference was not reported.[3]

14.3.3.3 Economic Outcomes

None of the research studies reviewed included any type of economic outcomes, although a cost benefit may be inferred from the report of decreased length of stay (LOS) associated with one intervention. Schweickert and colleagues' 2009 study of the effect of early mobility interventions among adult mechanically ventilated patients in the ICU setting demonstrated a decreased LOS in intervention compared with control group patients, which presumably is associated with lower overall hospital costs for the stays.[8]

14.3.3.4 Unintended Consequences

Only one study reported an adverse event. Schweickert and colleagues (2009) examined the effect of early physical and occupational therapy on delirium and functional outcomes among adult ICU patients. In 498 therapy sessions, desaturation (less than 80%) occurred in one patient, an adverse event characterized by the authors as severe. In the same study, 19 (4%) of the rehabilitation therapy sessions were discontinued because of patient instability.[8]

14.3.4 Implementation

Nonpharmacological intervention implementation was not fully described in the reviewed papers, particularly as pertains to details required for reproducibility. Details about adherence to intervention protocols were also lacking.

14.3.5 Gaps and Future Directions

14.3.5.1 Gaps

One or more nonpharmacological interventions are included in multicomponent trials, yet evidence about the relative effectiveness of each component is lacking. Providers interested in implementation of multicomponent nonpharmacological interventions in their own setting to prevent or reduce occurrence of ICU delirium have little guidance about how many and which specific components to include.

As mentioned above, the studies also lack details about specific prescriptions or protocols, guidelines, or clinical pathways that lay out how an intervention is to be carried out. There is currently no widely accepted, standardized approach to implementing nonpharmacological interventions. Finally, despite the general trend of evidence supporting the effectiveness of multicomponent nonpharmacological strategies for prevention and reduction of delirium in intensive care, large-scale methodologically

rigorous studies are lacking. The level and quality of available evidence are mixed, ranging from low to moderate. Given the importance of ICU delirium as a harm area and its implications for short- and long-term outcomes in critically ill patients, further research is warranted.

14.3.5.2 Future Directions

Although reorientation and interaction are hallmarks of multicomponent nonpharmacological programs, emerging research is exploring more specific cognitive training exercises that may prevent or reduce severity or duration of delirium in the ICU. Wassenaar and colleagues (2018) conducted a two-phase pilot study with ICU adult delirious and non-delirious patients to determine the feasibility of selected cognitive training exercises. Feasibility was assessed via surveys of patients and ICU nurses in multiple dimensions: difficulty, burden, exhaustion, clarity, fun factor, and general appreciation. Exercises that patients scored as more difficult or burdensome, not easy to understand, not fun, and/or very tiring were deleted following phase 1 of the pilot test. The remaining exercises tested in phase 2 of the study were found to be feasible among cooperative delirious and non-delirious patients.[14] Among several nonpharmacological interventions for prevention of delirium, future research may investigate the effect of these exercises on delirium and other outcomes.

Multidisciplinary team-based approaches have shown promise in preventing or improving management of delirium, involving collaboration among physicians, nurses, social workers, and engaged families and caregivers. The American Nurses Association (ANA) 2016 publication "Delirium: A Nurse's Primer" is an important resource in this harm area. A 2016 ANA Delirium Workgroup also published a set of prevention strategies that is a valuable resource.

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Conclusion and Comment

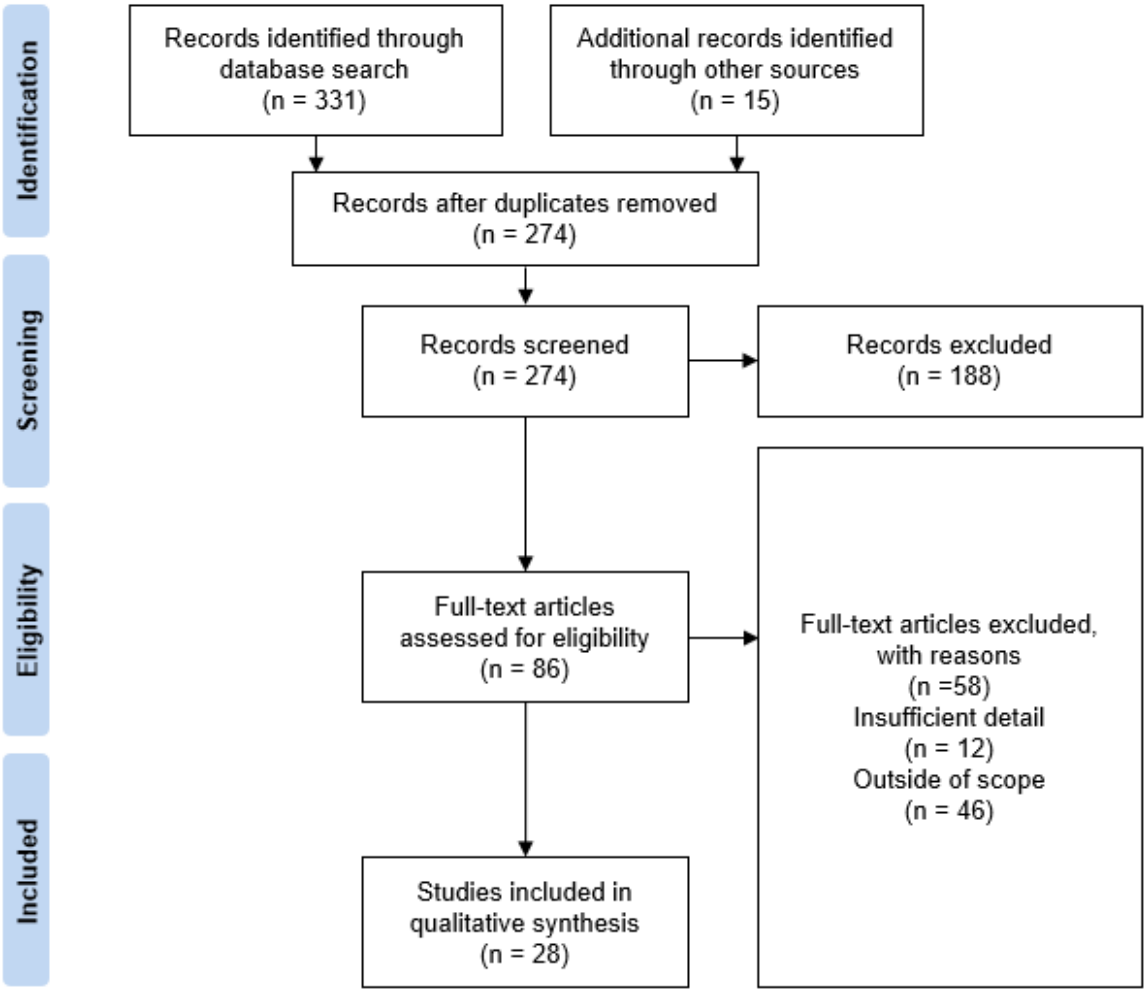
Large-scale, methodologically rigorous studies are lacking, despite a general trend of evidence supporting the effectiveness of multicomponent nonpharmacological strategies for prevention and reduction of delirium. Given the importance of delirium as a harm area in many healthcare settings, additional research appears necessary. The results of this review highlight the need for evidence-based tools that can be readily used by frontline caregivers to reliably assess and re-assess patients for signs/symptoms of delirium, whether they are in acute care or in a variety of post-acute care settings.

Early identification of delirium and the application of best practices to reduce harm with these populations at risk for delirium are crucial to maintaining patients' functional capabilities and improving their safety in the healthcare system. The literature is clear that unrecognized, untreated delirium leads to adverse events such as falls, polypharmacy, restraints, and readmissions. Studies reviewed found that the CAM or one of its variations and associated tools was reliable in identifying delirium patients. More studies should compare the CAM to other instruments available, such as the NuDESC, and in settings other than the hospital and intensive care environments. New tools should also be evaluated as they are developed, again especially in settings other than acute care. Attention will have to be given to how long it takes to assess patients using these tools and the ability of clinicians to accurately use them. Additional time may be needed for ongoing training and evaluation of competence in using methods and tools specific to a particular institution.

There is clearly an ongoing need for inclusion of delirium as an important patient safety topic in the education and training of clinicians and other providers including nurses, physicians, pharmacists, and social workers, especially as our population continues to rapidly age. Education and training utilizing a variety of modalities—including e-learning, partnering ACE units with non-ACE units, and combining didactic course work with either simulation or supervised clinical practice with feedback from experts—have shown promise.

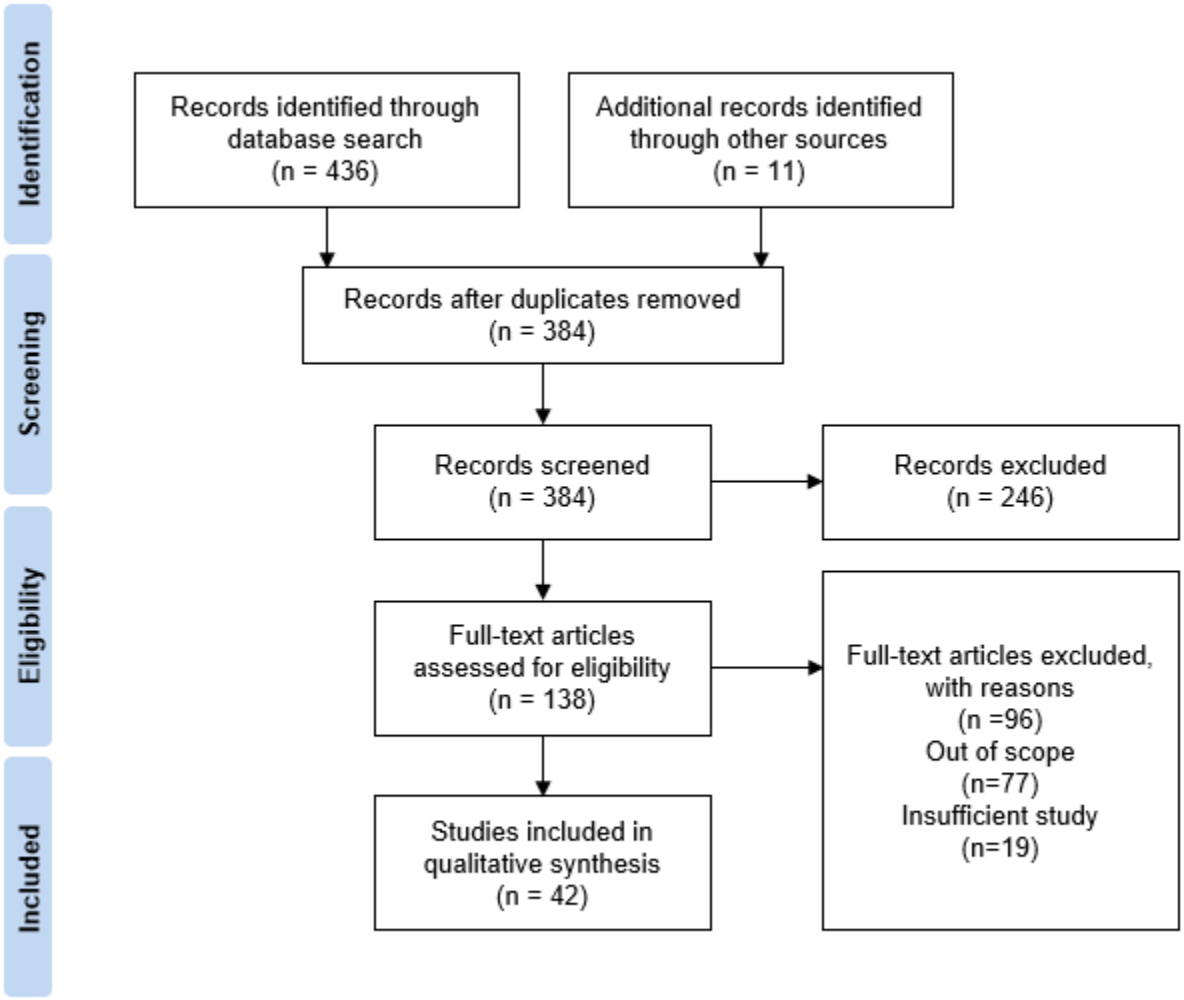
Appendix A. Delirium PRISMA Diagrams

Figure A.1: Delirium, Screening and Assessment—Study Selection for Review



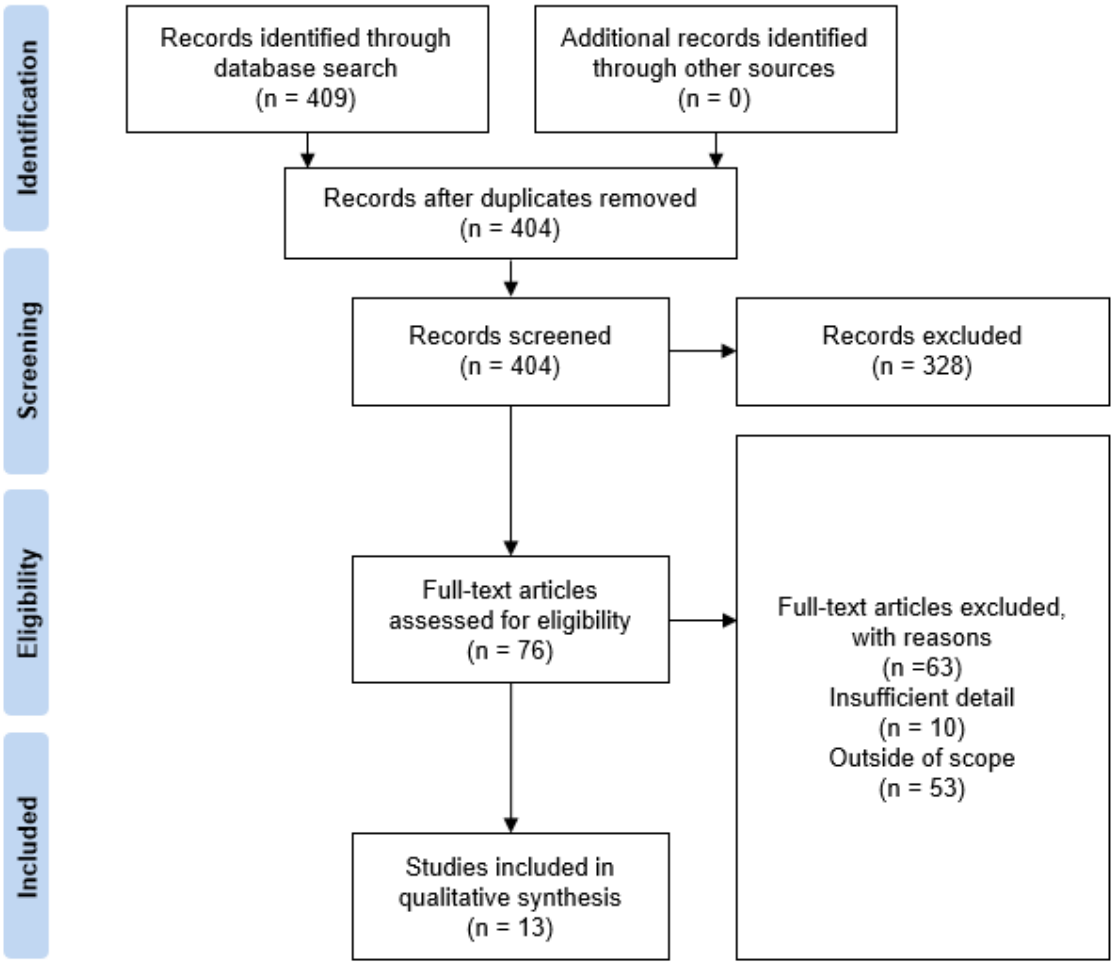
Criteria as described by Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

Figure A.2: Delirium, Staff Education and Training—Study Selection for Review



Criteria as described by Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

Figure A.3: Delirium, Nonpharmacological Interventions To Prevent Intensive Care Unit Delirium—Study Selection for Review



Criteria as described by Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

Appendix B. Delirium Evidence Tables

Table B.1: Delirium, Screening and Assessment–Single Studies

Note: Full references are available in the Section 14.1 reference list.

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcomes: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Adamis et al., 2010[5]	Evaluation of evidence-based assessment tools	Literature review; sample size range 47–432; older adults	Acute care	The Confusion Assessment Method (CAM), Delirium Rating Scale (DRS), DRS-Revised-98 (DRS-R-98), Memorial Delirium Assessment Scale (MDAS), and Neelon and Champagne (NEECHAM) confusion scale are sufficiently validated.	Not provided	Not provided	Low
Adamis et al., 2015[10]	Comparison of four different tools to identify delirium	Prospective observational study; 200 patients; adults aged 70+	University teaching general hospital	Agreement between Diagnostic and Statistical Manual-5 (DSM-5), DSM-IV, DRS-R-98, and CAM were all significant. Highest agreement was between DSM and DRS-R-98, while lowest agreement was between DSM-IV and DSM-5.	Not provided	Not provided	Low
Adamis et al., 2016[11]	Comparison of clock drawing test as screening tool (with DRS)	Prospective, observational, longitudinal study; 200 patients; adults aged 70+	Acute medical wards of general hospital	There was a significant negative correlation between the Clock Drawing Test (CDT) and DRS-R-98 (Pearson correlation r= -0.62, p<0.0010), CDT and CAM (Spearman's rho=-0.40, p<0.001), CDT and Montreal Cognitive Assessment (MoCA) (Pearson's r=0.69, p<0.001), and CDT and MoCA (Pearson's r=0.77, p<0.001).	Not provided	Not provided	Moderate
Arendts et al., 2017[4]	Use of Emergency Department (ED) Delirium Screening Form	Prospective three-phase trial; 3,905 patients; adults age 65+ admitted to an inpatient hospital bed from the ED	EDs of two tertiary hospitals	An absolute increase in delirium diagnosis of 2% across study phases was statistically insignificant (Pearson chi-square=2.49, P=0.29).	Not provided	Not provided	Not provided

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcomes: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Boettger et al., 2017[16]	Comparison of CAM and Intensive Care Delirium Screening Checklist (ICDSC) for delirium in intensive care unit (ICU) patients	Prospective, descriptive cohort study; 210 patients; adults under intensive care management for more than 18 hours	Twelve-bed ICU at level one trauma center	Agreement was moderate between the CAM-ICU and DSM-IV-TR (k=0.44, p<0.001), the ICDSC and DSM-IV-TR (k=0.60, p<0.001), and the CAM-ICU and ICDSC (k=0.56, p<0.001).	Not provided	Not provided	Low
Bull et al., 2017[22]	Evaluating telephone-based screening for delirium to be used by family members	Pre-post, quasi-experimental design; 34 family caregiver-older adult dyads; older adults aged 70+ who underwent joint surgery	Orthopedic clinic at a Veterans Affairs Medical Center	There was 94% agreement (32 out of 34) between the Family Confusion Assessment Method (FAM-CAM) and the researcher-led CAM 2 days after the patient's surgery. Cohen kappa for agreement was moderate (k=0.477; p=0.001). Two family caregivers reported positive FAM-CAM ratings during the 2 weeks after hospitalization, which led to the physician changing the prescribed pain medication.	Not provided	Not provided	Moderate
De et al., 2015[24]	Screening tools for culturally and linguistically different populations	Systematic review; hospitalized adult inpatients	Hospital, excluding ICU	CAM, DRS, Nursing Delirium Screening Scale (NuDESC), sleep quality rating, MDAS, 4 A's Test (4 AT)	Not provided	Not provided	Moderate
Van Eijk et al., 2009[17]	Comparison of screening tools (CAM-ICU vs. ICDSC)	One hundred twenty-six patients (mean age = 62.4 years)	Thirty-two-bed mixed medical and surgical ICU	The CAM-ICU showed superior sensitivity and negative predictive value (64% and 83%) compared with the ICDSC (43% and 75%). The ICDSC showed higher specificity and positive predictive value (95% and 82% vs. 88% and 72%). The sensitivity of the physician's view was only 29%.	Not provided	Not provided	Low

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcomes: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Flanagan and Spencer, 2016[32]	Use of CAM in post-acute patients—informal caregivers	Community-dwelling older adults aged 65+ admitted to postacute care (rehabilitation or skilled nursing center) with the intention of returning to community living and their family member/informal caregivers. The participants had to be English-speaking and have a caregiver willing to participate in the study.	Post-acute care	The FAM-CAM highly correlates with the confusion assessment method and diagnostic and statistical manual of mental disorders text revision criteria for detecting delirium in older adults in the postacute care setting.	Not provided	This study was a convenience sample; subjects were not randomized. The sample size was small, which limits generalization of the findings. A replication of this study with a larger sample size, as well as additional sites, would be beneficial.	Moderate
Frisch et al, 2013[31]	Tools for assessing patients in transport by emergency medical services staff; compared CAM to Glasgow Coma Scale (GCS)	A convenience sample of matched dyads of emergency medical services providers and elderly patients (age ≥65 years)	Two academic, tertiary-care EDs	Prehospital providers' recognition of any delirium symptom resulted in a sensitivity of 0.63 (95% confidence interval [CI] 0.43–0.79) and a specificity of 0.74 (95% CI 0.73–0.84). Prehospital report of a GCS <15 has a sensitivity of 0.67 (95% CI 0.47–0.82) and a specificity of 0.85 (95% CI 0.80–0.89).	Not provided	Not provided	Moderate

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcomes: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Gelinas et al., 2018[13]	Evaluation of nursing assessment tools for delirium in ICU	Systematic review; two independent reviewers analyzed the psychometric properties of five delirium assessment tools by using a standardized scoring system (range, 0–20) to assess the development process, reliability, validity, feasibility, and implementation of each tool	Intensive care	Psychometric properties were very good for the CAM-ICU (19.6) and the ICDSC (19.2), moderate for the NuDSS (13.6), low for the Delirium Detection Score (DDS) (11.2), and very low for the Cognitive Test for Delirium (8.2).	Not provided	Not provided	Low
Khan et al., 2012[7]	Evaluation of Richmond Agitation-Sedation Scale (RASS) and Riker Sedation-Agitation Scale (SAS) in identifying patients eligible for delirium assessment	Quality improvement project; 975 patients; patients aged 18 and older admitted to the ICU	Four hundred fifty-seven-bed university-affiliated urban public hospital	The Spearman rank correlation between the RASS and SAS scores was estimated at 0.91; 70.1% of screens were eligible for CAM-ICU assessment using RASS ≥-3 compared with 72.1% using SAS ≥3. The agreement between RASS and SAS for assessing CAM-ICU eligibility as estimated by the k coefficient was 0.93.	Not provided	Not provided	Not provided
Kuczmarska et al., 2016[9]	Evaluated CAM-ICU and 3D-CAM for hospitalized general medical/surgical patients	Hospitalized general medicine patients aged ≥75 years	Two non-intensive care general medicine units at a single academic medical center	The sensitivity (95% CI) of delirium detection for the 3D-CAM was 95% (74%, 100%) and for the CAM-ICU was 53% (29%, 76%), while specificity was >90% for both instruments. Subgroup analyses showed that the CAM-ICU had sensitivity of 30% in patients with mild delirium vs. 100% for the 3D-CAM.	Not provided	Not provided	Moderate

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcomes: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Marcantonio et al., 2014[8]	Derivation and validation of 3D-CAM	Prospective validation study; 201 patients; adults aged 75+ admitted to general medicine or geriatric medicine services	Large urban teaching hospital	Compared with the reference standard delirium diagnosis, the 3D-CAM had a sensitivity of 95% (CI 90 to 97%), resulting in a positive likelihood ratio of 16.8 (95% CI 8.9 to 31.8) and a negative likelihood ratio of 0.05 (CI 0.01 to 0.20). In post-hoc analyses, sensitivity of the 3D-CAM improved to 96% and specificity to 98%.	Not provided	Not provided	Not provided
Mistarz at al., 2011[27]	Demonstrated importance of using a structured assessment tool rather than relying on nursing documentation	Bedside nurses assessed 35 patients for delirium during routine patient care throughout their shift; this assessment was then compared to an independent assessment using the CAM-ICU performed by a nurse trained in this delirium detection tool	A 12-bed general ICU	Not provided	There was a significant discrepancy between the ICU bedside nurses' assessment of delirium and the independent formal delirium assessment using the CAM-ICU. Routine bedside nursing patient interactions do not reliably detect delirium in a critically ill patient.	Not provided	High

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcomes: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Moon et al., 2018[28]	Building delirium assessment tool into electronic health records; used CAM tool	Participants: a total of 3,284 patients for the development of Auto-DelRAS, 325 for external validation, 694 for validation after clinical applications	Medical and surgical ICUs in two university hospitals in Seoul, Korea.	The predictive validity, analyzed after the clinical application of Auto-DelRAS after 1 year, showed a sensitivity of 0.88, specificity of 0.72, positive predictive value of 0.53, negative predictive value of 0.94, and a Youden index of 0.59. A relatively high level of predictive validity was maintained with the Auto-DelRAS system, even 1 year after it was applied to clinical practice.	Not provided	Not provided	Moderate
Neufeld et al., 2011[18]	CAM-ICU and ICDSC in non-critically ill hospitalized patients	Not provided	Two medical oncology units at a large teaching hospital	Not provided	This study suggests that in non-critically ill hospitalized patients, the CAM-ICU and ICDSC intensive care delirium screening tools are not adequately sensitive for use in routine clinical practice.	Not provided	Low
Neufeld et al., 2013[14]	Comparison of CAM-ICU with NuDESC	Prospective study; 91 patients; adults aged 70+ receiving general anesthesia during surgery	One teaching hospital	CAM-ICU had sensitivity of 28% (95% CI 16 to 45) and specificity of 98% (95% CI 88 to 100). NuDESC (threshold ≥2) had similarly high specificity of 92% (95% CI 80 to 97) and low sensitivity of 32% (95% CI 19 to 48). The NuDESC (threshold ≥1) had improved sensitivity (80%; 95% CI 65 to 91) but reduced specificity (69%; 95% CI 54 to 80).	Not provided	Not provided	Not provided

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcomes: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
O'Regan et al., 2014[25]	Spatial Span Forwards (SSF) and months of the year backwards (MOTYB) as bedside screening tests to detect delirium	Cross-sectional study; 265 patients; adult inpatients excluding patients in the ED, ICU, and hematology/burns isolation unit	Large tertiary referral hospital	MOTYB was most accurate of the three, with a sensitivity of 83.3% (95% CI 69.8 to 92.5) and specificity of 90.8% (95% CI 86.1 to 94.3). SSF5 had high sensitivity (91.7%, 95% CI 80 to 97.6) but low specificity (69.12%, 95% CI 62.5 to 75.2). SSF4 had the lowest sensitivity (77.1%, 95% CI 62.7 to 87.9)	Not provided	Not provided	Not provided
Radtke et al., 2008[15]	Use of CAM, NuDESC, and DDS	Observational study; 154 patients; adults aged 18+ admitted to recovery room after general anesthesia	Recovery room of hospital	The CAM had a sensitivity of 0.43 and specificity of 0.985; the DDS had sensitivity of 0.14 and specificity of 0.99; the Nu-DESC had sensitivity of 0.95 and specificity of 0.87. Sensitivity between the CAM and DDS did not differ significantly (p=0.07). The NuDESC was most sensitive compared to the DDS (p<0.001) and CAM (p=0.003). Specificity did not differ significantly between scores.	False positives were 1.5% for CAM, 12.8% for the Nu-DESC, and 0.8% for the DDS. False negative rates were 57% for the CAM, 85% for the DDS, and 5% for the Nu-DESC.	Not provided	Not provided
Rainsford et al., 2014[12]	Compare CAM, DRS-R-98, and chart review	Fifty-one patients; adults aged 18+ with a diagnosis of advanced cancer	Nineteen-bed acute inpatient specialist palliative care unit	The DRS-R-98 identified 21 patients positively for delirium (41.2%) and 30 negatively for delirium (58.8%). The CAM identified 21 patients positively for delirium (41.2%) and 36 negatively for delirium (70.6%). The clinical team identified only 15 patients positively for delirium (29.4%) and 30 negatively (58.8%). The data are unclear about agreement between the CAM and DRS-R-98.	Not provided	Not provided	Not provided

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcomes: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Rice et al., 2011[26]	CAM performance in practice (nurse vs. researcher rating)	Prospective, descriptive design; 170 patients; adults aged 65+ at risk for delirium	Tertiary care teaching hospital (541 beds)	Sensitivity of nurses' rating of delirium using the CAM was low for all comparisons with researcher ratings (25% overall, 25% best case, 10% worst case). A significant difference was observed between nurses' recognition of delirium and that of the researcher, X^2 (1, n=170)= 40.21, p<0.001; Fisher exact p<0.001. Specificity was high (99.6% overall, 100% best case, 100% worst case). Agreement beyond chance in detecting delirium was poor for overall (k=0.34), best case (k=0.38) and worst case (k=0.14) comparisons.	Not provided	Not provided	Not provided
Ringdal et al., 2011[19]	Compare CAM with DSM-IV; evaluate Mini-Mental State Exam (MMSE) as screening tool	Mokken nonparametric latent trait model for unidimensional scaling; 365 patients; adults aged 65+ acutely admitted for hip fracture for at least 24 hours	Two hospitals in Oslo, Norway	The MMSE cutpoint of 24 had 84% agreement with the CAM for patients diagnosed with delirium. Using the total MMSE score had a sensitivity of 46% and specificity of 96%. Using step-wise logistic regression to locate a subset of MMSE items that may function as a screening tool resulted in a sensitivity of 51% and specificity of 95%.	Using the MMSE cutpoint of 24 had low agreement with the CAM for identifying negative cases (54% agreement), indicating a very high rate of false positives.	Not provided	Not provided

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcomes: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Rippon et al., 2016[20]	Development and evaluation of Delirium Early Monitoring System (DEMS) (two versions)	Observational study; 501 and 474 participants; healthcare assistants and support workers	Acute ward for patients with moderate to severe dementia in North East of England	Seventy-nine percent of staff completed the DEMS-CAM and 68% completed the DEMS-DOSS (Delirium Observation Screening Scale). Completion rates relating to the number of occasions that completion of the DEMS-CAM/DEMS-DOSS led to appropriate clinical action was 46% of the time for DEMS-CAM and 54% of the time for DEMS-DOSS.	Not provided	An end of study questionnaire completed by 10 of the non-medically trained staff found the DEMS-CAM was easier to understand than the DEMS-DOSS.	Not provided
Ryan et al., 2009[30]	CAM in palliative care	One hundred six patients; patients admitted to specialist palliative care unit study	Thirty-bed specialist palliative care unit in Mid-West region of Ireland	The sensitivity of the CAM in the pilot phase was 0.5 (0.22 to 0.78) and specificity was 1.0 (0.81 to 1.0). In the main study, the sensitivity of the CAM was 0.88 (0.62 to 0.98) and the specificity was 1.0 (0.88 to 1.0).	In the pilot phase, the non-consultant hospital doctors (NCHDs) made six false negative diagnoses of delirium. In the main study, the NCHDs made two false negative diagnoses of delirium.	A significant difference in the sensitivity of the CAM in the pilot phase and the main study was found (X^2=5.15, $p<0.05$), demonstrating that the performance of the CAM was improved when the NHCDs received the “enhanced” training module.	Not provided

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcomes: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Shulman et al., 2016[21]	Sour Seven questionnaire as screening tool for delirium	Pilot study; 80 patients; adults aged 65+ admitted to either the medical or surgical units of the study hospital and in the hospital for at least 1 day	Large academically affiliated community hospital in Canada.	Agreement between geriatric psychiatrist on Sour Seven questionnaire and untrained nurses ranged from 64.3 to 92.8%, between geriatric psychiatrist and caregivers ranged from 44 to 84%. For each of the seven questions, the Fisher exact test analysis had a p value greater than 0.05, suggesting there was no difference between the questionnaire posed to nurses versus informal caregivers. Out of a possible maximum total score of 18 on the Sour Seven Questionnaire, a score of 4 was selected as the screening cut-off and a score of 9 was selected as diagnostic of delirium because of its specificity of 100% and high Youden Index.	Not provided	Not provided	Not provided
Steis et al., 2012[23]	Convergent validation of FAM-CAM and CAM by family caregivers	Exploratory analysis of agreement between two primary studies: the eCare for Eldercare pilot study and the Hospital to Home: Cognitively Impaired Elders/Caregivers study; 52 paired assessments from patient-caregiver dyads; adults aged 65+ with preexisting cognitive impairment.	Communities across Pennsylvania	Overall agreement between the CAM and FAM-CAM was 96%. Compared with the original CAM algorithm, the FAM-CAM had a sensitivity of 88% (95% CI=47 to 99) and specificity of 98% (95% CI=86 to 100).	Not provided	Not provided	Not provided

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcomes: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Vasilevskis et al., 2011[29]	Evaluate performance of CAM-ICU (nurse vs. researcher)	Prospective cohort study; 510 patients; critically ill patients admitted to the ICU	Nine hundred-bed teaching hospital	Substantial agreement between bedside and research nurses on measures done within 2 hours of each other (CAM-ICU weighted kappa=0.67, 95% CI=0.66 to 0.70; RASS weighted kappa=0.66, 95% CI=0.64 to 0.68). Of 3,856 paired assessments for delirium within 2 hours, bedside nurses identified delirium with a sensitivity of 0.81 (95% CI=0.78 to 0.83) and specificity of 0.81 (95% CI=0.78 to 0.85) compared with research nurse reference standard.	Agreement between research and bedside nurses was slightly lower for mechanically ventilated patients and in nurses assessing delirium in patients aged 65+ compared to in assessments in patients younger than 65.	Not provided	Not provided

Table B.2: Delirium, Staff Education and Training–Single Studies

Note: Full references are available in the Section 14.2 reference list.

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Babine et al., 2018[1]	Education and training to reduce falls and length of stay via delirium recognition	Retrospective study looking at delirium and falls. Two chart reviews were performed on patient falls as identified in the hospital safety reporting system in 2009–2010 (98 fallers) and 2012 (108 fallers).	Hospital; 637-bed urban tertiary teaching organization	After the education, documentation of the "diagnosis of delirium" and "no evidence of delirium" increased from 14.3% to 29.5% and from 27.6% to 44.4%. The Confusion Assessment Method (CAM) identified the diagnosis of delirium at 76% accuracy. The length of stay decreased by 7.3 days. The fall rates in 2011 and 2012 were 3.01 and 2.82 falls per 1,000 patient days and in 2013 decreased to 2.16.	The results indicate that improving delirium recognition and treatment through interprofessional education can reduce falls and length of stay.	Moderate
Baird and Spiller, 2017[11]	Use of 4 A's Test (4AT) and CAM tools to assess cognition upon admission for hospice patients	A quality improvement (QI) approach (PDSA: Plan, Do, Study, Act) was used to improve screening for delirium on admission to a hospice unit. A baseline measure was taken of the rate of performance of cognitive assessment on admission. Five PDSA cycles were then undertaken which involved implementing change and then evaluating results through auditing case notes and interviewing staff.	Hospice	The 4AT is a usable tool in the hospice inpatient setting to assess patients' cognitive state on admission and can easily be incorporated into the admission process.	Not provided	None

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Belanger and Ducharme, 2015[14]	Educational intervention in one hospital designed to improve management of delirium	This study was undertaken to field test and qualitatively evaluate a narrative-based educational intervention for nurses in hospital units with a high incidence of delirium.	Acute care; cardiac and orthopedic surgery units at a short-stay hospital	The educational nursing intervention under study affords promising possibilities for improving the care provided older adults at risk for delirium and their families. It is also potentially transferable to populations of nurses who attend to other patient groups with complex health needs, particularly in geriatric care, oncology, and palliative care.	Not provided	Moderate
Booth et al., 2019[27]	"Virtual ACE Intervention" on two medical/surgical units in an academic medical setting	The "Virtual ACE Intervention" standardizes care processes for cognition and function without daily geriatrician oversight on two non-ACE units. The Virtual ACE Intervention includes staff training on geriatric assessments for cognition and function and on nurse-driven care algorithms.	Acute care; 1,152-bed tertiary care academic hospital with 52 acute care units, including one ACE Unit; the target units were two medical-surgical units serving hospitalist and orthopedic patients, selected based on having a high percentage of older adults and engaged physician leaders	Postintervention, the completion of the assessments for current functional status and delirium improved (62.5% vs. 88.5%, P <.001 and 4.2% vs. 96.5%, P <.001, respectively). In a subsample analysis in the postintervention period, more patients were "up to the chair" (i.e., had improved mobility) in the past day (36.4% vs. 63.5%, P .04) and the prevalence of an abnormal delirium screening score was lower (13.6% vs. 4.8%, P .16).	The Virtual ACE Intervention is a feasible model for disseminating ACE Unit principles to non-ACE Units and may lead to increased adherence to recommended care processes and improved clinical outcomes.	Low
Brooke et al., 2018[19]	Better understanding of "lived experience" of nurses caring for patients with delirium to improve care	Semi-structured interviews	Acute care (England)	These researchers concluded that there is a need for education about delirium across specialties.	Not provided	High
Coyle et al., 2017[20]	New educational initiatives for nurses	Semi-structured interviews	Hospital	Thematic analysis revealed that nurses described delirium assessment and identification variously as "it's not my job," "it is my job," and "it's complex." New educational initiatives are needed.	Not provided	High

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Detroyer et al., 2018[13]	E-learning tool that will be easier and more cost-effective for educating nurses on delirium screening and management	A before-after study in a sample of patients enrolled pre-intervention (non-intervention cohort; n = 81) and post-intervention (intervention cohort; n = 79), and nurses (n = 17)	Hospital; geriatric ward of a university hospital	No significant difference was found between the intervention cohort and the non-intervention cohort for in-hospital prevalence and duration of delirium.	This study, the first in its area to investigate effects of delirium e-learning on patient outcomes, demonstrated no benefits for either geriatric patients or nurses.	Moderate
Devlin et al., 2008[6]	Didactic and clinical-reasoning based educational approach to improve nurses' ability to identify delirium using a standardized tool correctly	Fifty intensive care unit (ICU) nurses evaluated an ICU patient for pain, level of sedation, and presence of delirium before and after an educational intervention	Intensive care; two different hospitals (university medical and community teaching)	After education, the number of nurses able to evaluate delirium using any scale (12% vs. 82%, P < 0.0005) and use it correctly (8% vs. 62%, P < 0.0005) increased significantly.	A simple composite educational intervention incorporating script concordance theory improves the capacity of ICU nurses to screen for delirium nearly as well as experts.	Moderate
DiLibero et al., 2016[7]	Improve use of CAM; included a feedback loop, real time auditing, and just- in-time learning	QI study (pre-test-post-test design) was used to evaluate the effectiveness of a program to improve the accuracy of delirium screenings among patients admitted to a medical ICU or coronary care unit	Acute care; medical ICU and cardiac care unit at an urban tertiary academic medical center and level I trauma center in the northeast region with more than 600 licensed beds, including 77 adult ICU beds.	Compliance with performing at least one delirium assessment every shift was 85% at baseline and improved to 99% during the postintervention period. Baseline assessment accuracy was 70.31% among all patients and 53.49% among sedated and agitated patients. Postintervention assessment accuracy improved to 95.51% for all patients and 89.23% among sedated and agitated patients.	The results from this project suggest the effectiveness of the program in improving assessment accuracy among difficult-to-assess patients. Further research is needed to demonstrate the effectiveness of this model across other critical care units, patient populations, and organizations.	Moderate

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
DiLibero et al., 2018[15]	Multifaceted nurse-led education program on delirium assessment among neuroscience patients	QI project; a multifaceted nurse-led intervention was implemented, and a retrospective analysis of preintervention and postintervention data on assessment accuracy was completed; results were stratified by population, level of sedation, and level of care; differences were analyzed using Fisher exact test	Acute care; urban tertiary academic medical and level I trauma center in the northeast region with more than 600 licensed beds, including 77 ICU beds	Data from 1,052 delirium assessments were analyzed and demonstrated improvement in assessment accuracy from 56.82% to 95.07% among all patients and from 29.79% to 92.98% among sedated or agitated patients.	Results from this project demonstrate the effectiveness of the nurse-led intervention among neuroscience patients. Future research is needed to explore its effectiveness across other institutions and to describe the effectiveness of new interventions to improve outcomes at the patient and organizational levels.	Moderate
Forsgren and Eriksson, 2010[24]	Education and implementation of validated screening tools to improve care	National survey (Sweden)	Intensive care	Awareness of delirium in ICUs is low, with a lack of implementation of validated screening tools for its diagnosis. Education is needed to improve quality of care.		Low

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Gesin et al., 2012[8]	Multifaceted education program on delirium using Intensive Care Delirium Screening Checklist (ICDSC) in surgical trauma ICU (STICU)	The knowledge and perceptions of subject nurses about delirium, and agreement between the independent assessments of delirium by the subject nurse and by a validated judge (who always used the ICDSC), were compared across three phases: Phase 1: No delirium screening tool and no education, Phase 2: ICDSC and minimal education (i.e., ICDSC validation study only), Phase 3: ICDSC and multifaceted education (i.e., pharmacist-led didactic lecture, Web-based module, and nurse-led bedside training)	Intensive care; ICU units at Carolinas Medical Center, an 813-bed community teaching hospital with 140 adult ICU beds located in Charlotte, NC	Agreement between nurses and the validated judge in the assessment of delirium increased from Phase 1 (k = 0.40) to Phase 2 (k = 0.62) to Phase 3 (k = 0.74). Nurses perceived use of the ICDSC as improving their ability to recognize delirium.	Use of a multifaceted education program improves both nurses' knowledge about delirium and their perceptions about its recognition. Implementation of the ICDSC improves the ability of STICU nurses to evaluate delirium correctly.	Low

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Godfrey et al., 2013[21]	Integrated delirium prevention system of care	Participatory action research (England); data collection included facilitated workshops, relevant documents/records, qualitative one-to-one interviews, and focus groups with multiple stakeholders and observation of ward practices; grounded theory strategies were used in analyzing and synthesizing data	Acute care	"Awareness of delirium was variable among staff, with no attention on delirium prevention at any level; delirium prevention was typically neither understood nor perceived as meaningful. The busy, chaotic, and challenging ward life rhythm focused primarily on diagnostics, clinical observations, and treatment. Ward practices pertinent to delirium prevention were undertaken inconsistently. Staff welcomed the possibility of volunteers being engaged in delirium prevention work, but existing systems for volunteer support were viewed as a barrier. [The] evolving conception of an integrated model of delirium prevention presented major implementation challenges flowing from minimal understanding of delirium prevention and securing engagement of volunteers alongside practice change. The resulting Prevention of Delirium Programme combines a multicomponent delirium prevention and implementation process, incorporating systems and mechanisms to introduce and embed delirium prevention into routine ward practices."	Not provided	Moderate

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Gordon et al., 2013[3]	Use of evidence-based screening tools to detect delirium in patients with neuroscience diagnoses	Pre-post design; 47 registered nurses	Hospital; 31-bed neuroscience intermediate care unit at a large academic medical center in Boston, MA	Findings reveal that the neuroscience nurses recognize the absence of delirium 94.4% of the time and the presence of delirium 100% of the time after a didactic session and coaching.	Expert coaching at the bedside may be a reliable method for teaching nurses to use evidence-based screening tools to detect delirium in patients with neuroscience diagnoses.	Moderate
Horvath et al., 2011[12]	Use of pocket cards with a variety of assessment tools for delirium in a primary care setting	Project target: practitioners in primary care settings, in particular physicians, nurse practitioners, and physician assistants	Primary care (Veterans Health Adminstration)	A low-tech, easy-to-use pocket card and assessment guide to evaluate delirium, dementia, and depression received favorable reception from an interdisciplinary group of clinical providers.	Not provided	Moderate
Johnson et al., 2016[18]	Education program to emphasize importance of delirium screening in trauma unit to reduce harm	Evaluate change in practice and beliefs regarding delirium among nurses, pharmacists, respiratory therapists, and physicians after an educational intervention	Acute care (trauma ICU); the hospital consists of 266 beds, with a 22-bed TICU. The hospital is one of eight trauma facilities in Arizona designated as level I by the State, annually caring for more than 3,000 of the region's most critically injured patients.	Changes in staff responses to the statement, ''Delirium is largely preventable'' were statistically significant ($p = 0.035$). The questionnaire revealed that the healthcare team believes that delirium is largely preventable. Early identification of delirium and risk factors associated with delirium can initiate the first step in preventing, identifying, and correctly treating delirium in the TICU.	An educational intervention emphasizing the importance of screening for delirium, risk factors for delirium, and approaches to decrease the incidence of delirium can improve identifying and correctly treating delirium in a critical care setting.	Moderate
Kennelly et al., 2013[22]	Understanding provider knowledge, skills, and attitudes toward assessing cognition to improve care	Self-administered questionnaire	Emergency Department (Ireland); older patients	One-third of respondents felt they lacked the relevant expertise to perform cognitive screening, with those with training in geriatrics being less likely to cite lack of experience as a factor.	Not provided	Moderate-High

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Kubota et al., 2016[25]	Program to increase oncology nurses' confidence and knowledge regarding care of patients, focused on four "psychological issues": normal reactions, clinically significant distress, suicidal thoughts, and delirium	A stratified, open, parallel-group, randomized trial; oncology nurses were assigned randomly to either the intervention group (n= 50) or the waiting list control group (n= 46)	Oncology hospitals and clinics (Japan)	In the intervention group, confidence and knowledge (but not attitudes) were significantly improved relative to the control group. No significant intervention effects were found for job-related stress and burnout. A high percentage (98%) of participants considered the program useful in clinical practice.	This psycho-oncology training program improved oncology nurses' confidence and knowledge regarding care for patients with psychological problems.	Moderate
LaFever et al., 2015[16]	Delirium education program to increase oncology registered nurses' (RNs') confidence and knowledge in a community hospital	A repeated-measures research design using general linear modeling was used for this study; an evidence-based delirium protocol and an educational session were developed for the nursing staff; the nurses attended a delirium educational session to learn about risk factors, prevention, assignment, and management of delirium	Inpatient medical-surgical oncology unit	The nursing educational program on the topic of delirium increased the nursing staff's knowledge from 69% to 86%, and overall confidence in managing patients with delirium increased from 47% to 66%.	This study confirms the benefits of delirium education in the inpatient medical-surgical oncology setting.	Moderate

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Marino et al., 2015[9]	Use of ICDSC to increase awareness and knowledge among ICU nurses regarding how best to care for patients with delirium	QI project; a didactic training program for bedside critical-care nurses was developed and implemented; upon completion of the educational sessions, a daily bedside delirium screening and care bundle protocol were implemented for all patients in ICUs throughout the facility; bedside critical-care nurses were invited to participate in the formal teaching sessions	Intensive care; 446-bed local teaching facility	All five nursing attitude and perceived confidence statements measured before and after the educational sessions showed a significant increase in positive perceptions overall (P.0001).	This quality improvement project demonstrates that a formal didactic training program for ICU nurses can result in increased awareness and knowledge of ICU delirium, and adequately prepare them for how to properly screen and treat patients.	Moderate
Meako and Thompson, 2011[17]	Educational program for orthopedic nurses; curriculum based on Hartford Foundation for Geriatric Nursing in a Nurses Improving Care to Healthsystem Elders (NICHE) unit	A pre-test–post-test quasi-experimental design was used to test the effectiveness of an educational intervention and to describe orthopedic nurses' knowledge about delirium and delirium risk in hospitalized orthopedic patients	Hospital; convenience sample of RNs working on a 39-bed orthopedic unit was used in this study	Regardless of education, years of experience, or shift worked, orthopedic RNs had difficulty with questions related to recognition of delirium, predisposing, and precipitating risk factors, and medications that can contribute to delirium. The educational intervention was effective, and scores significantly improved from baseline following the intervention.	Baseline knowledge assessment confirmed orthopedic nurses' lack of understanding of delirium. The 1-hour educational intervention, based on nationally recommended standards, improved the nurses' knowledge and could be useful in orthopedic nursing continuing education.	Moderate

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Nelson, 2009[10]	Teaching the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) to staff nurses, using RDSS and Richmond Agitation Assessment Scale	The CAM-ICU is a tool for screening for delirium in ventilated patients that with proper training can be administered quickly by staff nurses in the ICU. This article explains six preparatory decisions required in training staff to use the CAM-ICU	Hospital (ventilated patients)	The CAM-ICU tool is designed to allow nurses in the ICU to screen ventilated patients for delirium. The features of the tool can be easily taught and the tool, once understood, requires very little time for administration.	The challenge of teaching nurses is to assist them to embrace the tool as part of their routine assessment, rather than as something to be added on to existing procedures.	Moderate
Nydahl et al., 2018[23]	Evaluate delirium management in nurses and physicians in critical care to improve education and training to improve care	Open online survey	Intensive care (Germany)	More nurses than physicians reported screening for delirium. A majority reported screening when delirium was suspected, and more than 50% used validated instruments. Half of the clinicians surveyed had structures in place, such as a delirium-related process of care. Authors concluded that both nurses and physicians need more knowledge and training on when and how to use validated assessment instruments for identifying and managing delirium.	Not provided	Moderate
Sockalingam et al., 2014[2]	Interprofessional education (IPE) to improve delirium care	Systematic review	N/A	Review of the limited evidence suggests that IPE programs may influence team and patient outcomes in delirium care. More systematic studies of the effectiveness of interprofessional delirium education interventions are needed.	Not provided	Low

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Sockalingam et al., 2016[2]	Flipped classroom (FC) approach to improving the quality of delirium care using an interprofessional train-the-trainer (TTT) program	Implementation of novel education methods and post-implementation evaluation of test scores; delirium care self-efficacy and knowledge test scores were measured before, after, and 6 months after the training session; clinician delirium assessment rates were measured by chart audits before and 3 months after implementation of delirium training sessions	Hospital	Delirium knowledge test scores (7.8 ± 1.6 versus 9.7 ± 1.2, P <.001) and delirium care self-efficacy were significantly higher immediately after the TTT session compared with those of pre-session, and these differences remained significant at 6 months after the TTT session. Trainer sessions significantly improved clinician delirium assessment rates, from 53% for pretraining to 66% for post-training. Data suggest that a TTT FC delirium training approach can improve participants' perceived delirium care skills, confidence, and knowledge up to 6 months after the session. This approach provides a model for implementing hospital-wide delirium education that can change delirium assessment behavior while minimizing time and personnel requirements.	Not provided	Moderate
Young et al., 2012[5]	Understanding barriers to systematic inpatient delirium screening to improve staff education and improve quality of patient care	Survey	Hospital	Eighty-two percent of respondents had never used or heard of the CAM; only three respondents felt proficient with the use of CAM.	Not provided	Moderate
Wong et al., 2018[4]	Understanding barriers to inpatient delirium screening to improve staff education and improve quality of patient care	Qualitative focus group survey of nurses	Hospital (orthopedic unit; Canada)	While those surveyed had mixed feelings about the CAM, only 35% of participants recalled receiving training on the tool in the past.	Not provided	Moderate

Table B.3: Delirium, Nonpharmacological Interventions To Prevent Intensive Care Unit Delirium–Single Studies

Note: Full references are available in the Section 14.3 reference list.

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcome: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Alvarez et al., 2017[1]	Cognitive and sensorial stimulation, physical therapy, and family involvement in care	Design: Randomized controlled trial (RCT) Sample Size: n=65 Patient Population: Older adults	Intensive care	Multicomponent nonpharmacological intervention effective in prevention of delirium among critically ill patients	No adverse events reported.	Not provided	Moderate
Black, et al., 2011[2]	Family participation in care: nurses provided verbal and written advice to patients and families about communication and delirium	Design: Cohort study with control group Sample size: n=170 (83 control, 87 intervention) Patient population: Adult patients and families	Intensive care	Incidence of delirium (measured at days 1–7 and 14) did not differ significantly between intervention and control groups.	No adverse events reported.	Intervention is not described in sufficient detail for replication.	Moderate

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcome: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Foster and Kelly, 2013[3]	Promotion of sleep-wake cycles; sensory stimulation; mobility; preferred music listening	Design: Quality improvement pre-post design Sample Size: n=32 for intervention Patient Population: Adult hemodynamically stable; hearing able	Intensive care	Delirium assessment improved post-intervention compared to baseline (likely the reason for slightly increased prevalence of delirium reported).	No adverse events reported.	Barriers to feasibility of the pilot study: protocol adherence for sleep promotion (due to care activity interruptions) and mobility (due to nurse reported time constraints and lack of assistance); Director of Physical Therapy declined to participate in mobility activity due to lack of personnel; physicians did not write orders for the mobility protocol; lack of support from other disciplines; patient/family consent process; documentation deficiencies (some study items not available for documentation in electronic medical record and required additional hard copy documentation, leading to missing data).	High

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcome: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Guo and Fan, 2016[4]	Preoperative orientation visit to intensive care unit (ICU), flexible visiting hours; social, emotional, informational support; improving sleep quality: use of single room, reduction of multiple sensory experiences; cluster care to avoid night hours; provision of back massages; playing relaxation music; provision of warm milk before sleeping	Study Design: Controlled trial, no randomization Sample Size: n=59 (intervention), and n=63 (control) Patient Population: Adult abdominal or cardiac surgery patients	Intensive care	Delirium measured at 2, 4, 8, and 16 hours after awakening from anesthesia postoperatively. Significantly fewer intervention than control group patients experienced delirium at each time point measured. Multicomponent nonpharmacological intervention effective for reduction of delirium incidence.	No adverse events reported.	Not provided	Low
Guo et al., 2016[5]	Preoperative orientation visits to the surgical ICU (SICU); reorientation measures; noise reduction; day and night light; cluster care; eyeshades and acoustic earplugs allocated; minimized restraints; patient selected preferred music; optimized nutrition	Study Design RCT with random assignment Sample Size: n=160 (81 intervention and 79 control group) Patient Population Post-surgical older adult oral cancer patients, with postoperative SICU stay of 3 days or more	Intensive care	Postoperative delirium occurred significantly less frequently among intervention than control patients (10 vs. 25; 15%–31.25%, p=0.006). Duration of postoperative delirium was significantly less among intervention than control group patients (28.1 vs. 60.2 hours, p<0.001). Multicomponent nonpharmacological interventions reduced incidence and duration of postoperative delirium.	No adverse events reported.	The impact of each component was not assessed; reproduction of the intervention must include all components.	Low

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcome: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Ono et al., 2011[6]	Efficacy of bright light therapy	Design: RCT Sample Size: 26 Patient Population: Patients with esophageal cancer	Intensive care	Reduction in risk of developing delirium in patients receiving bright light therapy, but not statistically significant.	No adverse events reported.	Not provided	High
Rivosecchi et al., 2016[7]	Music; light adjustment; reorientation, cognitive stimulation; assure use of glasses, hearing aids	Design: Pre-post quality improvement project Sample Size: n=230 in pre-phase and 253 in post-phase Patient Population: Adult critically ill patients	Intensive care	Reduction of 50.6% (16.1% vs. 9.6%, p<.001) in delirium days. Incidence of delirium was reduced (15.7% vs. 9.4%, p=.04). The intervention reduced the odds of developing delirium by 57% (odds ratio 0.43, p=.005) after adjusting for age, Acute Physiology and Chronic Health Evaluation II (APACHE II) score, mechanical ventilation, and dementia. Multicomponent nonpharmacological intervention effective in prevention of delirium, reduction of delirium duration.	No adverse events reported.	Not provided	High
Schweickert et al., 2009[8]	Effect of early physical and occupational therapy on delirium, functional outcomes	Design: RCT, with random assignment Sample Size: n=104 Patient Population: Critically ill adult patients	Intensive care	Shorter duration of delirium (median 2.0 days, interquartile range (IQR) 0.0–6.0 vs. 4.0 days, 2.0–8.0 days; p=0.02). Early physical and occupational therapy effective in reduction of delirium duration.	One serious adverse event in 498 therapy sessions (desaturation less than 80).	Not provided	Low

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcome: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Flannery et al., 2016[9]	Nonpharmacological interventions for sleep in the ICU; impact on ICU delirium	Studies Included: 10 studies with 1,639 patients	Intensive care	Six studies reported statistically significant reductions in rate of ICU delirium. Two reported nonsignificant reductions. Four studies reported duration of delirium, of which three demonstrated reduction in delirium duration. Five studies reported ICU length of stay (LOS), and two demonstrated reduction. Evidence is mixed about whether interventions to promote sleep prevent ICU delirium; reduce duration of delirium, or reduce ICU LOS.	Not provided	Not provided	Low

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcome: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Ghaeli et al., 2018[10]	Any non-pharmacological intervention to prevent or manage delirium Interventions: HELP; mobility; environmental noise reduction; sleep promotion and sleep-wake cycle protection; music; orientation; addressing risk factors and sensory impairment (vision, hearing)	Narrative review Adults, older adults	Intensive care	Based on review and classification of level of evidence*, the authors made the following recommendations: • Mobility/rehabilitation therapy at the first possible opportunity (1B) • Reduce noise to improve sleep (1B) • Soft, soothing music to reduce anxiety and confusion (1B) • Pleasant fragrance/scents to make the environment more soothing (5) • Orientation with visible clock, calendar; promote day light and night light cycles (1B) • Ensure patients who use glasses and hearing aids have access to these devices to improve interaction and reduce confusion (IB) *1A - SR of RCTs; 1B - RCT; 2A - SR of cohort studies; 2B - cohort studies; 3A - SR of case control studies; 3B - case control studies; 4A - SR of case series; 4B - Case series, or cross-sectional studies; 5 - Other studies	Not provided	Not provided	Moderate-High

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcome: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Hu et al. 2015[11]	Nonpharmacological interventions for sleep promotion	Systematic review Samples: Total 1,569 participants Population: Critically ill adults (aged 18 years and older) Studies Included: 30 RCT and quasi-RCT	Intensive care	Outcome: risk of delirium (sleep outcomes also reported) Three trials of earplugs or eye masks or both were suitable for meta-analysis. Findings demonstrated a lower incidence of delirium during the ICU stay (risk ratio 0.55, 95% CI 0.38 to 0.80, p=0.002) for these interventions; the reviewers rated the quality of this evidence as low. Clinical heterogeneity of the studies limited quantitative synthesis; only a small number of studies available for most interventions; quality of the evidence generally low or very low. Use of earplugs or eye masks or both for ICU patients may help prevent delirium.	Not provided	Not provided	Low

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcome: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Luther and McLeod, 2018[12]	Chronotherapy - "modifying circadian rhythms with therapeutic intent": dynamic light application (DLA) versus usual lighting (control); bright light therapy (BLT) versus usual lighting (control) (n=2 studies); reduction of lighting and noise (no control); use of ear plugs, eye shades, reduction in noise and lighting versus usual care (control)	Studies included: Six included in review: five RCTs and one cohort study	Intensive care	Statistically significant reductions in incidence of delirium among intervention versus control or post- vs. pre-intervention participants was demonstrated in three studies. One study identified a slight increase (not statistically significant) in occurrence of delirium among participants receiving DLA versus control group. The two final studies reported decreased occurrence of delirium in the intervention groups, but these were non-significant results, due to small sample sizes. Two studies identified statistically significant reductions in duration of delirium among multicomponent intervention recipients vs. controls (where interventions comprised reduction of light and noise, and reduction of light and noise plus use of ear plugs and eye shades). One study reported nonsignificant (due to small sample size) reduction in duration of delirium symptoms among the intervention group. Use of multicomponent interventions reduced prevalence of delirium; to enable use, education of the multidisciplinary team is a key factor. Insufficient evidence to recommend BLT or DLA; however, all studies agreed natural bright lighting is preferable in critical care. Need for large, multicenter RCTs that measure all relevant outcomes reliably.	All studies reviewed had limitations regarding design, control of confounding variables, and lack of validated measurement of important outcomes such as sleep.	Not provided	Moderate

Author, Year	Description of Patient Safety Practice	Study Design; Sample Size; Patient Population	Setting	Outcomes: Benefits	Outcome: Harms	Implementation Themes/Findings	Risk of Bias (High, Moderate, Low)
Zaal and Slooter, 2012[13]	Interventions: Reduction of environmental precipitating factors (noise, light); use of earplugs; early mobilization protocol (physical and occupational therapy); use of bright day-light	Studies Included: Five included in the review: one published prior to 2008, excluded from this review; two RCTs; one before and after; one design not reported.	Intensive care	One RCT of ICU patients compared 69 patients sleeping with earplugs during the night to 67 without; use of earplugs did not prevent delirium, as measured by the Neelon and Champagne (NEECHAM) confusion scale. One study found the number of days patients spent delirious was on average 0.4 days shorter in single-room ICU rather than in ICU with wards, although occurrence rate of delirium did not differ. An early exercise and mobilization protocol in the ICU showed lower incidence and shorter duration of ICU delirium in one before-after study, and one RCT. The RCT showed, as a secondary endpoint, a reduction of delirium days from 4 days in the control group to 2 days in the intervention group. Heterogeneity of design, aim, intervention, measures and outcomes prevents summarizing results. Evidence of included studies was rated low to moderate.	Not provided	Not provided	Moderate

Appendix C. Delirium Search Terms

Method	Search	Search String for: CINAHL	Search String for: MEDLINE
Search 2008-Present, English Only MedLine Publication Types: • Clinical Trial • Clinical Trial, Phase I • Clinical Trial, Phase II • Clinical Trial, Phase III • Clinical Trial, Phase IV • Comparative Study • Controlled Clinical Trial • Corrected and Republished Article • Evaluation Studies • Guideline • Journal Article • Meta-Analysis • Multicenter Study	Screening and Assessment	(((MH “Delirium/Prevention AND Control” OR “Delirium/Diagnosis”) OR (AB Delirium)) AND ((MH “Diagnostic Techniques and Procedures”) OR (AB “Screening*” OR “Assessment*” OR “Structured Approach*” OR “Confusion Assessment Model” OR “CAM”)) NOT ((MH "Alcohol Withdrawal Delirium”) OR (AB "Alcohol Withdrawal Delirium” OR "Delirium, Alcohol Withdrawal" OR “Ped*” OR “Child*”)))	(((MH “Delirium/Prevention AND Control” OR MH “Delirium/Diagnosis”) OR (AB Delirium)) AND ((MH “Diagnostic Techniques and Procedures”) OR (AB “Screening*” OR “Assessment*” OR “Structured Approach*” OR “Confusion Assessment Model” OR “CAM”)) NOT ((MH "Alcohol Withdrawal Delirium”) OR (AB "Alcohol Withdrawal Delirium” OR "Delirium, Alcohol Withdrawal" OR “Ped*” OR “Child*”)))

Method	Search	Search String for: CINAHL	Search String for: MEDLINE
• Practice Guideline • Published Erratum • Randomized Controlled Trial • Review • Scientific Integrity Review • Technical Report • Twin Study • Validation Studies CINAHL Publication Types: • Clinical Trial • Corrected Article • Journal Article • Meta-Analysis • Meta Synthesis • Practice Guidelines • Randomized Controlled Trial • Research Review • Systematic Review			

Method	Search	Search String for: CINAHL	Search String for: MEDLINE
Search 2008-Present, English Only MedLine Publication Types: • Clinical Trial • Clinical Trial, Phase I • Clinical Trial, Phase II • Clinical Trial, Phase III • Clinical Trial, Phase IV • Comparative Study • Controlled Clinical Trial • Corrected and Republished Article • Evaluation Studies • Guideline • Journal Article • Meta-Analysis • Multicenter Study	Staff Education and Training	((((MH Delirium) OR (AB Delirium)) AND ((MH Education) OR (AB Inservice OR “In-Service” OR “Staff Education“ OR “Staff Training” OR Training OR Education)) AND (AB Clinician* OR Employee* OR Staff OR Physician* OR Doctor* OR Nurse* OR “Nurse Practitioner*” OR “Physical Therapist*” OR “Social Worker*” OR “Physician Assistant*” OR “Occupational Therapist*”)) NOT ((MH "Alcohol Withdrawal Delirium”) OR (AB "Alcohol Withdrawal Delirium” OR "Delirium, Alcohol Withdrawal" OR “Ped*” OR “Child*”)))	((((MH Delirium) OR (AB Delirium)) AND ((MH Education) OR (AB Inservice OR “In-Service” OR “Staff Education“ OR “Staff Training” OR Training OR Education)) AND (AB “Clinician*” OR “Employee*” OR “Staff” OR “Physician*” OR “Doctor*” OR “Nurse*” OR “Nurse Practitioner*” OR “Physical Therapist*” OR “Social Worker*” OR “Physician Assistant*” OR “Occupational Therapist*”)) NOT ((MH "Alcohol Withdrawal Delirium”) OR (AB "Alcohol Withdrawal Delirium” OR "Delirium, Alcohol Withdrawal" OR “Ped*” OR “Child*”)))

Method	Search	Search String for: CINAHL	Search String for: MEDLINE
• Practice Guideline • Published Erratum • Randomized Controlled Trial • Review • Scientific Integrity Review • Technical Report • Twin Study • Validation Studies CINAHL Publication Types: • Clinical Trial • Corrected Article • Journal Article • Meta-Analysis • Meta Synthesis • Practice Guidelines • Randomized Controlled Trial • Research Review • Systematic Review			

Method	Search	Search String for: CINAHL	Search String for: MEDLINE
Search 2008-Present, English Only MedLine Publication Types: • Clinical Trial • Clinical Trial, Phase I • Clinical Trial, Phase II • Clinical Trial, Phase III • Clinical Trial, Phase IV • Comparative Study • Controlled Clinical Trial • Corrected and Republished Article • Evaluation Studies • Guideline • Journal Article • Meta-Analysis • Multicenter Study	Non-Pharmacologic Intervention Programs	((((MH Delirium) OR (AB Delirium)) AND ((MH “Quality Improvement”) OR (AB “Non-Pharmacologic*” OR “Nonpharmacologic*” OR “Intervention Program*” OR “Quality Improvement”))) NOT ((MH "Alcohol Withdrawal Delirium") OR (AB "Alcohol Withdrawal Delirium” OR "Delirium, Alcohol Withdrawal" OR “Ped*” OR “Child*”)))	((((MH Delirium) OR (AB Delirium)) AND ((MH “Quality Improvement”) OR (AB “Non-Pharmacologic*” OR “Nonpharmacologic*” OR “Intervention Program*” OR “Quality Improvement”))) NOT ((MH "Alcohol Withdrawal Delirium") OR (AB "Alcohol Withdrawal Delirium” OR "Delirium, Alcohol Withdrawal" OR “Ped*” OR “Child*”)))

Method	Search	Search String for: CINAHL	Search String for: MEDLINE
• Practice Guideline • Published Erratum • Randomized Controlled Trial • Review • Scientific Integrity Review • Technical Report • Twin Study • Validation Studies CINAHL Publication Types: • Clinical Trial • Corrected Article • Journal Article • Meta-Analysis • Meta Synthesis • Practice Guidelines • Randomized Controlled Trial • Research Review • Systematic Review			

Method	Search	Search String for: CINAHL	Search String for: MEDLINE