American Journal of Emergency Medicine 59 (2022) 121–128

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

Delirium prevalence in geriatric emergency department patients: A systematic review and meta-analysis

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ARTICLE INFO

Article history:
Received 30 December 2021
Received in revised form 13 April 2022
Accepted 29 May 2022

Keywords:
Prevalence
Delirium
Meta-analysis
Older adults

ABSTRACT

Background: In the emergency department, delirium associated with serious adverse outcomes is common in geriatric patients. We performed a meta-analysis and estimated the prevalence of delirium and its related factors among geriatric emergency department patients.
Methods: PubMed, Embase, Web of Science, Cochrane Library, CINAHL, PsycINFO, and CBM databases were searched before November 7, 2021. The random-effects model was used to estimate the prevalence of delirium. In addition, subgroup analyses were performed based on continent or region, publication year, age, sample size, and diagnostic criteria or assessment methods.
Results: 30 studies involving 19,534 geriatric patients in the emergency department were included. The overall pooled crude prevalence estimate of delirium was 15.2% [95% confidence interval (CI) 12.5–18.0%]. Subgroup analyses revealed that the region, publication year, age, sample size, and delirium assessment methods were significantly correlated with the prevalence of delirium. Meta-regression analysis showed that the publication year was positively, while the sample size was negatively associated with the pooled prevalence of delirium.
Conclusion: In the emergency department, delirium is common in geriatric patients. We should pay specific attention to delirium screening, prevention, and treatment in geriatric patients. Overall appropriate interventions should be utilized to reduce the occurrence of delirium and the adverse outcomes.

1. Introduction

Delirium is an acute confusional state characterized by decreased attention, awareness, and cognitive performance [1,2]. It's a common clinical syndrome in geriatric patients in the emergency department, and its incidence increases with patient age, disease severity, and associated complications [3,4]. Studies have shown that delirium is associated with extended hospital stays, decreased physical function and cognitive performance, risk of falls, and increased medical costs in older patients [5-8]; delirium is also an independent risk factor for death [9]. In addition, studies show that delirium costs patients between $38–$152 billion a year in health care in the United States [10]. Moreover, it puts enormous strain on the healthcare system [11], patients, and families [12,13].

Delirium is particularly prevalent in adults over 65 in emergency departments [14]. In addition, there is growing evidence that delirium is highly prevalent (7–20%) in emergency department patients, with a missed diagnosis rate of 57–83% [15]. However, no studies have analyzed the reported data together; thus, the prevalence of delirium in geriatric emergency patients remains unclear. Since 2014, several correlation studies on delirium in geriatric patients in the emergency department have been performed [16-19]. These latest research results need to be updated and analyzed to explore the latest evidence on the prevalence of delirium in geriatric patients in the emergency department.

Therefore, the present study was conducted to estimate the prevalence of delirium in geriatric patients in the emergency department using a systematic review and meta-analysis of currently published studies. Furthermore, this study intends to provide a theoretical basis for the early identification and prevention of delirium by bringing the reference for the rational allocation of health care resources in the emergency department.

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https://doi.org/10.1016/j.ajem.2022.05.058
0735-6757/

2. Methods

This meta-analysis was conducted based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (see Appendix 1) [20].

2.1. Search strategy

Two investigators independently searched the literature in PubMed, Embase, Web of Science, Cochrane Library, CINAHL, PsycINFO, and CBM databases to collect the relevant studies on delirium in geriatric patients in the emergency department from database establishment to November 7, 2021. Search medical subject headings (Mesh) and free words: delirium, deliri*, emergency department, emergency, emerg* et al. We also hand-searched the references of all the included studies and relevant systematic reviews to supplement the access the relevant studies. The literature search procedure is shown in Appendix 2.

2.2. Inclusion and exclusion criteria

The inclusion criteria were made according to the PICOS acronym as follows: (1).

Participants (P): age 60 and over, patients with delirium according to standardized diagnostic criteria, such as CAM-ICU (the Confusion Assessment Method for the ICU), CAM (the Confusion Assessment Method), bCAM (The modified Brief Confusion Assessment Method), physician diagnosis, the DSM-5 (Diagnostic and Statistical Manual of Mental Disorders criteria), the 4AT (Abbreviated Mental Test-4), with no restriction on the cause and type of delirium, gender, race, or region. Intervention (I): not applicable. Comparison (C): not applicable. Outcomes (O): the prevalence of delirium, or data from which the prevalence of delirium could be generated, and Study design (S): cross-sectional or cohort studies (only the baseline data of cohort studies were extracted).

Exclusion Criteria: (1) self-reported delirium; (2) meetings, abstracts; (3) studies that did not provide the definitive diagnostic criteria for delirium; (4) duplicate publications and unavailability of outcomes.

2.3. Study selection

Two investigators independently screened the literature, extracted the data, and cross-checked them according to the inclusion and exclusion criteria. Any disagreements were resolved through discussion or consultation with the third investigator. The titles were first read during the literature screening. Then, after excluding irrelevant studies, the abstracts and full texts were read for inclusion. If required, the original study's authors were contacted by mail or telephone to obtain information that was not reported but was crucial for this study.

2.4. Data extraction

Two investigators extracted data independently using a standardized pre-defined data-collection spreadsheet in Microsoft Excel 2019. The extracted contents included: (1) study characteristics, including the first author and publication year; (2) participant characteristics, such as sample size, mean age, and proportion of females; (3) study design, study setting, study location; (4) assessment methods for delirium and (6) outcomes: prevalence of delirium. Any disagreements were resolved through discussion or consultation with the third investigator.

2.5. Quality assessment

The methodological quality of the included studies was assessed using a modified version of the Newcastle-Ottawa scale. The scale included five items: sample representativeness and size, comparability between respondents and non-respondents, determination of delirium, and statistical quality; studies were categorized to be at low risk of bias (≥ 3 points) or high risk of bias (<3 points) (Appendix 2). Two investigators independently conducted the quality evaluation of each study. The third investigator resolved any disagreements or differences after discussion and adjudication.

2.6. Statistical analysis

Meta-analysis was performed using Stata 12.0 (Version 15, Stata Corp., USA). The random-effects model was used to calculate the pooled prevalence of delirium with a 95% confidence interval (95% CI) [21-23]. The heterogeneity among the included study results was analyzed by the chi-square test (the test level was $\alpha = 0.1$). The heterogeneity was quantitatively determined in combination I^2 and $I^2 > 50\%$ was used as a criterion to validate inter-study heterogeneity. In the case of statistical heterogeneity among the study results ($I^2 < 50\%$, $P > 0.1$), the fixed-effect model was used for meta-analysis; when there was statistical heterogeneity among the study results ($I^2 > 50\%$, $P \le 0.1$), the random-effects model was used for meta-analysis. The significance level of the meta-analysis was set at $\alpha = 0.05$.

To further explore potential causes of heterogeneity, subgroup analyses were performed using the geographic locations (North-America/Europe/Asia/Africa/Oceania), publication year, delirium assessment tool, age (60–75/>75), and sample size using the median splitting method (≤150/>150). In addition, meta-regression analysis was done for publication year, delirium assessment, regions, age, gender, and sample size. The $p < 0.10$ was used to determine whether covariates could explain the heterogeneity between studies. Sensitivity analyses were conducted using the leave-one-out method. In addition, publication bias was investigated using funnel plots and Egger's linear regression test. Statistical tests were 2-sided, and significance was set at $p < 0.05$.

3. Results

3.1. Literature search

4536 relevant studies were initially detected, 609 duplicate studies were removed, and 3806 unrelated studies were excluded by reading the titles and abstracts. 121 studies that may meet the inclusion criteria were read in full, and finally, 30 studies were included [6,7,16-19,24-47]. The literature screening process and results are shown in Fig. 1.

3.2. Characteristics of the studies

Study and participant characteristics are summarized in Table 1. A total of 4536 articles were identified, and ultimately 30 articles covering 19,534 patients were included in this meta-analysis. Ten studies were cross-sectional, 19 were cohort, and 1 was a retrospective chart review study. The included samples were recruited from North America ($n = 21$), Europe ($n = 4$), South America (n = 2), Asia (n = 2), and Oceania ($n = 1$). The sample size ranged from 108 to 3383. The mean age ranged from 71.8 to 86.1 years. All included studies had clear diagnostic criteria for delirium, of which the diagnostic criteria used were CAM-ICU, CAM, b-CAM, physician diagnosis, the DSM-5, and the 4AT.

3.3. Study quality

Based on the modified Newcastle-Ottawa Scale for quality assessment, the 30 included studies were scored from 2 to 5. Only three studies were found to be of high risk (NOS score < 3), and 27 studies (NOS score ≥ 3) were of low risk. The details of NOS scores are shown in Appendix 2.

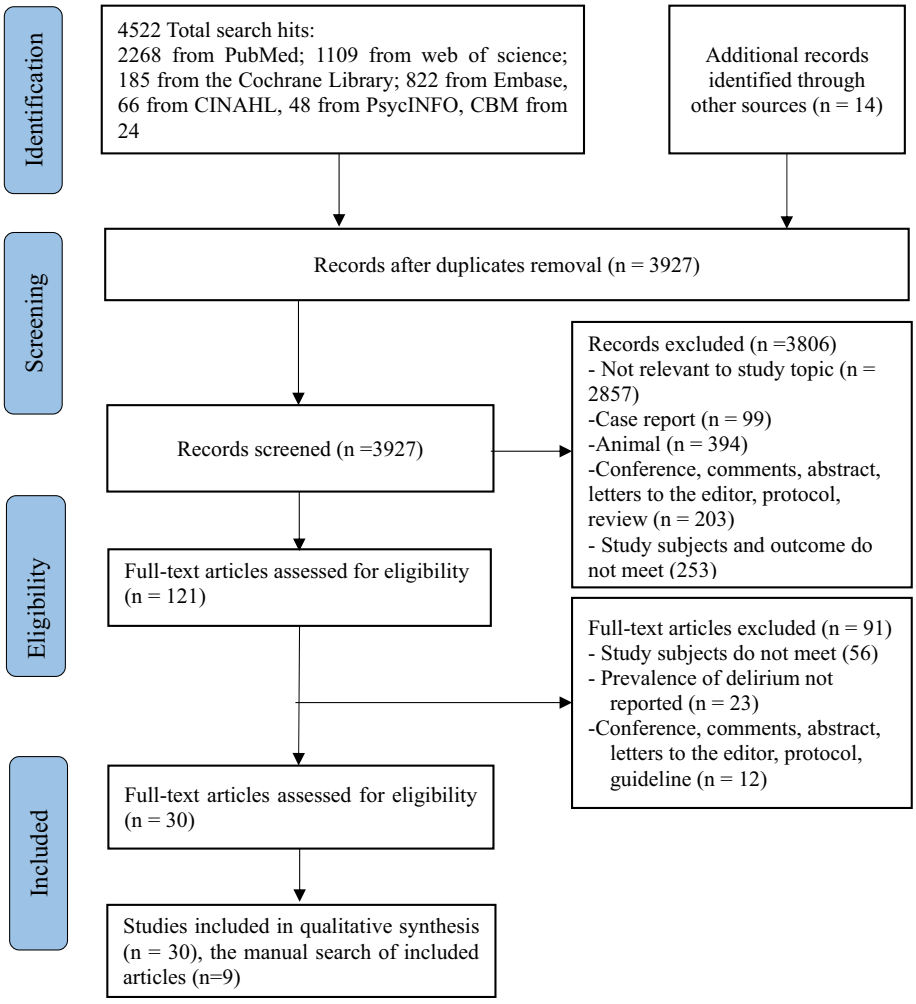

Fig. 1. Literature screening procedure and results (PRISMA Diagram).

3.4. Pooled prevalence of delirium in older adults in the emergency department

In this meta-analysis, 30 studies reported delirium in geriatric patients in the emergency department. The pooled prevalence of delirium in geriatric patients in the emergency department was 15.2% (95% CI 12.5–18.0%; $I^2 = 98.0\%$) (Fig. 2).

3.5. Subgroup analysis

As shown in Table 2, the publication year, delirium assessment tool, geographic locations, age, and sample size were significantly associated with the pooled prevalence of delirium. Studies published from 2018 to 2020 also had a higher pooled prevalence of delirium. Geriatric patients from South America had a higher pooled prevalence of delirium than patients from other geographic locations. The combined prevalence of delirium was higher in geriatric patients >75 years of age in the emergency department than in those 60–75 years of age. Sample size ≤300 had a higher pooled prevalence of delirium. Studies using the DSM-5 had a higher pooled prevalence of delirium ($P < 0.001$).

3.6. Meta-regression analysis

Meta-regression analysis revealed that publication year (Coef. = 0.005, $t = 2.20$, $P = 0.038$) were positively associated with the pooled prevalence of delirium. While the sample size (Coef. = 0.000, $t = -2.39$, $P = 0.026$) was negatively associated with the pooled prevalence of delirium (Table 3).

3.7. Publication bias and sensitivity analysis

The Funnel plot and Egger's test reveal publication bias in the pooled prevalence of delirium (Egger test: $t = 7.01$, $P < 0.001$) (Fig. 3). Sensitivity analyses did not find outliers that could significantly change the pooled prevalence of delirium, indicating that the results of our meta-analysis were statistically stable (Appendix 2).

4. Discussion

4.1. Delirium is common in the emergency department in geriatric patients

Delirium is a common geriatric finding associated with serious adverse consequences. In this study (30 studies, total sample size of 19,534 cases), the prevalence of delirium in geriatric patients in the emergency department was investigated using quantitative analysis methods. The current study reported the 15.2% combined prevalence of delirium in geriatric patients in the emergency department.

Most geriatric patients in the emergency department are critically ill, with multiple co-morbidities and complex treatment options [48]. Current research evidence suggests that advanced age, predisposing factors such as cognitive impairment, dementia, limb dysfunction, sensory

Table 1
Characteristics of the studies included in the meta-analysis.

Author (year)	Country	Setting	Study design	Assessment method for delirium	Population (years)	N	Mean age, years[a]	Males, n (%)	Female, n (%)	delirium, % (n/total)
Béland E et al. (2021)	Canada	Trauma centers, hospital	Prospective cohort	CAM	>65	612	delirium: 80.6 (8.8)	301 (49.2)	311 (50.8)	11.1 (68/612)
Mailhot T et al. (2020)	Canada	Hospital	Prospective cohort	CAM	>70	108	80.3 (7.0)	54 (50.0)	54 (50.0)	27.8 (30/108)
Kennedy M et al. (2020)	USA	Hospital	Prospective cohort	CAM	>65	817	77.7 (8.2)	386 (47.0)	431 (53.0)	27.7 (226/817)
Daoust R et al. (2020)	Canada	Trauma centers, hospital	Prospective cohort	CAM	>65	338	77 (8.0)	165 (49.0)	173 (51.0)	12.1 (41/338)
Ohl ICB et al. (2019)	Brazil	Hospital	Cross-sectional	CAM	>60	200	71.8 (8.1)	104 (52.0)	96 (48.0)	28.0 (56/200)
Cirbus J et al. (2019)	USA	Hospital	Prospective cohort	bCAM	>65	3383	delirious: 75 (68, 83)[b]	NA	delirious: 68 (64.8)	3.1 (105/3383)
Thompson C et al. (2018)	Canada	Hospital	Retrospective chart review	CAM	>65	688	85 (75, 90)[b]	187 (27.2)	501 (72.8)	27.1 (181/688)
Ritter SRF et al. (2018)	Brazil	Hospital	Cross-sectional	CAM	>60	110	72.2 (8.3)	62 (56.4)	58 (43.6)	28.2 (31/110)
Nguyen PV et al. (2018)	Canada	Hospital	Retrospective cross-sectional chart review	Physician diagnosis	>75	1205	83.4 (5.7)	455 (37.8)	750 (62.2)	19.1 (230/1205)
Gagné AJ et al. (2018)	Canada	Hospital	Prospective cohort	CAM	>65	320	76.8 (7.4)	152 (47.7)	168 (52.3)	15.3 (49/320)
Fallon A et al. (2018)	Ireland	Hospital	Prospective cohort	CAM-ICU	>70	198	78.8 (−)	96 (48.5)	102 (51.5)	8.6 (17/198)
Evensen S et al. (2018)	Norway	Hospital	Prospective cohort	The DSM-5	>75	254	86.1 (5.2)	103 (41.6)	151 (58.4)	19.3 (49/254)
Han JH et al. (2017)	USA	Hospital	Prospective cohort	bCAM	>65	3383	delirium:75 (68, 83)[b]	37 (35.2)[c]	68 (64.8)[c]	3.1 (105/3383)
Han JH et al. (2017)	USA	Hospital	Prospective cohort	CAM-ICU	>65	1084	delirium:77 (71, 84)[b]	493 (45.5)	591 (54.5)	14.3 (155/1084)
Émond M et al. (2017)	Canada	Hospital	Retrospective cohort	CAM	>65	200	78.9 (7.3)	91 (45.5)	109 (54.5)	18.0 (36/200)
Aslaner MA et al. (2017)	Turkey	Hospital	Prospective cohort	bCAM	>65	822	77 (70,83)	392 (47.7)	430 (52.3)	33.9 (279/822)
Sri-on J et al. (2016)	Thailand	Hospital	Prospective cohort	CAM-ICU	>65	232	76 (6.0)	98 (42.0)	134 (58.0)	12.0 (27/232)
Bo M et al. (2016)	Italy	Hospital	Prospective cohort	The 4AT	>75	330	83.2 (5.4)	171 (51.8)	159 (48.2)	15.8 (52/330)
Kennedy M et al. (2014)	USA	Hospital	Prospective cohort	CAM	>65	676	77 (8.0)	328 (49.0)	348 (51.0)	9.3 (63/676)
Hare M et al. (2014)	Australia	Hospital	Prospective cross-sectional	CAM	>65	320	80 (8.0)	142 (44.0)	178 (56.0)	7.0 (23/320)
Han JH et al. (2010)	USA	Hospital, nursing home	Prospective cohort	CAM-ICU	>65	628	75 (69, 81)[b]	263 (41.9)	365 (58.1)	17.2 (108/628)
Han JH et al. (2009) a	USA	Hospital	Prospective cross-sectional	CAM-ICU	>65	303	74 (69, 80)[b]	134 (44.2)	169 (55.8)	8.3 (25/303)
Han JH et al. (2009) b	USA	Hospital	Prospective cross-sectional	CAM-ICU	>65	341	NA	146 (42.8)	195 (57.2)	11.2 (38/341)
Bo M et al. (2005)	Italia	Hospital	Prospective cohort	Physician diagnosis	>70	252	82.4 (4.1)	118 (47.0)	134 (53.0)	11.1 (28/252)
Vida S et al. (2006)	Canada	Hospital	Prospective cohort	CAM	>66	259	NA	108 (41.7)	151 (58.3)	39.0 (101/259)
Kakuma R et al. (2003)	Canada	Hospital	Prospective cohort	CAM	>66	1268	80.1 (7.9)	440 (34.7)	828 (65.3)	8.4 (107/1268)
Hustey FM et al. (2003)	USA	Hospital	Prospective cross-sectional	CAM	>70	271	77.9 (5.8)	119 (44.0)	152 (56.0)	7.0 (19/271)
Hustey FM et al. (2002)	USA	Hospital	Prospective cross-sectional	CAM	>70	297	77.9 (6.0)	133 (45.0)	164 (55.0)	6.0 (17/297)
Elie M et al. (2002)	Canada	Hospital	Prospective cross-sectional	CAM	>65	447	NA	203 (45.4)	244 (54.6)	9.6 (43/447)
Naughton BJ et al. (1995)	USA	Hospital	Prospective cross-sectional	CAM	>70	188	79.7 (6.5)	72 (38.3)	116 (61.7)	9.6 (18/188)

CAM: the Confusion Assessment Method; CAM-ICU: the Confusion Assessment Method for the ICU; bCAM: The modified Brief Confusion Assessment Method; DSM-5: Diagnostic and Statistical Manual of Mental Disorders criteria; the 4AT: Abbreviated Mental Test-4; NA: not available.

[a] Mean age as reported by the authors. For the studies of Béland E et al. (2021), Cirbus J et al. (2019), Han JH et al. (2017), and Han JH et al. (2017), mean age refers to the age of delirium patients included as reported by the authors, not the total number of study subjects.

[b] Median (interquartile range [IQR]) age.

[c] Median (interquartile range [IQR]) number.

impairment such as visual and auditory, environmental changes and co-existence of multiple diseases [36,37], acute pain, infection, reduced limb movement, urinary retention or catheterization, alcohol consumption, drug use, and psychosocial factors are the main confounding factors [49]. Therefore, medical staff should pay special attention to the predisposing factors of delirium in geriatric patients during clinical work evaluation in the emergency department for timely intervention. The findings of Bo et al. showed that the duration of stay in the emergency department was associated with an increased risk of delirium in elderly patients [36]. However, due to the limited access to the original

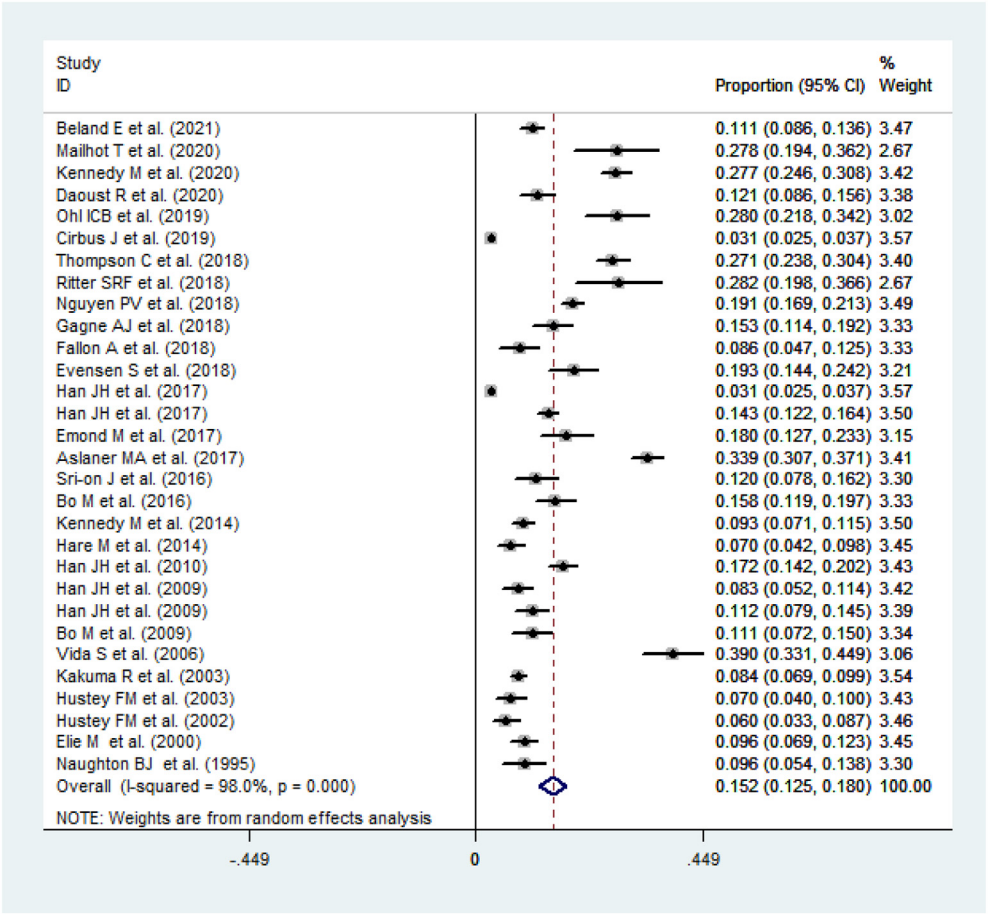

Fig. 2. The prevalence of delirium in geriatric patients admitted to the Emergency Department.

data of the included studies, future studies should be conducted to further investigate the relationship between the length of hospital stay with the risk of delirium.

In summary, in the emergency department, delirium in geriatric patients is mainly due to multiple factors. Therefore, the attention of clinical nursing staff to delirium should be improved further. Moreover,

Table 2
Subgroup analysis of the prevalence of delirium in geriatric patients admitted to the Emergency Department.

Subgroup	Meta-analysis		Heterogeneity		*P*-values across subgroups
	No. of studies	Prevalence (95% CI) (%)	I2 (%)	*P* value	
Publication year					
1995–2017	18	0.132 (0.096, 0.167)	97.6	< 0.001	< 0.001
2018–2021	12	0.187 (0.122, 0.252)	98.5	< 0.001	
Delirium assessment tool					
CAM	17	0.166 (0.128, 0.205)	95.9	< 0.001	< 0.001
BCAM	3	0.128 (0.066, 0.190)	99.4	< 0.001	
Physician diagnosis	2	0.153 (0.074, 0.231)	91.9	< 0.001	
CAM-ICU	6	0.121 (0.093, 0.149)	79.2	< 0.001	
The DSM-5	1	0.193 (0.144, 0.242)	_	_	
The 4AT	1	0.158 (0.119, 0.197)	_	_	
Regions					< 0.001
North-America	21	0.141 (0.112, 0.170)	98.1	< 0.001	
South America	2	0.281 (0.231, 0.331)	0	0.970	
Europe	4	0.136 (0.091, 0.180)	78.9	0.003	
Asia	2	0.230 (0.015, 0.445)	98.5	< 0.001	
Oceania	1	0.070 (0.042, 0.098)	_	_	
Age					< 0.001
60–75	27	0.149 (0.121, 0.177)	98.0	< 0.001	
> 75	3	0.184 (0.164, 0.203)	8.60	0.335	
Sample Size					< 0.001
Sample sizes ≤300	12	0.174 (0.122, 0.226)	93.9	< 0.001	
Sample sizes >300	18	0.140 (0.107, 0.173)	98.6	< 0.001	

Note: CAM: the Confusion Assessment Method; bCAM: The modified Brief Confusion Assessment Method; CAM-ICU: the Confusion Assessment Method for the ICU; the DSM-5: the Diagnostic and Statistical Manual of Mental Disorders criteria; the 4AT: Abbreviated Mental Test-4.

Table 3
Multivariate meta-regression analysis demonstrates the strength of covariates in predicting the prevalence of delirium in geriatric patients in the Emergency Department.

Covariates	Coef.	Std. err.	t	P > | t |	95% Conf. interval	
Publication year	0.005328	0.0024234	2.20	0.038	0.0003149	0.0103411
Regions	−0.0014041	0.0155846	−0.09	0.929	−0336433	0.0308351
Age	0.0379346	0.0652095	0.58	0.566	−0969615	0.1728306
Sample size	−0.0000498	0.0000208	−2.39	0.026	−0000929	−6.66e-06
Delirium assessment tool	−0.0154384	0.0131487	−1.17	0.252	−0426386	0.0117618
Gender	0.0000774	0.0000836	0.93	0.364	−0000954	0.0002503
Cons	−10.56629	4.860453	−2.17	0.04	−20.62091	−5116813

delirium-related risk factors should be recognized, assessed as early as possible, and personalized measures should be actively implemented to prevent the occurrence of delirium syndrome and improve the prognosis of these patients.

4.2. The prevalence of delirium varies in geriatric patients in different emergency departments

A comprehensive understanding of the factors influencing delirium syndrome in geriatric patients is essential for preventing and treating delirium in the emergency department. However, due to the limitation of the included studies, it was impossible to conduct an analysis based on all factors associated with the prevalence of delirium in geriatric patients and explore the source of inter-study heterogeneity. Our results suggest that age is one of the reasons for the high heterogeneity among the included studies. A recent systematic review study showed advanced age as a risk factor for delirium [50]. This study showed that the prevalence of delirium in geriatric patients in the emergency department increased with age. Consistent with Zaal et al., advanced age was one of the most important risk factors for delirium syndrome in geriatric patients in the emergency department [51]. This factor may be related to the degenerative changes in these patient's organ structure, function, and tissues. Moreover, geriatric patients have reduced cerebral blood flow and are prone to hypoxia, leading to neurotransmitter synthesis blockage. In turn, reduced neurotransmitter synthesis causes transmission dysfunction, thereby increasing the risk of delirium [52].

The DSM-5 and the International Statistical Classification of Diseases and Related Health Problems (ICD-10) are the gold standards for diagnosing delirium. At present, various validated tools are used to help clinicians to screen patients for the presence of delirium. For example, CAM-ICU, CAM, physician diagnosis, the DSM-5, and other tools were used to assess delirium in this study. While the included studies had clear, validated methods or assessment tools for delirium, the diversity of methods or assessment tools might have contributed to the increased heterogeneity. Moreover, due to the heavy emergency department workload and tasks, health care providers often consider other life-threatening emergency medical problems more important than the delirium intervention [53,54]. Therefore, emergency department medical staff may not take delirium as a key focus in the treatment and nursing process. However, in geriatric patients with critical conditions, combined with a variety of underlying diseases, the delirium easily remains masked, which reduces the attention of medical staff towards it. As a result, in the emergency department, delirium status is not effectively managed in up to 80% of geriatric patients, which loses the appropriate time for delirium management [55]. In clinical practice, medical staff should pay more attention to delirium and achieve early evaluation, detection, diagnosis, and treatment of delirium in geriatric patients in the emergency department. Besides, the personalized intervention should be implemented to optimize the delirium management pathway and reduce the prevalence of delirium in geriatric patients in the emergency department.

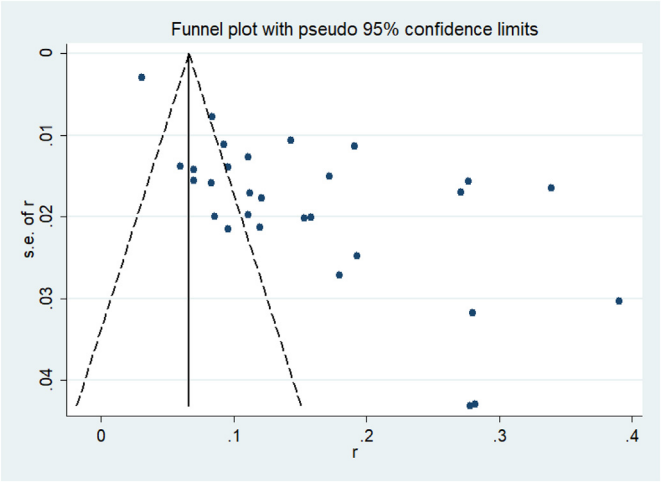

Fig. 3. Funnel plot.

Our study showed that the prevalence of delirium in geriatric patients in emergency departments was higher in South America than in other regions; the finding was consistent with the observation of Ohl et al. [24]. The high prevalence may be due to differences in the socioeconomic status of the different regions. The study by Vandelaar et al. showed a higher prevalence of delirium in geriatric patients in the emergency department in the Korean region than in the United States due to inconsistent delirium assessment tools. Future studies should use uniform criteria to assess the state of delirium in an older patient admitted to the emergency department in different regions for early detection and prompt intervention.

5. Strengths and limitations

This study is the first systematic review to investigate the prevalence of delirium in geriatric patients in the emergency department using a quantitative analysis method. First, the modified NOS score of the included studies ranged from 2 to 5, suggesting that the overall quality of the included studies was high and ensured the reliability and authenticity of the conclusions of this study. Second, multiple databases were searched in this study to ensure the broad representation of the articles and improve the stability of the findings.

This study had some limitations. First, diagnostic criteria for delirium were inconsistently defined, which might have resulted in large variations in estimates of delirium in geriatric patients in the emergency department. Due to the limitations of the data included in the study, the impact of delirium subtype, disease severity, and gender on the prevalence of delirium in geriatric patients in the emergency department could not be explored. In addition, the sample size of the included studies was relatively small. Moreover, given the apparent heterogeneity, the pooled results should be interpreted with caution.

6. Conclusion

This study shows that delirium is common in geriatric patients in the emergency department. Therefore, it is vital to identify individuals with possible delirium in geriatric patients in the emergency department in

clinical practice. Future studies are required to investigate the prevalence of delirium of different severities in geriatric patients in the emergency department, with the impact of gender, age, and other factors. The information will provide a basis for developing targeted preventive measures to manage delirium associated with geriatric patients in the emergency department.

Author contributions

CF and CJT contributed to study concept and design, acquisition of the data.

CJT, FLD, LY and CF contributed to analysis and interpretation of the data.

CF, LLB, and WYT contributed statistical expertise.

CF, LLB, WYT, LY, FLD and CJT contributed to drafting and critical revision of the manuscript.

CJT takes responsibility for the paper as a whole.

Financial support

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CRediT authorship contribution statement

Fei Chen: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation. **Libo Liu:** Methodology, Investigation, Formal analysis, Data curation. **Yetong Wang:** Methodology, Investigation, Formal analysis, Data curation. **Ying Liu:** Validation, Supervision, Conceptualization. **Luodan Fan:** Validation, Supervision, Conceptualization. **Junting Chi:** Writing – review & editing, Writing – original draft, Validation, Supervision, Conceptualization.

Declaration of Competing Interest

None.

Acknowledgements

The authors would like to thank all the reviewers who participated in the review, as well as MJEditor (www.mjeditor.com) for providing English editing services during the preparation of this manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajem.2022.05.058.

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