UC San Diego
Articles

Title

Validation of Caregiver-Centered Delirium Detection Tools: A Systematic Review

Permalink

Authors

Rosgen, Brianna
Krewulak, Karla
Demiantschuk, Danielle
et al.

Publication Date

2018-04-18

DOI

10.1111/jgs.15362

Supplemental Material

Peer reviewed

Validation of Caregiver-Centered Delirium Detection Tools: A Systematic Review

(Caregiver-Centered Delirium Detection Tools)

Brianna Rosgen[1], Karla Krewulak[2], PhD, Danielle Demiantschuk[3], MA,

E Wesley Ely[4], MD, MPH, Judy E Davidson[5], DNP, Henry T. Stelfox[6], MD, PhD, Kirsten Fiest[7], PhD

Corresponding Author:

Kirsten M. Fiest

Department of Critical Care Medicine

Ground Floor, McCaig Tower

3134 Hospital Drive NW, Calgary, Alberta, Canada

T2N 5A1

kmfiest@ucalgary.ca

[1] Research Student, Departments of Critical Care Medicine and Community Health Sciences, and Hotchkiss Brain Institute, Cumming School of Medicine, University of Calgary, 2500 University Drive NW, Calgary, Alberta, Canada, T2N 1N4, @briannarosgen

[2] Senior Research Associate, Departments of Critical Care Medicine and Community Health Sciences, O'Brien Institute for Public Health, and Hotchkiss Brain Institute, Cumming School of Medicine, University of Calgary, 2500 University Drive NW, Calgary, Alberta, Canada, T2N 1N4, @karlakrewulak

[3] Senior Research Associate, Departments of Critical Care Medicine, Cumming School of Medicine, University of Calgary, 2500 University Drive NW, Calgary, Alberta, Canada, T2N 1N4

[4] Professor, Tennessee Valley Veteran's Affairs Geriatric Research Education Clinical Center (VA GRECC), Department of Medicine, Center for Health Services Research and Division of Pulmonary and Critical Care Medicine, 1211 Medical Center Drive, Nashville, Tennessee, United States, 37232

[5] Evidence Based Practice Research Nurse Liaison, University of California San Diego, 9500 Gilman Drive, La Jolla, California, United States, 92093

[6] Professor, Departments of Critical Care Medicine and Community Health Sciences, O'Brien Institute for Public Health, Cumming School of Medicine, University of Calgary, 2500 University Drive NW, Calgary, Alberta, Canada, T2N 1N4

[7] Assistant Professor, Departments of Critical Care Medicine and Community Health Sciences, O'Brien Institute for Public Health, and Hotchkiss Brain Institute, Cumming School of Medicine, University of Calgary, 2500 University Drive NW, Calgary, AB, Canada, T2N 1N4, @kmfiest

Abstract

Objectives: To summarize the validity of caregiver-centered delirium detection tools in hospitalized adults and assess associated patient and caregiver outcomes.

Design: Systematic review

Setting: We searched MEDLINE, EMBASE, PsycINFO, CINAHL, Scopus from inception to May 15, 2017

Participants: Hospitalized adults

Intervention: Caregiver-centered delirium detection tools

Measurements: We drafted a protocol from Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Two reviewers independently completed abstract and full-text review, data extraction, and quality assessment. We summarized findings using descriptive statistics including mean, median, standard deviation, range, frequencies (percent), and Cohen's Kappa (κ). Included studies reported on the validity of caregiver-centered delirium detection tools or associated patient and caregiver outcomes, and were cohort or cross-sectional in design.

Results: We reviewed 6056 titles and abstracts, included six articles, and identified six caregiver-centered tools. All tools were designed to be used in several minutes or less, and had 11 items or fewer. Three tools were caregiver-*administered* (completed independently by caregivers): Family Confusion Assessment Method (FAM-CAM), Informant Assessment of Geriatric Delirium (I-AGeD), and Sour Seven. Three tools were caregiver-*informed* (administered by a healthcare

professional using caregiver input): Single Question in Delirium (SQiD), Single Screening Question Delirium (SSQ-Delirium), and the Stressful Caregiving Response to Experiences of Dying (SCARED). Caregiver-administered tools had higher psychometric properties [FAM-CAM sensitivity 75% (95%, confidence interval CI, 35-95%), specificity 91% (95% CI, 74-97%); Sour Seven positive predictive value, PPV 89.5%, negative predictive value, NPV 90%] than caregiver-informed tools [SQID: sensitivity 80% (95% CI, 28.3-99.5%), specificity 71% (95% CI, 58.77-99.8%), SSQ-Delirium sensitivity 79.6%, specificity 56.1%].

Conclusions: Delirium detection is essential for appropriate delirium management. Caregiver-centered delirium detection tools are promising to improve delirium detection and associated patient and caregiver outcomes. Comparative studies utilizing larger sample sizes and multiple centers are required to determine validity and reliability characteristics.

Key Words: delirium; caregiver; family; hospital; screening

Introduction

Delirium is an acute confusional state characterized by fluctuating course, attention deficits, and cognitive disturbances.[1] Delirium is common in hospital settings, affecting over 20% of patients, and may lead to longer hospital stays and mechanical ventilation, long-term cognitive impairment, physical disability, and death.[2-5] Delirium is also distressing to caregivers (i.e. family or friends involved in patient care), potentially increasing the risk of adverse psychological outcomes, including major depressive disorder, generalized anxiety disorder, and posttraumatic stress disorder.[6]

In many hospitals, healthcare professionals (e.g. nurses and clinicians) screen for delirium using validated healthcare professional-administered delirium detection tools, such as the Confusion Assessment Method (CAM).[7] Despite routine screening, over 60% of delirium cases remain undetected in general hospital settings.[8] If delirium remains undetected, then it cannot be managed appropriately, further increasing the risk of adverse patient and caregiver outcomes.[9]

Using caregiver-centered delirium detection tools, caregivers may be able to identify symptoms of delirium more readily than a healthcare professional who is unfamiliar with the patient.[10] Delirium can often be missed by intermittent screening due to the fluctuating course of delirium, causing many cases of delirium to remain undetected.[11] Using caregiver-centered tools, caregivers can independently screen for delirium throughout the patient's hospital stay and notify healthcare professionals accordingly, potentially leading to earlier and more frequent diagnoses.

Engaging caregivers in delirium detection may also decrease caregiver distress and adverse psychological outcomes. Multiple high-impact guidelines and studies in palliative care and community settings have demonstrated that caregiver involvement in patient care is recommended to improve patient and caregiver outcomes.[12-15] For instance, symptoms of anxiety and depression decreased in caregivers who witnessed cardiopulmonary resuscitation and received information on end-of-life care.[16, 17] Additionally, a community-based study suggested that involving caregivers in delirium detection improves caregiver satisfaction with patient care.[18]

Caregiver-centered delirium detection tools exist, and have been studied in various hospital settings. Caregiver-centered tools may be caregiver-*administered* (i.e. administered independently by caregivers), or caregiver-*informed* (i.e. administered by healthcare professionals but informed by caregiver input). Understanding the properties of these tools is crucial to improve delirium detection, yet there have been no reviews summarizing the validity of caregiver-centered delirium detection tools in hospital settings. Using systematic review methodology, this study will summarize and compare caregiver-centered delirium detection tools in hospitalized adults and evaluate associated patient and caregiver outcomes.

Methods

Search, Registration, and Information Sources

We drafted the study protocol (available from https://prism.ucalgary.ca/handle/1880/52090) *a priori* according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[19] and registered the systematic review on the International Prospective Register of Systematic Reviews (PROSPERO) (registration ID: CRD42017067107).[20] We searched PROSPERO and the Cochrane Database of Systematic Reviews[21] for related systematic reviews to ensure study originality. The search strategy was finalized after independent consultation and review with two medical librarians. The search was conducted in the following online bibliographic databases: MEDLINE, EMBASE, PsycINFO, CINAHL, and Scopus, from inception to May 15, 2017, with no restrictions. To identify additional studies, we searched the reference lists of included full-text articles and relevant reviews.

Eligibility Criteria

We included studies that fulfilled the following four criteria: 1) original/primary peer-reviewed research, 2) observational study design (e.g. cohort study, cross-sectional study), 3) conducted in adult patients (≥ 18 years old) in any hospital setting, and 4) reported on the validity of caregiver-centered delirium detection tools. We also identified associated outcomes in patients (e.g. length of hospital stay, duration of mechanical ventilation, long-term cognitive impairment, death) and caregivers (e.g. anxiety, depression). Caregiver was defined as any family member or friend who is directly involved in patient care. Hospital was defined as any inpatient facility that provides primary medical care. Caregiver-centered delirium detection tools were defined as any delirium measurement tools that involved the caregiver's assessment of delirium symptoms.

Study Selection

Two of three reviewers (BR, KK, DD) completed title and abstract screening independently, and in duplicate. If either reviewer indicated a study to be included, it was reviewed in full-text. Two reviewers (BR, KK) completed full-text screening independently, and in duplicate using the standardized eligibility criteria. At this stage, both reviewers agreed on inclusion and reasons for exclusion. Disagreements were resolved by discussion or the involvement of a third reviewer (DD or KF). Reviewers translated all non-English manuscripts using Google Translate.[22]

Data Extraction

Two reviewers (BR, KK) extracted data independently, and in duplicate from included studies using a standardized electronic data form developed and piloted by study authors. Data elements extracted included: study information (e.g. author, publication year, study design),

patient and caregiver demographics (e.g. age, sex, education), index and reference tool used, delirium prevalence, psychometric properties [e.g. sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) and 95% confidence intervals when reported], patient outcomes, and caregiver outcomes.

Study Quality

Two reviewers assessed methodological quality of included studies independently, and in duplicate using Quality of Diagnostic Accuracy Studies 2 (QUADAS-2), a tool designed to evaluate the quality of diagnostic accuracy studies.[23] QUADAS-2 was used to assess bias and concerns regarding applicability using signaling questions in four domains: 1) patient selection, 2) index test, 3) reference standard, and 4) flow and timing. Risk of bias was "low" if all signaling questions in the domain were answered "yes". Risk of bias was "high" if any signaling questions in the domain were answered "no". Risk of bias was "unclear" if half or more of the signaling questions did not have sufficient information to make a judgment. Concern of applicability was "low" if the domain matched the review question. Concern of applicability was "high" if the domain did not match the review question. Concern of applicability was "unclear" if insufficient data were reported to make a judgment.

Data Synthesis and Analysis

We summarized findings using descriptive statistics including mean, median, standard deviation (SD), range, frequencies (percent), and Cohen's Kappa (κ). A meta-analysis was not conducted due to clinical heterogeneity between study outcomes.

Results

Methodological Quality

Table 1 presents the methodological quality evaluated using QUADAS-2.[23] All studies had an overall "unclear" or "low" risk of bias and concern of applicability; all studies were of acceptable quality to include in the systematic review.

Study Selection and Characteristics

The search strategy yielded 10,290 citations; 19 additional citations were found by reviewing reference lists of included studies (Figure 1). After duplicates were removed, reviewers screened titles and abstracts of 6,076 unique citations; 5,892 citations did not meet inclusion criteria. Reviewers assessed 184 articles in full-text and six studies were included in the final systematic review.[6, 10, 24-27]

Dates of publication ranged from 2007 to 2016. Studies were conducted in the United States (n = 1), Canada (n = 1), Portugal (n = 1), the Netherlands (n = 1), the United Kingdom (n = 1), and Australia (n = 1). Study designs included cross-sectional (n = 2), and prospective cohort (n = 4). The mean (± SD) number of participating patient-caregiver dyads in each study was 98.3 (± 69.4) (range: 21-200).

Caregiver-*Informed* Delirium Detection Tools

Three of the included articles evaluated caregiver-informed delirium detection tools, including the Stressful Caregiving Response to Experiences of Dying (SCARED),[6] Single Question in Delirium (SQiD),[24] and Single Screening Question-Delirium (SSQ-Delirium).[27]

SCARED

The SCARED is a 10-item tool that evaluates potentially distressing events witnessed by caregivers during terminal illness, including observing a patient in a state of confusion or

delirium.[28] The SCARED scores feelings of fear and helplessness, and frequency of distressing events on a 4-point Likert scale.[28]

In a multi-center cross-sectional study in palliative care settings, caregiver-perceived delirium was suggested if the caregiver reported seeing the patient confused or delirious at least once per week in the previous month.[6] Nineteen percent of patients had caregiver-perceived delirium.[6] The Short Portable Mental Status Questionnaire (SPMSQ) conducted by a research assistant was used as a reference of cognitive function for the SCARED.[6] The SPMSQ is a scalar measure of cognition ranging from 0 to 10; 0 indicates severe cognitive impairment and 10 indicates normal cognition.[29] Although the SPMSQ does not directly measure delirium, scores below eight are correlated with higher rates of delirium.[30] Patients with caregiver-perceived delirium on the SCARED were more likely to have a SPMSQ score indicative of mild cognitive dysfunction than patients without caregiver perceived delirium (15.6% versus 0.7%; p<0.001).[6]

The study also evaluated the relationship between caregiver-perceived delirium and caregiver psychological outcomes, including major depressive disorder, generalized anxiety disorder (GAD), and posttraumatic stress disorder.[6] The Structured Clinical Interview for the DSM-IV (SCID Axis I modules) was used to measure psychological outcomes in caregivers.[31, 32] Caregivers of patients with caregiver-perceived delirium were 12 times more likely to have GAD symptomology than caregivers of patients without caregiver-perceived delirium, [odds ratio, OR = 12.12 (95% CI, 2.26-65.18; p<0.01)].[6]

SQiD

The SQiD is a delirium detection tool that consists of one question: "Do you feel that [patient's name] has been more confused lately?"[24] Delirium is suggested if the caregiver's answer indicates any decline in the patient's cognition.[24]

A single-center validation study in an inpatient oncology unit evaluated the psychometric properties of the SQiD.[24] The reference standard was a psychiatric interview conducted by trained physicians using DSM-IV criteria.[33] DSM-IV criteria yields a dichotomous delirium diagnosis (yes/no) by evaluating features of delirium, including altered attention, consciousness, cognition, and fluctuating course.[30] The reference standard identified five cases of delirium in the sample of 19 patients.[24, 33] The SQiD identified eight cases of delirium in the sample of 19 patients.[24] The sensitivity and specificity of the SQiD were 80% (95% CI, 28.3-99.5%) and 71% (95% CI, 41.9-91.6%), respectively.[24] The PPV of the SQiD was 50% (95% CI, 15.7-84.3%) and the NPV was 91% (95% CI, 58.7-99.8%).[24] The SQiD demonstrated a significant inter-tool correlation to the reference standard, with a κ of 0.431 (p = 0.023).[24]

SSQ-Delirium

The SSQ-Delirium is a delirium detection tool that consists of one question: "how has your relative/friend's memory changed with his/her current illness?"[27] Caregiver answers are scored on a five-point Likert scale ranging from 1 (much improved) to 5 (much worse).[27] Scores of 4 (a bit worse) to 5 (much worse) suggest delirium.[27]

A single-center validation study conducted in an acute geriatric ward evaluated psychometric properties of the SSQ-Delirium.[27] The CAM conducted by a trained senior medical student was used as a reference standard for delirium diagnosis (Table 2).[27] The CAM is a 4-item measure of delirium yielding a dichotomous diagnosis (yes/no) by evaluating features of

delirium based off of the DSM-III-R criteria.[27,34] The sensitivity and specificity of the SSQ-Delirium were 79.6% and 56.1%, respectively.[27] The PPV of the SSQ-Delirium was 28.6% and the NPV was 91.4%.[27]

Caregiver-*Administered* Delirium Detection Tools:

Three included articles evaluated three caregiver-*administered* delirium detection tools: the Family Confusion Assessment Method (FAM-CAM),[10] Informant Assessment of Geriatric Delirium (I-AGeD),[25] and Sour Seven.[26]

I-AGeD

The I-AGeD is a 10-item questionnaire used to detect symptoms of delirium based on DSM-IV criteria.[25, 33] A multi-center cross-sectional study was conducted to evaluate the validity of the I-AGeD in geriatric ward settings. The reference standard was a psychiatric interview conducted by a geriatric resident physician using the DSM-IV criteria.[25, 33] Patients with delirium had a significantly higher mean ±SD I-AGeD score (6.03 ± 2.7) than non-delirious patients (3.58 ± 2.9, p<0.001).[25] With a cut-off score for delirium of 4 or greater, the sensitivity of the I-AGeD was 77.4% and the specificity was 63.2%.[25] In a subgroup without dementia and a cut-off score for delirium of 4 or greater, the sensitivity of the I-AGeD was 100% and the specificity was 65.2%.[25] Against the CAM, the sensitivity of the I-AGeD was 81.5% and the specificity was 64.3%.[25]

FAM-CAM

The FAM-CAM is an 11-item delirium detection questionnaire that evaluates four distinct features of delirium: acute onset and fluctuating course, inattention, disorganized thinking, and altered level of consciousness.[35]

A single-center validation study in an intermediate care unit (i.e. a medical unit for medically stable patients who are too unstable to use traditional long-term care facilities) evaluated the validity of the European Portuguese version of the FAM-CAM with a high level of comprehensibility and conceptual equivalence to the English version.[10] The reference standard was a psychiatric interview conducted by a psychiatrist using DSM-IV-TR criteria.[33] The sensitivity and specificity of the FAM-CAM were 75% (95% CI, 35-95%) and 91% (95% CI, 74-97%), respectively.[10] The PPV of the FAM-CAM was 67% (95% CI, 31-91%) and the NPV was 93% (95% CI, 77-99%).[10] There was statistically significant agreement between the FAM-CAM and the DSM-IV-TR, with a κ of 0.6 (95% CI, 0.4-1.0).[10]

Sour Seven

The Sour Seven is a 7-item weighted questionnaire totalling a maximum score of 18.[26] The items evaluate features of delirium including altered awareness and attention, fluctuation, disordered thinking and behaviour, impaired eating or drinking, and difficulty in mobility.[26]

A single-center study validated the Sour Seven for use by untrained (i.e. with no formal review of the tool) caregivers and nurses in general medical and surgical hospital units.[26] The reference standard was a psychiatric interview conducted by a geriatric psychiatrist using on DSM-IV criteria.[33] A score of 4 was used to indicate "possible delirium", and a score of 9 to indicate delirium.[26] With a cut-off score for delirium of 4, the Sour Seven had a PPV of 89.5% and an NPV of 90.0%.[26] With a cut-off score for delirium of 9, the Sour Seven had a PPV of 100.0% and an NPV of 74.1%.[26] There were no significant differences in delirium ratings on questionnaires completed by nurses versus caregivers.[26]

<u>Discussion</u>

The systematic search of the literature identified six caregiver-centered delirium detection tools.[6, 10, 24-27] All included studies had acceptable methodological quality to include the systematic review. Caregiver-informed tools, including the SQiD and SSQ-Delirium may be highly feasible for use in hospitals because they require no training and consist of one item each. Future research should evaluate the use of these tools in hospital settings where patients are likely to remain for a short period of time (i.e. less than 24 hours), such as emergency departments (EDs). Delirium screening is often not prioritized in EDs, leading to decreased detection upon admission.[36-39] For instance, studies have demonstrated that delirium often remains undetected in EDs due to the lack of structured psychiatric interviews, incomplete documentation of cognitive impairment in medical records, and insufficient psychiatric referrals.[36, 37, 40] These tools require no training, therefore any healthcare professional could administer the SQiD or SSQ-Delirium to quickly screen for delirium. Overall, these tools may improve delirium detection in EDs leading to increased documentation of cognitive impairment and further screening or psychiatric referral, but further validation is required.

The SCARED is a caregiver-informed tool that evaluates caregiver responses to experiences in palliative care, rather than directly detecting delirium. As such, the SCARED may be useful to evaluate the frequency and extent of caregiver distress caused by delirium, but may not be feasible for delirium detection in hospitals. Using the SCARED, Buss *et al.* demonstrated an important correlation between caregiver-perceived delirium and increased symptoms of GAD in caregivers, highlighting the need for research evaluating how the use of caregiver-centered delirium detection tools can help reduce psychiatric outcomes.

Caregiver-administered delirium detection tools, including the FAM-CAM, I-AGeD, and Sour Seven require minimal effort from the care team and no preliminary training. Using these tools, caregivers can independently detect symptoms of delirium and notify healthcare professionals accordingly. Studies using the original English version of the FAM-CAM were not included in this review due to being conducted in a community-based setting[17] with an interventional study design.[35] Similar to the Portuguese FAM-CAM, the English FAM-CAM consists of 11 items that evaluate four distinct features of delirium: acute onset and fluctuating course, inattention, disorganized thinking, and altered level of consciousness.[35] Future research should evaluate the use of caregiver-administered tools in hospital settings where patients are likely to remain for longer periods of time (i.e. more than 24 hours), such as ICUs, palliative care units, and other hospital wards. These settings demonstrate high delirium prevalence according to healthcare professional-administered tools, with 45-87% of ICU patients, 13-42% of palliative care patients, and over 20% of general ward patients experiencing delirium during their stay.[41, 42] Allowing caregivers to continuously screen for symptoms of delirium during patient hospital stays may reduce cases of delirium that remain undetected by intermittent screening. Caregiver-administered tools also may be particularly useful due to high caregiver presence in these settings. For instance, in a study evaluating ICU patients who stayed longer than two days, over 96% of patients were visited by family or friends.[15] The median visitation time was 11.5 hours (IQR = 6.3-17).[15] Additionally, in settings where the patient is sedated or functionally limited (e.g. ICU) delirium detection can be difficult for healthcare professionals who are unfamiliar with the patient.[11] Using these tools, caregivers may be able to detect symptoms of delirium where healthcare professionals may not. For instance, Bull *et al*.

demonstrated that caregivers using the FAM-CAM observed excessive drowsiness that healthcare professionals did not.[43]

Based on the literature, it is possible that these tools may reduce adverse caregiver psychological outcomes; however, more research is required. Though none of the included studies evaluated the effects that caregiver-centered tools had on caregiver psychological outcomes, literature in community settings suggests that caregivers are highly satisfied with the use of caregiver-centered tools. For instance, 62% of caregivers reported that use of the FAM-CAM increased their confidence in their caregiving abilities.[18]

<u>Strengths & Limitations</u>

This study has several qualities that strengthen its conclusions. This study followed rigorous, published protocol (according to PRISMA standards) to ensure transparency and quality.[19] No restrictions were placed on the search to ensure all relevant studies were appropriately included. This study provides an up-to-date summarization of caregiver-centered delirium detection tools, and is the first to summarize the use of caregiver-centered delirium detection tools in hospital settings only; past studies have included outpatient settings.[44] This review focused on hospitalized patients because they have a higher risk of developing delirium than patients in long-term care and community medical facilities.[45] We aimed to reduce clinical heterogeneity by focusing solely on hospitalized populations because the pathophysiology of delirium is inherently heterogeneous and clinical outcomes differ between hospital and community settings.

The strength of the conclusions of this study may be limited by several factors, highlighting the need for comparative studies to yield robust evidence on operating

characteristics with respect to reference standard, setting, population, and timing. First, reference standards between studies differed. Some reference standards, such as the CAM demonstrated lower psychometric properties than the gold standard, a psychiatric interview using DSM-5 criteria. Differing reference standards decreases the relevance of comparison between index tools. For instance, Martins *et al.* found that the sensitivity of the FAM-CAM varied based on the reference standard that was used (DSM-V or CAM); thus using psychometrically different reference tools may change validation outcomes.[10] Second, the definition of hospital was very broad resulting in the inclusion of varied hospital settings, which could not be corrected for using systematic review methodology. Different hospital settings pose unique diagnostic challenges (e.g. mechanically ventilated patients in ICU, high prevalence of dementia in geriatric units), therefore tools may have different psychometric properties and operating characteristics in varying populations and clinical settings. Third, there was significant clinical heterogeneity in study outcomes impairing direct comparison of operating characteristics. Only four studies reported sensitivity and specificity and only two reported PPV and NPV, making it difficult to directly compare the validity of the tools. Lastly, the quality of included studies varied and was not always optimal. Although no studies had clear violations in any QUADAS-2 categories, many did not provide sufficient information to make an informed judgment.

Conclusions

Delirium detection is essential to appropriately manage delirium. Caregiver-centered delirium detection tools may feasibly improve the timeliness and frequency of delirium detection. Overall, caregiver-centered delirium detection tools engage caregivers to improve

delirium detection and potentially reduce adverse patient and caregiver outcomes associated with unmanaged delirium. Further studies are needed to evaluate the validity and reliability of these tools in different hospital settings (using the same reference standard) where they may be most useful. Additional research with these tools should involve larger sample sizes and multiple centers to further explore their validity, and increase generalizability and impact. No risks associated with these tools have been reported; further research and knowledge translation studies should monitor potential adverse effects on patients and families and healthcare provider perceptions of their use in patient care.

References

[1]   The American Psychiatric Association. *Diagnostic and statistical manual of mental disorders (5th Ed.): DSM-5*. Washington, DC: American Psychiatric Association, 2013.

[2]   Ryan DJ, Regan NA, Caoimh RÓ, *et al.* Delirium in an adult acute hospital population: predictors, prevalence and detection. *BMJ Open*. 2013;**3**: e001772.

[3]   Ely E, Shintani A, Truman B, *et al*. Delirium as a predictor of mortality in mechanically ventilated patients in the intensive care unit. *JAMA*. 2004;**291**: 1753-1762.

[4]   Rockwood K, Cosway S, Carver D, *et al*. The risk of dementia and death after delirium. *Age ageing*. 1999;**28**: 551-556.

[5]   Andrew MK, Freter SH, Rockwood K. Incomplete functional recovery after delirium in elderly people: a prospective cohort study. *BMC geriatrics*. 2005;**12**: 141-144.

[6]   Buss MK, Vanderwerker LC, Inouye SK, *et al.* Associations between caregiver-perceived delirium in patients with cancer and generalized anxiety in their caregivers. *J Palliat Med*. 2007;**10**: 1083-1092.

[7]   Wei L, Fearing M, Sternberg E, *et al*. The Confusion Assessment Method (CAM): A Systematic Review of Current Usage. *JAGS*. 2008;**56**: 823-830.

[8]   Collins N, Blanchard M, Tookman A, *et al*. Detection of delirium in the acute hospital. *Age ageing*. 2010;**39**: 131-135.

[9]   Hsieh SJ, Ely EW, Gong MN. Can Intensive Care Unit Delirium Be Prevented and Reduced?. Lessons Learned and Future Directions. *Ann Am Thorac Soc*. 2013;**10**: 648-656.

[10]   Martins S, Conceicao F, Paiva JA, *et al.* Delirium recognition by family: European Portuguese validation study of the family confusion assessment method. *JAGS*. 2014;**62**: 1748-1752.

[11]   Inouye S. The dilemma of delirium: Clinical and research controversies regarding diagnosis and evaluation of delirium in hospitalized elderly medical patients. *Am J Med*. 1994;**97**: 278-288.

[12]   Davidson J, Aslakson R, Long A*, et al.* Guidelines for Family-Centered Care in the Neonatal, Pediatric, and Adult ICU. *Crit Care Med*. 2017;**45**: 103-128.

[13]   Conway J, Edgeman-Levitan S, Ford D, *et al.* Partnering with patients and families to design a patient-and family-centered health care system. The institute for patient-and family-centered care, 2006.

[14]   The American Association of Critical Care Nurses. Family presence: visitation in the adult ICU. *Crit Care Nurse*. 2012;**32**: 76-78.

[15]   Ramos D, Fumis F, Lins R, *et al.* Perceptions of an open visitation policy by intensive care unit workers. *Ann Intensive Care*. 2013;**3**: 34-34.

[16]   Jabre P, Belpomme V, Azoulay E*, et al.* Family presence during cardiopulmonary resuscitation. *NEJM*. 2013;**368**: 1008-1018.

[17]   Lautrette A, Darmon M, Megarbane B*, et al.* A communication strategy and brochure for relatives of patients dying in the ICU. *NEJM*. 2007;**356**: 469-478.

[18]   Steis M, Prabhu V, Kolanowski A, *et al.* Detection of delirium in community-dwelling persons with dementia. *OJNI* 2012;**16**.

[19]   Liberati A, Altman DG, Tetzlaff J*, et al.* The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions: Explanation and Elaboration. *PLOS Medicine*. 2009;**6**: e1000100.

[20]   International Prospective Register of Systematic Reviews (PROSPERO). York, UK: Centre for Reviews and Dissemination (online). Available at https://www.crd.york.ac.uk/prospero/. Accessed January 25, 2018.

[21]   Cochrane Database of Systematic Reviews. The Cochrane Library (online). Available at http://www.cochranelibrary.com/cochrane-database-of-systematic-reviews/. Accessed January 25, 2018.

[22]   Google. Google Translate (online). Available at https://translate.google.com/. Accessed January 25, 2018.

[23]   Whiting PF, Rutjes AS, Westwood ME. QUADAS-2: A revised tool for the quality assessment of diagnostic accuracy studies. *Ann Intern Med*. 2011;**155**: 529-536.

[24]   Sands MB, Dantoc BP, Hartshorn A, *et al.* Single question in delirium (SQiD): Testing its efficacy against psychiatrist interview, the confusion assessment method and the memorial delirium assessment scale. *Palliat Med*. 2010;**24**: 561-565.

[25]   Rhodius-Meester HF, Van Campen JP, Fung W, *et al.* Development and validation of the Informant Assessment of Geriatric Delirium Scale (I-AGeD). Recognition of delirium in geriatric patients. *Eur Geriatr Med*. 2013;**4**: 73-77.

[26]   Shulman RW, Kalra S, Jiang JZ. Validation of the Sour Seven Questionnaire for screening delirium in hospitalized seniors by informal caregivers and untrained nurses. *BMC geriatrics*. 2016;**16**.

[27]   Hendry K, Quinn TJ, Evans JJ, *et al*. Informant single screening questions for delirium and dementia in acute care--a cross-sectional test accuracy pilot study. *BMC geriatrics*. 2015;**15**: 17.

[28]   Prigerson H, Cherlin E, Chen J, *et al*. The Stressful Caregiving Adult Reactions to Experiences of Dying (SCARED) Scale: a measure for assessing caregiver exposure to distress in terminal care. *Am Geriatr Psychiatry*. 2003;**3**: 309-319.

[29]   Pfeiffer E. A Short Portable Mental Status Questionnaire for the Assessment of Organic Brain Deficit in Elderly Patients. *JAGS*. 1975;**23**: 433-441.

[30]   Erkinjuntti T, Sulkava R, Wikström J, *et al*. Short Portable Mental Status Questionnaire as a Screening Test for Dementia and Delirium Among the Elderly. *JAGS*. 1987;**35**: 412-416.

[31]   Williams J, Gibbon M, First MB*, et al.* The Structured Clinical Interview for DSM-III-R (SCID). II. Multisite test-retest reliability. *49*. 1992;**8**.

[32]   Spitzer M, GIbbon R, Williams J. *Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Research Version*. New York: Biometrics Research: New York State Psychiatric Institute, 2002.

[33]   The American Psychiatric Association. *The Diagnostic and Statistical Manual of Mental Disoders (4th Ed.): DSM-IV-TR*. Washington, DC: American Psychiatric Association, 2000.

[34]   The American Psychiatric Association. *The Diagnostic and Statistical Manual (3rd ed.): DSM-III-R*. Washington, DC: American Psychiatric Association, 1987.

[35]   Steis MR, Evans L, Hirschman KB*, et al.* Screening for Delirium via Family Caregivers: Convergent Validity of the Family Confusion Assessment Method (FAM-CAM) and Interviewer-Rated CAM. *JAGS*. 2012;**60**: 2121-2126.

[36]   Lewis LM, Miller DK, Morley JE, *et al.* Unrecognized delirium in ED geriatric patients. *Am J Emerg Med*. 1995;**13**: 142-145.

[37]   Hustey FM, Meldon SW. The prevalence and documentation of impaired mental status in elderly emergency department patients. *Ann Emerg Med*. 2002;**39**: 248-253.

[38]   Han JH, Zimmerman EE, Cutler N*, et al.* Delirium in older emergency department patients: recognition, risk factors, and psychomotor subtypes. *Acad Emerg Med*. 2009;**16**: 193-200.

[39]   Elie M, Rousseau F, Cole M, *et al*. Prevalence and detection of delirium in elderly emergency department patients. *CMAJ*. 2000;**8**: 977-981.

[40]   Press Y, Margulin T, Grinshpun Y*, et al.* The diagnosis of delirium among elderly patients presenting to the emergency department of an acute hospital. *Arch Gerontol Geriatr*. 2009;**48**: 201-204.

[41]   Hosie A, Davidson P, Agar M, *et al.* Delirium prevalence, incidence, and implications for screening in specialist palliative care inpatient settings: A systematic review. *Palliat Med*. 2012;**27**: 486-498.

[42]   Cavallazzi R, Saad M, Marik PE. Delirium in the ICU: an overview. *Ann Intensive Care*. 2012;**2**: 49.

[43]   Bull MJ, Boaz L, Maadooliat M*, et al.* Preparing Family Caregivers to Recognize Delirium Symptoms in Older Adults After Elective Hip or Knee Arthroplasty. *JAGS*. 2017;**65**: e13-e17.

[44]   Lawlor PG, Bush SH. Delirium diagnosis, screening and management. *Curr Opin Palliat Care*. 2014;**8**: 286-295.

[45]   Andrew M, Freter S, Rockwood K. Prevalence and outcomes of delirium in community and non-

acute care settings in people without dementia: a report from the Canadian Study of Health and Aging. *BMC Med*. 2006;**4:** 15.

Table 1: Characteristics of Included Studies

Study	Year	Location	Hospital Setting	Mean Patient Age, n (±SD)	Dyads*, n	Caregiver-Centered Tool Used
Buss *et al.*	2007	United States	Oncology, palliative		200	SCARED
Hendry *et al.*	2015	United Kingdom	Acute, geriatric	80.9	70	SSQ-Delirium
Martins *et al.*	2014	Portugal	Intermediate care*		40	FAM-CAM
Rhodius-Meester *et al.*	2013	The Netherlands	Geriatric	86.4 (±8.0)	88	I-AGeD
Sands *et al.*	2010	Australia	Oncology, palliative	53.2	21	SQiD
Shulman *et al.*	2016	Canada	Medical, surgical	81.3 (±8.9)	80	Sour Seven

Abbreviations:

FAM-CAM= Family Confusion Assessment Method; SCARED= Stressful Caregiving Responses to Experiences of Dying; SSQ-Delirium= Single Screening Question Delirium; I-AGeD= Informant Assessment of Geriatric Delirium; SQiD= Single Question in Delirium

*Intermediate care: a medical unit for medically stable patients who are too unstable to use traditional long-term care facilities

*Dyad: a patient and caregiver

Table 2: Validation Outcomes of Included Tools

Index Tool	Caregiver-administered or -informed	Reference Standard	Sensitivity % (95% CI, %)	Specificity % (95% CI, %)	PPV % (95% CI, %)	NPV % (95% CI, %)	Inter-Tool Correlation κ, (p-value)
I-AGeD	Administered	CAM	80	64	50%	-	-
FAM-CAM	Administered	DSM-IV-TR CAM	75 (35-95) 86 (42-99)	91 (74-97) 91 (74-97)	67 (31-91) 67 (31-91)	93 (77-99) 97 (81-99)	0.6, 95% CI 0.3-0.9 with DSM-IV-TR; 0.7, 95% CI 0.4-1 with CAM
Sour Seven	Administered	DSM-5	-	-	89.5 (cut-off score 4) 100 (cut-off score 9)	90 (cut-off score 4) 74.1 (cut-off score 9)	-
SCARED	Informed	SPMSQ	-	-	-	-	-
SQiD	Informed	CAM	80 (28.4-99.5)	71 (41.9-91.6)	50 (15.7-84.3)	91 (58.7-99.8)	0.43 (0.023) with DSM-IV
SSQ-Delirium	Informed	CAM	76.9	56.1	28.6	91.4	-

Abbreviations:

CI- confidence interval; I-AGeD- Informant Assessment of Geriatric Delirium; FAM-CAM- Family Confusion Assessment Method; SCARED- Stressful Caregiving Responses to Experiences of Dying; SQiD- Single Question in Delirium; SSQ-Delirium- Single Screening Question Delirium; CAM- Confusion Assessment Method; DSM-IV-TR- Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision; SPMSQ- Short Portable Mental Status Questionnaire; DSM-5- Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

Table 3. QUADAS-2 Quality Assessment of Included Studies

Study Author	Risk of Bias				Applicability Concerns			
	Patient Selection	Index Test	Reference Standard	Flow and Timing	Patient Selection	Index Test	Reference Standard	Overall
Buss et al.	±	±	±	+	+	±	+	±
Hendry et al.	+	±	+	+	+	±	±	+
Martins et al.	±	±	+	+	±	±	+	±
Rhodius-Meester et al.	±	+	+	+	+	+	+	+
Sands et al.	+	+	+	+	+	+	+	+
Shulman et al.	±	±	+	+	+	+	+	+

All questions in each domain were answered with "yes" (+), "no" (-), or "unclear" (±). The overall risk of bias was rated as "low" (+), "high" (−), or "unclear" (±).

Figure 1: PRISMA Study Flow Diagram