2020

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This article was originally published as:
Koirala, B., Hansen, B. R., Hosie, A., Budhathoki, C., Seal, S., Beaman, A., & Davidson, P. M. (2020). Delirium point prevalence studies in inpatient settings: A systematic review. *Journal of Clinical Nursing, Early View, Online First.*

Original article available here:
10.1111/jocn.15219

This is the peer reviewed version of the following article:

Koirala, B., Hansen, B.R., Hosie, A., Budhathoki, C., Seal, S., Beaman, A., and Davidson, P.M. (2020). Delirium point prevalence studies in inpatient settings: A systematic review and meta-analysis. *Journal of Clinical Nursing, Early View Online First,* doi: 10.1111/jocn.15219

This article has been published in final form at: -

https://doi.org/10.1111/jocn.15219

Delirium Point Prevalence Studies in Inpatient Settings: A Systematic Review and Meta-analysis

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Previous presentation:

Hansen, B.R., Koirala, B., Beaman, A., & Davidson, P.M. (2018). Point prevalence studies on delirium: A systematic review. Paper presented at the 8th American Delirium Society Annual Conference, San Francisco, California.

Authors Contribution Statement:

BK, BH, AB and PD conceptualized this manuscript. BK, BH and SS performed literature search. BK, BH screened studies and performed data extraction. BK, CB performed meta-analysis and interpretation. BK, BH, PD and AH made material contribution in terms of developing the construct and making substantial editorial contribution. All co-authors critically reviewed the manuscript and approved final version for submission.

No disclosures to Report

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Abstract

Aims: To examine the delirium point prevalence studies conducted in different inpatient settings and to discuss the implication of the findings for delirium screening, assessment,

prevention, and management.

Background: Delirium—a common and distressing condition manifesting as an acute decline of attention and cognition—is frequently overlooked, misdiagnosed or treated inappropriately. This neuropsychiatric syndrome manifests as changes in attention, cognition, and awareness, with a resultant impact on behavior, function, and emotions. Delirium is recognized as a patient management challenge in the inpatient setting and there is a need to understand the current point prevalence and assessment practices of delirium.

Design: A systematic review and meta-analysis

Methods: A systematic review of published delirium prevalence studies in inpatient settings was conducted and the implications of findings for delirium screening, assessment, prevention, and management identified. The random-effects meta-analysis was conducted among studies measuring delirium point prevalence. The PRISMA statement was used to report systematic review and meta-analysis.

Results: Nine studies were included in the review, with sample sizes ranging from 47 to 1867. Delirium point prevalence ranged from 9% to 32%. Hypoactive delirium was the most common subtype, ranging from 23% to 78%. Fifteen delirium screening tools or assessment or diagnostic methods were used. Comorbid dementia was present in up to 50% of inpatients.

Conclusions: Gaining a consensus on effective delirium instruments, the time windows for assessment and measurement will be crucial in driving benchmarking and quality improvement studies.

Relevance to clinical practice: Consistent identification of high-risk patients and treatment settings with elevated risk, accompanied by the implementation of effective preventive and management strategies, are critical to addressing delirium— a frequent and burdensome condition, that adversely affects patient outcomes.

Key words: delirium, inpatient, meta-analysis, point prevalence, systematic review

Introduction

Delirium is a neuropsychiatric syndrome that manifests as an acute decline of attention and cognition and occurs across healthcare settings (European Delirium Association & American Delirium Society, 2014; National Institute for Health and Care Excellence, 2010). The healthcare costs of delirium are considerable: 182 billion Euros per year in Europe and 164 billion dollars in the United States (Bellelli et al., 2016). Delirium occurs suddenly, usually after exposure to an acute stressor, such as sepsis, surgery, administration of medications with anticholinergic effects or prolonged periods of immobility (American Psychiatric Association, 2013). Given sufficient physiological stressors, delirium can occur in people of any age; however, it is more common in older adults who have experienced major illness or surgery, especially involving an intensive care stay (Devlin et al., 2018). At least 20% of older hospitalized inpatients (Ryan et al., 2013) and up to 80% of patients in intensive care units are affected by delirium (Richardson et al., 2017). Delirium can last from hours to many weeks before resolving (Kolanowski, 2018) or—for a significant proportion of the population—may last a long time and never return to pre-hospitalization baseline.

Delirium impacts the patients' communication abilities, decision-making, functional capacity and quality of life (Logan, 2018). Patients recovering from an episode of delirium and their family members generally recall the experience as humiliating and frightening (O'Malley, Leonard, Meagher, & O'Keeffe, 2008). Behavioral symptoms of delirium, commonly and imprecisely referred to as terminal restlessness or terminal agitation, can also cause distress for caregivers (Finucane, Lugton, Kennedy, & Spiller, 2017). In addition, delirium is associated with worsening functional independence, longer hospital stays, and higher mortality rates (Bellelli et al., 2016; Pandharipande et al., 2017). Recent literature indicates that delirium is a strong predictor of cognitive decline and dementia in older people (Davis, Muniz-Terrera, & Keage, 2017), consistently occurring after any hospitalization in which delirium occured,

including patients who are postoperative or were in critical care (Pandharipande et al., 2013), in a long-term care settings, and in the community (Davis et al., 2014).

Despite the burden, delirium is often unrecognized and undiagnosed, resulting in inadequate care, treatment, and adverse health outcomes (Pandharipande et al., 2017). Delirium has multiple precipitating factors, occurs in a variety of settings such as home, long-term care, acute care, and intensive care, and the baseline cognitive status of patients who develop this neuropsychiatric syndrome is often unknown or unclear (Marra et al., 2019). The recognition of delirium characteristics, and optimizing clinical management, continue to pose a challenge for healthcare providers. Thus, the need for identification, appropriate prevention, and management strategies of delirium is increasingly receiving the attention of researchers and healthcare providers alike as a major public health priority (Salluh et al., 2015).

Evidence for the identification, management and support for delirium is evolving but needs further development. Previous reviews on delirium have underscored delirium prevalence, incidence, and outcomes for patients in intensive care units (Krewulak, Stelfox, Leigh, Ely, & Fiest, 2018; Salluh et al., 2015), palliative care inpatient settings (Hosie, Davidson, Agar, Sanderson, & Phillips, 2013) and post-acute and long-term care settings (Forsberg, 2017). However, no review has explicitly examined delirium point prevalence studies and identification methods across inpatient settings, nor discussed the implication of the findings for delirium screening, assessment, prevention, and management. Point prevalence is based on an examination at a given point in time, which reflects current estimates of disease frequency or burden (Hunter & Risebro, 2011) and has implications for practice. Though systematic identification methods help improve recognition of delirium, they are not routinely conducted across healthcare settings (Marra et al., 2019). Developing a clearer understanding of point prevalence and screening practices across inpatient settings will help inform the significance of the problem and highlight areas of need supporting improvement efforts to

effectively prevent, identify, and manage delirium.

Aim

To examine the delirium point prevalence studies conducted in different inpatient settings and discuss the implication of the findings for delirium screening, assessment, prevention, and management.

Methods

Design

This systematic review and meta-analysis was guided and reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (see Supplementary File 1; Moher, Liberati, Tetzlaff, & Altman, 2009).

Search method

The search strategy was guided by an experienced health librarian and used PubMed, Embase, Scopus, and CINAHL databases. Two stages of the search were performed using Medical Subject Headings (MeSH) and keywords, along with their associated derivatives. The first search was specific to delirium point prevalence among the elderly in a hospital or acute care settings. The second search was broader and without any keywords related to location to capture all the relevant studies for the review. Search terms were: "Delirium" OR "delirium" OR "delirious" OR "delirious" AND "point prevalence" OR "point NEAR/3 Prevalen*" AND "adult" OR "aged" OR "elder" OR "senior" or "older" or "frail" OR "geriatric". To specify a specific location in the first search stage, the search terms used were: "hospitals" OR "hospital" OR "Hospital*" "acute". In addition to the database search, hand searching, and reference lists of included studies and relevant reviews were also examined to find potentially relevant papers. In the initial search, studies undertaken between 1986 and 2017 were included. Additional hand searches, searching of the relevant studies through Google, Google Scholar, databases other than the included and reference lists of previous studies, were conducted in

February 2019 and June 2019 to determine whether other recent eligible delirium point prevalence studies met the inclusion criteria.

Study selection and data extraction

The criteria for inclusion were papers published in English reporting delirium point prevalence in adult participants (18 years of age or older) in inpatient settings (i.e., hospitals or acute care settings). The search resulted in a total of 193 papers, which were reduced to 66 after deleting duplicates. Authors examined titles and abstracts of 66 papers to determine whether they were relevant to include in the study. Twenty-four papers were excluded after title and abstract review, with 42 papers identified for full-text review. Study screening was completed by the first two authors independently, with final inclusion determined after consultation with senior authors. Nine studies were selected for inclusion. The PRISMA flow diagram is presented in Figure 1.

The final selected studies were reviewed by two authors to evaluate the delirium point prevalence, delirium screening tools, and additional findings on types of delirium, screening practices, and dementia comorbidities.

Data analysis

Meta-analysis of delirium point prevalence was conducted using comprehensive meta-analysis software. Studies with two or more measurements of delirium were included in the meta-analysis with point prevalence that was measured using the Diagnostic and Statistical Manual of Mental Disorder (DSM) criteria. Heterogeneity (Q-test) with I squared (I^2) statistics were measured and helped decide on the random-effects model for the study (Riley, Higgins, & Deeks, 2011). Further, analysis estimated Tau squared (τ^2) (using the DerSimonian and Laird method) and produced a funnel plot to assess publication bias.

Results

Among the nine point-prevalence studies included in the review, the majority were

performed in a single country: Australia (Casey et al., 2019; Hosie et al., 2016), Denmark (Norbaek & Glipstrup, 2016), Ireland (Ryan et al., 2013), Italy (Bellelli et al., 2016), Scotland (Spiller & Keen, 2006), and UK (Giraud & Vuylsteke, 2014). One study (Elliott et al., 2013) included two countries: Australia and New Zealand; one study (Salluh et al., 2010) included 11 countries: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Spain, USA, and Uruguay. All studies focused on inpatient settings: ICU (n=3) (Elliott et al., 2013; Giraud & Vuylsteke, 2014; Salluh et al., 2010); acute care hospital (n=4) (Bellelli et al., 2016; Casey et al., 2019; Norbaek & Glipstrup, 2016; Ryan et al., 2013); palliative care unit or hospice (n=2) (Hosie et al., 2016; Spiller & Keen, 2006). The sample size for the selected studies ranged from 47 to 1,867 participants: who were primarily older adults with a reported mean age range of 61-82 years and 42-63% male. Information on setting, sample size, population characteristics, delirium screening tools, and point prevalence results were extracted and are presented in Table 1.

Delirium screening tools

Fifteen different screening, assessment, or diagnostic methods were used to identify delirium (Table 2). The Diagnostic and Statistical Manual of Mental Disorders criteria for delirium, DSM-5 (Hosie et al., 2016) and DSM-IV (Norbaek & Glipstrup, 2016; Ryan et al., 2013) were commonly used to assess delirium. The next most frequently used tools were: the Confusion Assessment Method (CAM) (Ryan et al., 2013; Spiller & Keen, 2006); the 4A Test—screening instrument for cognitive impairment and delirium (Bellelli et al., 2016; Casey et al., 2019); the Confusion Assessment Method for the ICU (CAM-ICU) (Giraud & Vuylsteke, 2014; Salluh et al., 2010); the 3-Minute Diagnostic Interview for the Confusion Assessment Method (3D-CAM) (Casey et al., 2019); Brief Confusion Assessment Method (bCAM) (Norbaek & Glipstrup, 2016); Clinical Assessment (Elliott et al., 2013); Delirium Rating Scale-Revised-98 (DRS-R98), (Ryan et al., 2013); Delirium-specific ICD codes (F05.0,

F05.1, F05.8, F05.9) (Casey et al., 2019); Intensive Care Delirium Screening Checklist (ICDSC) (Elliott et al., 2013); Spatial Span Forwards (SSF), counting backwards from 20 was used for visually-impaired patients (Ryan et al., 2013); Months Backwards (MB), adapted from the Short Blessed Test for dementia (Ryan et al., 2013); Nursing Delirium Screening Scale (Nu-DESC) (Hosie et al., 2016) and other (Elliott et al., 2013). Two assessment tools were used to identify delirium subtype— Memorial Delirium Assessment Scale (MDAS) (Hosie et al., 2016; Spiller & Keen, 2006) and Delirium Motor Subtype Scale (DMSS) (Bellelli et al., 2016). Seven studies used multiple assessment methods.

Delirium point prevalence

The delirium point prevalence ranged from 9% to 34%. The time periods used to measure point prevalence varied—one day (n=4) (Bellelli et al., 2016; Casey et al., 2019; Ryan et al., 2013; Salluh et al., 2010); two non-consecutive days (n=2) (Hosie et al., 2016; Norbaek & Glipstrup, 2016); two consecutive days (n=2) (Casey et al., 2019; Spiller & Keen, 2006); three non-consecutive days (n=1) (Elliott et al., 2013); and seven days (n=1) (Giraud & Vuylsteke, 2014).

Meta-analysis findings on delirium point prevalence

The findings from meta-analysis with forest plot is presented in Table 3. The study estimated τ^2 (using the DerSimonian and Laird method) to be 0.162. The Q-test of heterogeneity was statistically significant ($Q=79.894$, $p<0.001$) and the I^2 was also high (90%); both measures suggested presence of substantial heterogeneity. Hence, we used the random-effects model using delirium prevalence as an outcome, and a meta-analysis estimate of prevalence was 22.3%, with a 95% prediction interval of (17.8%, 27.7%). The funnel plot suggested some evidence of publication bias.

Additional results

These studies highlighted the issue of under-screening and as a consequence under-

reported delirium. In one study, only 3% of participants were assessed for delirium as part of routine clinical practice (Elliott et al., 2013). Of the participants who screened positive with delirium in another two studies, less than half had the diagnosis documented in their medical records (Casey et al., 2019; Norbaek & Glipstrup, 2016). One study reported that delirium was associated with increased ICU and hospital mortality and longer duration of hospitalization (Salluh et al., 2010). The motoric, or repetitive muscle movement, delirium subtype was identified in 64.1% of the delirium patients. Hypoactive delirium was most common (23-78%), followed by mixed delirium (4.6-27.3%), and hyperactive delirium (1.8-21.5%). Non-motoric delirium was identified least commonly (12.7%) (Bellelli et al., 2006). Comorbid dementia was identified in about half (50.9% and 52.9%) of identified delirium cases in two studies (Bellelli et al., 2016; Ryan et al., 2013).

Discussion

This review identified that delirium point prevalence ranged from 9% to 32% in inpatient settings. The included studies were characterized by diversity and heterogeneity in populations and instruments and signaled the need for obtaining consensus on a range of issues, including screening and assessment tools appropriate for inpatient settings. These results have important implications for the development of guidelines and models of care.

Although time periods included within the measurement window of this review varied, each of the included studies used the estimate of point prevalence. In the literature, some studies defined point prevalence and period prevalence similarly; however, a distinction can also be made between these two approaches to prevalence measurement. The proportion of a population who have specific characteristics at a specific point in time is point prevalence, whereas, the proportion of a population who have specific characteristics at any point in time during a given period of interest is a period prevalence, with “past 12 months” being a commonly used period prevalence time span (National Institute of Mental Health, 2017). The

delirium literature more often uses period prevalence as opposed to point prevalence. Point prevalence provides more contemporary estimates for burden of disease (Ward, 2013). The identification of point estimates of delirium in inpatient setting is crucial to increase awareness concerning this condition among healthcare providers and administrators, driving the implementation of delirium prevention and management programs.

One of the key findings of this review is that delirium point prevalence was fairly stable and consistent across the time periods, clinical settings and countries of these studies. This may suggest that there is commonality in patients' risk across inpatient settings of care. This is not a novel observation, but it underscores the need to consider consolidated care systems for delirium across hospitals. For example, prevention interventions addressing fundamental human needs have been found to be effective for older patients across a range on inpatient settings (Hshieh et al., 2015; Pun et al., 2019; Siddiqi et al., 2016). A meta-analysis on the impact of 11 studies on delirium prevention with multi-component non-pharmacological interventions found, >50% odds reduction (OR=0.47, 95% CI, 0.38–0.58) in occurrence of delirium during hospitalization (Hshieh et al., 2015). In addition, outpatient models of care, such as Hospital-at-Home, which have consistently demonstrated good patient outcomes and cost-effectiveness, may be an approach to care delivery that can decrease the risk of delirium (Caplan, 2008; Conley, O'brien, Leff, Bolen, & Zulman, 2016; Shepperd et al., 2016).

Since delirium is often under-screened, under-recognized and under-reported, this and previous reviews highlight the need to identify an appropriate delirium screening tool for timely recognition (Watt et al., 2019). Further, there is a need to evaluate delirium identification strategies across inpatient settings. A study of the utility of delirium screening and diagnostic tools across settings would not only help reach consensus on delirium identification processes but also develop clinical practice guidelines for early detection of delirium (Lawlor & Bush, 2014; Watt et al., 2019). Obtaining consensus on delirium

identification is also needed for study comparison and data harmonization (Neufeld et al., 2014).

This review found that hypoactive delirium was the most commonly identified sub-type (Martins & Fernandes, 2012) and was also the most likely to be under-recognized (Marra et al., 2019). This is important to consider as hypoactive delirium has been associated with poor outcomes including longer lengths of stay and mortality (Peritogiannis, Bolosi, Lixouriotis, & Rizos, 2015; Robinson, Raeburn, Tran, Brenner, & Moss, 2011). Another important observation of this review was the high rates of documented co-morbid dementia in participants with delirium. The prevalence of delirium superimposed on dementia ranges from 22 to 89%, with the high prevalence among those who are hospitalized (Davis et al., 2015; Grossi et al., 2019). This review and other studies highlight the importance of guideline-directed assessment for delirium, identification of high risk groups, and preventive strategies (Devlin et al., 2018). The association between immobility, lack of sleep and delirium are important issues to consider, particularly in critical care units.

Strengths and Limitations

This study has several limitations. First, the review included only papers published in English. Second, although this appraisal focused on the inpatient setting, a diversity of populations and assessment methods make it harder to make definitive recommendations. The non-inclusion of community setting delirium point prevalence studies is a limitation of this review. The study analysis produced a funnel plot (Figure 2), and there appears to be some publication bias; however, the number of studies was small to make a comprehensive assessment of publication bias.

Despite the limitations, this review has identified important issues for consideration, such as the critical need to standardize the timing and the assessment instruments for delirium both in clinical practice and research. Further, this review reinforced standard care

recommendations for care providers and nurses on early diagnosis and management of delirium. Standardization of delirium assessment and widespread adoption of intervention recommendations are important to promote optimum patient outcomes in inpatient settings, especially in the context of a steady global increase in population age, multi-morbidity, and healthcare complexities.

Conclusions

In the studies reviewed, up to a third of adults in inpatient settings were identified as delirious during the assessment time windows with hypoactive delirium being the most prevalent. As part of the increasing focus on delirium reduction it will be important to develop both research and clinical consensus on the best approach to delirium screening and assessment as an important step toward effective, systematic, and widely disseminated delirium intervention implementation.

Relevance to clinical practice

As populations age and the risk for delirium increases, the importance of age-friendly environments, caregiver engagement, and close attention to the known precipitants of delirium— especially in high-risk populations—is underscored. Multimorbidity, or the presence of two or more long term chronic conditions, is another factor that frequently increases with age and contributes to the risk for the development of delirium (Yarnall et al., 2017). As these factors comprise the composite picture of many individuals in inpatient settings, health systems should refocus and recalibrate care to address these specific needs. Young and Inouye (2007) comment that delirium could be prevented with better systems of routine care in least a third of patients (Young & Inouye, 2007). Consistent identification of high-risk patients and treatment settings with elevated risk, accompanied by implementation of effective preventive and management strategies, are critical to addressing this frequent and

burdensome condition that adversely affects patient outcomes. Given the results of the present review and delirium clinical care standards (Australian Commission on Safety and Quality in Health Care, 2016), the recommendations for basic elements of delirium care for patients in inpatient settings are as follows:

- *Early screening:* Health care organizations and care providers, including nurses, should focus on routine screening of cognitive function for patients at risk of delirium using appropriate and validated screening tools. Additionally, patients and caregivers should be asked to report any recent changes in a patient's behavior and thinking for early detection of delirium.
- *Assessment of delirium:* If the presence of delirium is suspected, prompt patient assessment should be completed by physicians and nurses who are trained and competent in delirium diagnosis, using validated diagnostic tools.
- *Intervention to prevent and manage delirium:* Provide patients who are at risk of or with delirium a set of interventions to prevent delirium and involve their caregivers. Potential interventions that can be initiated by nurses and other care providers include medication review, mobility exercises, oxygen therapy, correction of dehydration, malnutrition, and constipation, pain assessment and management, cognition stimulating activities, reassurance and reorientation, and sleep promotion.
- *Prevention of potential harm:* If a patient is diagnosed with delirium, assess, monitor and document the patient's risk of developing pressure injury and having a fall. Further, implement appropriate interventions with both patient and caregivers that are tailored to the assessment findings.
- *Minimize the use of antipsychotic drugs:* Non-pharmacological interventions are the first-line interventions for both prevention and treatment of delirium (Hshieh, Inouye, & Oh, 2018). Treat patients with delirium with antipsychotic drugs only if the patient is distressed

and the cause of distress cannot be addressed or when non-pharmacological interventions have failed to ease the symptoms.

- *Transition from hospital:* Develop and provide an individualized care plan for patients with current or resolved delirium before discharge. Involve patients and caregivers in developing these plans and educate them about delirium.

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What does this paper contribute to the wider global clinical community?

- This review identified delirium point prevalence of 9% to 32.2% in inpatient settings, with hypoactive delirium being the most prevalent.
- Comorbid dementia was present in about half of delirium cases underscoring the complexity of diagnosis and the presence of multi-morbidity.
- Fifteen different screening, assessment, or diagnostic methods were used to identify delirium in inpatient settings. Gaining consensus on delirium instruments, time windows for assessment and measurement will be critical for research and practice.

Table 1. Summary of studies included

Author (s), Year	Country	Setting	Population (sample size, population rate)	Sample characteristics Age (Mean ± SD/ Median [IQR]); Male (%)	Diagnostic criteria for point prevalence	Point prevalence = Patients with delirium /sample size = x/n (%)	Time period	Other findings
Casey et al., 2019	Australia	Australian Health Service including 5 hospitals and 25 inpatient wards	n = 559 (aged 18 years and older)	73.0 ± 16.4 45% male	4AT, 3D-CAM, ICD codes	91/559 (16.3)	One day for four hospitals and two days for one large hospital	Only 58/559 participants (10.4%) had ICD delirium codes recorded in their medical record. Of participants with confirmed delirium, only 31/91 (34.1%) had ICD delirium codes assigned.
Bellelli et al., 2016	Italy	Multicenter: 108 acute care; 12 rehabilitation wards	n = 1867 (aged 65 years or more)	82.0 ± 7.5 years 42% male	4AT, DMSS	429/1867 (22.9)	One day	The most common delirium subtype observed was hypoactive followed by mixed, hyperactive, and non-motoric. Among those identified with delirium, 227/429 (52.9%) also had dementia.
Hosie et al., 2016	Australia	2 palliative care units	n = 47	74 ± 10 years 60% male	Nu-DESC, MDAS, DSM 5	16/47 (34) screened positive & 9/47 (19) met DSM-5 diagnostic criteria	Two non-consecutive days (24-hours period)	Only 2/16 (12.5%) of participants could be assessed using the MDAS.
Norbaek & Glipstrup., 2016	Denmark	Acute hospital	n = 118	Age over 65 years 43% male	bCAM, DSM-IV	38/118 (32)	Two non-consecutive days (3-hours period)	Among patients with delirium only 18/38 (47%) had a diagnosis documented in their medical charts.
Giraud & Vuylsteke., 2014	UK	9 intensive care units	n = 217	-	CAM-ICU	63/217 (29)	One week	If delirium was previously diagnosed, routine screening of delirium was

								conducted on 170/208 (82%) of bed-days. If no previous delirium diagnosis, routine assessment was conducted 270/552 (52%) of bed-days.
Elliott et al., 2013	Australia & New Zealand	41 intensive care units: Australia= 36; New Zealand= 5	n = 428 (lightly sedated to very agitated patients)	62 (48-72) years 63% male	ICDSC, Clinical Assessment, Other	40/428 (9)	Three days, non-consecutive (4-hours period)	Only 19/569 (3%) of the participants were routinely assessed for delirium across all units on the respective study days in which they participated.
Ryan et al., 2013	Ireland	Tertiary care teaching hospital	n = 311	69 (17-100) years 48.9% male	SSF, MB, CAM, DRS-R98, DSM-IV	CAM: 52/296 (17.6) DSM IV: 55/280 (19.6) DRS-R98: 58/280 (20.7) full delirium, & 24/280 (8.6) subsyndromal delirium	One day	Among those diagnosed with delirium using DSM-IV criteria, 28/55 (50.9%) patients had pre-existing dementia that was poorly documented in medical record.
Salluh et al., 2010	11 countries from South America, North America & Spain	104 intensive care units	n = 497	62 (47-74) years 52.5% male	CAM-ICU	75/232 (32.2); after excluding deeply sedated and unarousable patients	One day	Delirium was an independent predictor of intensive care unit and hospital mortality and was also associated with longer duration of hospitalization.
Spiller & Keen, 2006	Scotland	8 specialist palliative care units	n = 109	Mean age ranged from 63.7 to 82.8 years in 8 specialist palliative care units	CAM, MDAS	32/109 (29.4)	Two days consecutive	Among patients with delirium, 25/32 (78%) had hypoactive delirium, (5/32) 16% had mixed, and 2/32 (6%) had hyperactive.

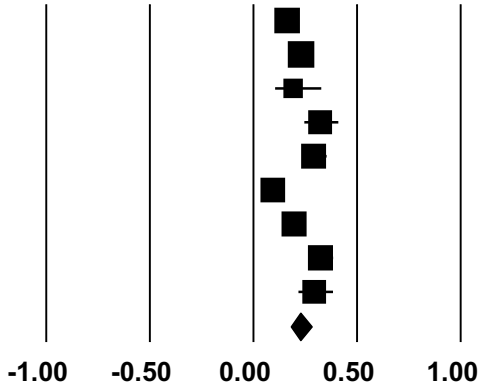
DSM: Diagnostic and Statistical Manual of Mental Disorders; CAM: Confusion Assessment Method; CAM-ICU: Confusion Assessment Method for the Intensive Care Unit; MDAS: Memorial Delirium Assessment Scale; 4AT: 4A Test; 3D-CAM; 3-Minute Diagnostic Interview for the Confusion Assessment Method; bCAM: Brief Confusion Assessment Method; DMSS: Delirium Motor Subtype Scale; DRS-R98: Delirium Rating Scale-Revised-98; ICD: Internationa Classification of Disease; ICDSC: Intensive Care Delirium Screening Checklist; IQR: Interquartile Range; MB: Months Backwards; Nu-DESC: Nursing Delirium Screening Scale; SSF: Spatial Span Forwards

Table 2. Delirium screening, assessment or diagnostic tools used in included studies

Delirium Screening/Assessment Tools	No. of studies used
Diagnostic and Statistical Manual of Mental Disorders (DSM)	3
Confusion Assessment Method (CAM)	2
Confusion Assessment Method for the Intensive Care Unit (CAM-ICU)	2
Memorial Delirium Assessment Scale (MDAS)	2
The 4A Test: screening instrument for cognitive impairment and delirium	2
3-Minute Diagnostic Interview for the Confusion Assessment Method (3D-CAM)	1
Brief Confusion Assessment Method (bCAM)	1
Clinical Assessment	1
Delirium Motor Subtype Scale (DMSS)	1
Delirium Rating Scale-Revised-98 (DRS-R98)	1
Delirium-specific Internationa Classification of Disease (ICD) codes (F05.0, F05.1, F05.8, F05.9)	1
Intensive Care Delirium Screening Checklist (ICDSC)	1
Months Backwards (MB), adapted from the Short-Blessed Test for dementia	1
Nursing Delirium Screening Scale (Nu-DESC)	1
Spatial Span Forwards (SSF),	1
- Counting backwards from 20 was used for visually-impaired patients	
Other (not specified in the study)	1

Table 3. Meta-analysis results on delirium point prevalence

Study name	Event rate	Lower limit	Upper limit	Z-Value	p-Value
Casey et al., 2019	0.163	0.134	0.196	-14.294	0.000
Bellelli et al., 2016	0.230	0.211	0.249	-21.987	0.000
Hosie et al., 2016	0.191	0.103	0.329	-3.885	0.000
Norbaek & Glipstrup, 2016	0.322	0.244	0.411	-3.779	0.000
Giraud & Vuylsteke, 2014	0.290	0.234	0.354	-5.977	0.000
Elliott et al., 2013	0.093	0.069	0.125	-13.682	0.000
Ryan et al., 2013	0.196	0.154	0.247	-9.366	0.000
Salluh et al., 2010	0.323	0.266	0.386	-5.263	0.000
Spiller & Keen, 2006	0.294	0.216	0.386	-4.175	0.000
	0.223	0.178	0.277	-8.498	0.000



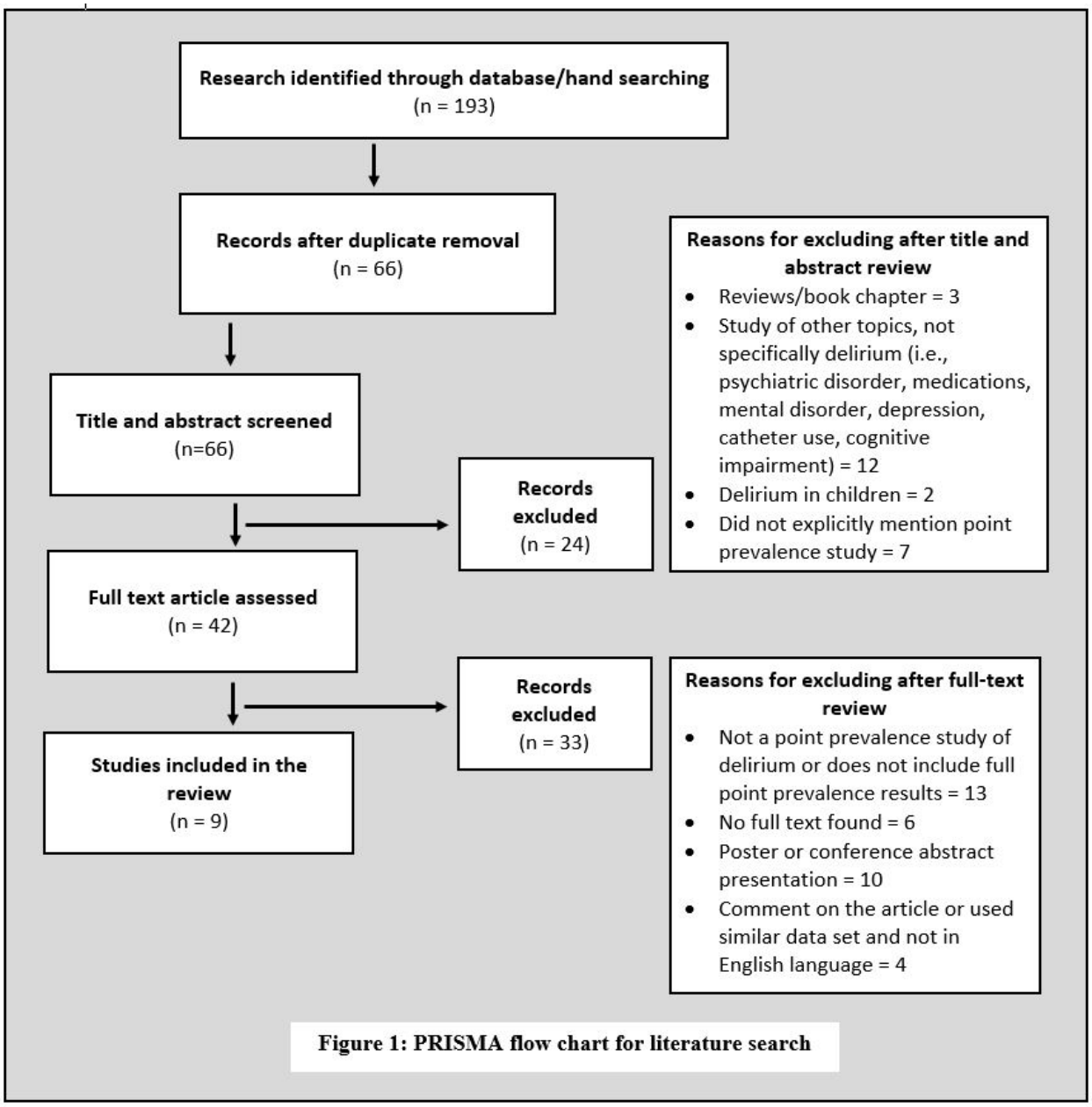


Figure 1: PRISMA flow chart for literature search

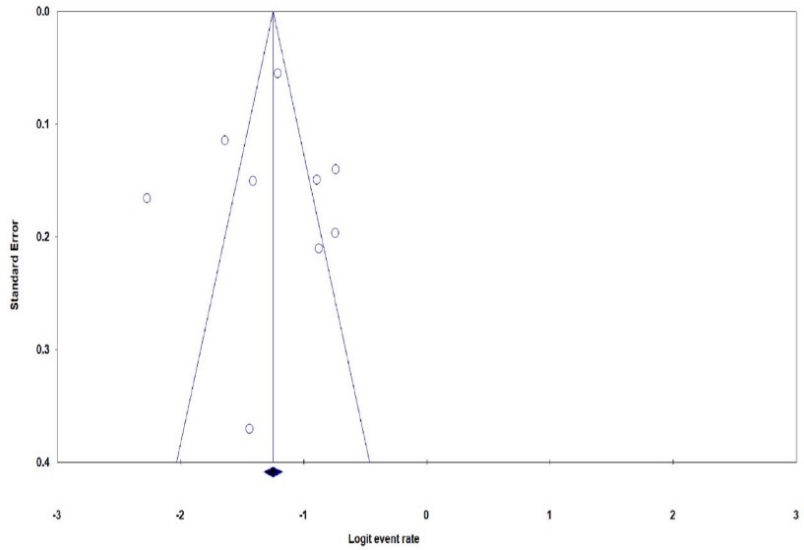


Figure 2: Funnel plot of standard error by logit event rate