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Incidence and determinant factors of delirium in children in the PICU: A systematic review

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Abstract

Background: Delirium in children admitted to the Pediatric Intensive Care Unit (PICU) is an acute neuropsychiatric complication associated with increased morbidity, mortality, length of stay, and long-term neurocognitive impairment. Its incidence ranges from 17–65.6% and exceeds 90% in infants. Various determinant factors including young age, developmental delay, mechanical ventilation, benzodiazepine sedation, metabolic disturbances, physical restraints, and severity of illness have been identified in previous studies.

Purpose: To identify the incidence and determinant factors of delirium in children hospitalized in the PICU.

Method: A systematic review design with narrative synthesis following PRISMA 2020 guidelines was employed. Literature searches were conducted in PubMed, Scopus, Web of Science, and Google Scholar. Study selection followed PICOS criteria, and methodological quality was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist. Due to heterogeneity in delirium assessment tools, populations, and effect sizes, analysis was conducted using a narrative synthesis approach.

Results: Eight studies met the inclusion criteria. The most consistent determinant factors of delirium included developmental delay (OR 3.34–4.20), mechanical ventilation (OR 3.7–6.02), benzodiazepine use (OR 2.89–5.05), high PRISM/PIM scores, hypoxia, metabolic disturbances (OR 3.73), and the use of physical restraints (OR 4.67–5.86). PICU length of stay increased the risk of delirium by 1.1 times for each additional day.

Conclusion: Delirium in children in the PICU is a multifactorial condition influenced by biological, clinical, pharmacological, and environmental factors. Prevention efforts should include early detection, routine screening using validated instruments, minimization of high-risk sedation, optimization of ventilation management, environmental modifications to support sleep patterns, and family involvement.

Keywords: Children; Delirium; Pediatric Intensive Care Unit (PICU); Risk Factors.

INTRODUCTION

Delirium is an acute brain dysfunction characterized by disturbances in attention, awareness, cognition, and fluctuating behavioral patterns (Fan, Luo, Wang, Yuan, Sun, & Jing, 2024). In adult populations, delirium has long been recognized as a significant complication in intensive care settings; however, understanding delirium in pediatric populations has emerged only within the past decade. This gap is due to the fundamentally different neurological developmental characteristics

in children, making clinical manifestations of pediatric delirium more difficult to identify and frequently underdiagnosed (Savrimuthu, & Yubbu, 2025). Diagnostic challenges are further exacerbated by children's limited communication abilities, variability in behavioral expression, and the scarcity of age-appropriate screening instruments (Meyburg, Dill, Traube, Silver, & von Haken, 2017).

The incidence of delirium among children admitted to Pediatric Intensive Care Units (PICUs) is

notably high and varies across studies. Recent evidence reports an incidence of 17–65.6% in the general pediatric population and more than 90% among infants the most vulnerable age group due to brain immaturity (Holberg, Larsen, Mariussen, & Kynø, 2021). Pediatric delirium is not merely a transient acute condition; it is strongly associated with adverse clinical outcomes, including prolonged mechanical ventilation, increased length of stay in the PICU, higher complication rates, and long-term neurocognitive impairments such as memory deficits, concentration difficulties, and behavioral problems after hospital discharge (AlDaithan, Shaheen, Alahmari, Smari, Al Ahmadi, Almalahi, & Hazwa, 2024).

Pathophysiologically, pediatric delirium is a multifactorial condition involving complex interactions among systemic inflammation, neurotransmitter imbalance, metabolic dysfunction, cerebral hypoperfusion, and environmental stressors in the PICU. Excessive microglial activation, release of pro-inflammatory cytokines, and acetylcholine–dopamine imbalance trigger disturbances in attention and arousal the hallmark features of delirium. These biological mechanisms heighten vulnerability in children with developmental delay, neurological comorbidities, congenital heart disease, or critical illness with high PRISM/PIM scores (Ormseth, LaHue, Oldham, Josephson, Whitaker, & Douglas, 2023).

In addition to biological factors, several precipitating factors in the PICU environment significantly contribute to the onset of pediatric delirium. The use of benzodiazepines, opioids, anticholinergics, mechanical ventilation, physical restraints, excessive exposure to light and noise, and sleep disruption are consistently identified risk factors across studies (Flores, Oura, Rocha, Belega-Anacleto, & Kusahara, 2021). Mechanical ventilation, in particular, increases the risk of delirium by up to fourfold, whereas benzodiazepines are identified as the strongest pharmacologic risk factor according to recent meta-analyses (Zhu, Feng, Lin, & Ding, 2022). Metabolic disturbances such as hyponatremia, hyperglycemia, and hypocalcemia also contribute through impaired cellular energy metabolism and oxidative stress (Molina, von Dessauer, Rodrigo, & Carvajal, 2017).

Despite growing research, findings on pediatric delirium risk factors remain heterogeneous due to variations in patient populations, operational definitions, assessment tools, and analytical methods. Moreover, most available evidence comes from observational studies with varying methodological quality, underscoring the need for a comprehensive synthesis of determinants consistently associated with pediatric delirium. The limited number of recent systematic reviews specifically focusing on delirium determinants in children between 2020 and 2025 highlights a research gap that warrants further investigation.

Given the substantial clinical impact, high incidence, and fragmented evidence on pediatric delirium determinants, a systematic review is necessary to summarize, evaluate, and synthesize the latest empirical findings. Therefore, this study aims to identify the incidence and determinant factors of delirium in children hospitalized in the PICU based on current scientific evidence. The findings are expected to strengthen pediatric critical care nursing practice, support routine delirium screening implementation, and facilitate the development of national delirium prevention guidelines.

RESEARCH METHOD

A systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The aim was to identify and synthesize scientific evidence examining the incidence and risk factors of delirium among children admitted to the Pediatric Intensive Care Unit (PICU).

Studies included in this systematic review were selected based on predefined inclusion and exclusion criteria using the PICOS framework (Population, Intervention/Exposure, Comparison, Outcome, Study design). Population (P): Pediatric patients aged 0–18 years admitted to the PICU and assessed for delirium using validated instruments such as CAPD, pCAM-ICU, psCAM-ICU, SOS-PD, or DSM-based diagnostic approaches. Intervention/Exposure (I/E): Factors considered to be associated with delirium, including biological factors (age, developmental delay, comorbidities), clinical factors (mechanical ventilation, PRISM/PIM score, hypoxia, metabolic disturbances), pharmacological factors (benzodiazepines, opioids, anticholinergics,

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antiepileptics), and environmental factors (physical restraints, sleep disturbance, length of PICU stay). Comparison (C): Groups without exposure to the identified risk factors or groups exposed at different levels, such as benzodiazepine vs. non-benzodiazepine sedation, mechanical ventilation vs. no mechanical ventilation, or developmental delay vs. normal development. Outcome (O): Delirium occurrence reported as prevalence/incidence, odds ratios, relative risks, confidence intervals, or other statistical measures demonstrating associations between risk factors and delirium. Study design (S): Observational studies including cohort (prospective and retrospective), case-control, and cross-sectional designs. Systematic reviews and meta-analyses were used for background purposes but were excluded from the primary synthesis.

Exclusion criteria included retracted articles, duplicate publications, letters to the editor, studies available only as abstracts without full-text access, studies not using validated delirium assessment instruments, and studies conducted outside PICU settings or combining pediatric and adult populations without separate analysis.

A systematic literature search was conducted across four major databases: PubMed, Scopus, Web of Science, and Google Scholar, limited to publications from 2020–2025. The search strategy combined free-text keywords and controlled vocabulary (MeSH terms in PubMed) structured around three key concepts: pediatric population, delirium, and risk factors. Terms included “pediatric delirium,” “delirium in children,” “ICU delirium,” “Pediatric Intensive Care Unit,” “PICU,” “risk factors,” “determinants,” and “predictors.” Boolean operators AND and OR were used to enhance search sensitivity and specificity.

Study selection followed several systematic steps in accordance with PRISMA 2020. Following database searches, all records were merged, and duplicates were removed. Initial screening involved reviewing titles and abstracts based on eligibility criteria. Full-text articles were then assessed for inclusion, focusing particularly on PICU pediatric populations, use of validated delirium assessment tools, and reporting of risk factors and outcomes.

Studies that did not meet inclusion criteria such as lacking statistical data, using non-PICU settings, or applying nonvalidated delirium assessments were excluded.

Data extraction was performed using a standardized table capturing authorship, year, country, purpose, study design, sample size, delirium assessment tools, analyzed risk factors, and key outcomes including odds ratios or confidence intervals. Two reviewers independently conducted the extraction to minimize bias, with disagreements resolved through discussion or consultation with a third reviewer. This ensured accuracy, consistency, and reliability of extracted data for narrative synthesis.

Methodological quality and risk of bias for each included study were independently appraised by two reviewers using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist. This tool was selected due to its strong validity for evaluating observational studies and its structured assessment tailored to different designs, including cohort, case-control, and cross-sectional studies. Domains assessed included clarity of inclusion criteria, accuracy of exposure and outcome measurements, management of confounding factors, appropriateness of statistical analyses, and completeness of follow-up. Each item was rated as “Yes,” “No,” or “Unclear,” and the proportion of “Yes” responses was calculated to determine overall methodological quality. Studies were classified as having high (70–100%), moderate (50–69%), or low (<50%) risk of bias. Final assessments were based on consensus between reviewers.

Due to substantial clinical and methodological heterogeneity across studies particularly in operational definitions of delirium, variability in assessment tools (e.g., CAPD, pCAM-ICU, psCAM-ICU), and inconsistent categorization of exposure variables (e.g., age groups, disease severity, sedation regimens) a statistical meta-analysis was not feasible. Additionally, effect sizes were reported in diverse formats (odds ratios, risk ratios, confidence intervals), and some studies lacked quantitative data suitable for pooling.

These discrepancies created significant heterogeneity that would compromise the validity of combined effect estimates. Thus, a narrative synthesis was selected as the most appropriate analytical approach. This method enabled grouping and comparison of findings based on categories of risk factors biological, clinical, pharmacological, and environmental and facilitated identification of

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consistent patterns across studies. Narrative synthesis also allowed for contextual interpretation of methodological differences, resulting in a more comprehensive understanding of the determinants of delirium among children in the PICU.

The initial search across four databases (PubMed, Scopus, Web of Science, and Google Scholar) yielded a total of 612 articles. After removing 94 duplicates, 518 articles were screened by title and abstract, resulting in the exclusion of 472 articles due to irrelevance to the topic, non-PICU populations, or failure to assess delirium. A total of 46 articles were then reviewed in full text; of these, 8 articles were unavailable in full-text format, and 30 articles were excluded for not meeting the inclusion criteria, including the absence of validated delirium assessment tools, lack of reported effect sizes, or failure to explicitly evaluate risk factors. After the final

appraisal process, 8 studies met all eligibility criteria and were included in the qualitative synthesis.

A total of eight observational studies published between 2020 and 2025 were included in this systematic review. These studies originated from various regions worldwide, providing broad geographic representation, including Asia (China, India, Pakistan), North America (United States), Europe, and the Middle East. The research designs comprised prospective cohort, retrospective cohort, case-control, and cross-sectional studies. Most studies were conducted in Pediatric Intensive Care Unit (PICU) settings, with several performed in tertiary PICUs and specialized pediatric intensive care units. Sample sizes ranged from 75 to more than 3,000 patients, focusing primarily on identifying risk factors, clinical outcomes, and the incidence of delirium using validated assessment tools such as CAPD, psCAM-ICU, and pCAM-ICU.

RESEARCH RESULTS

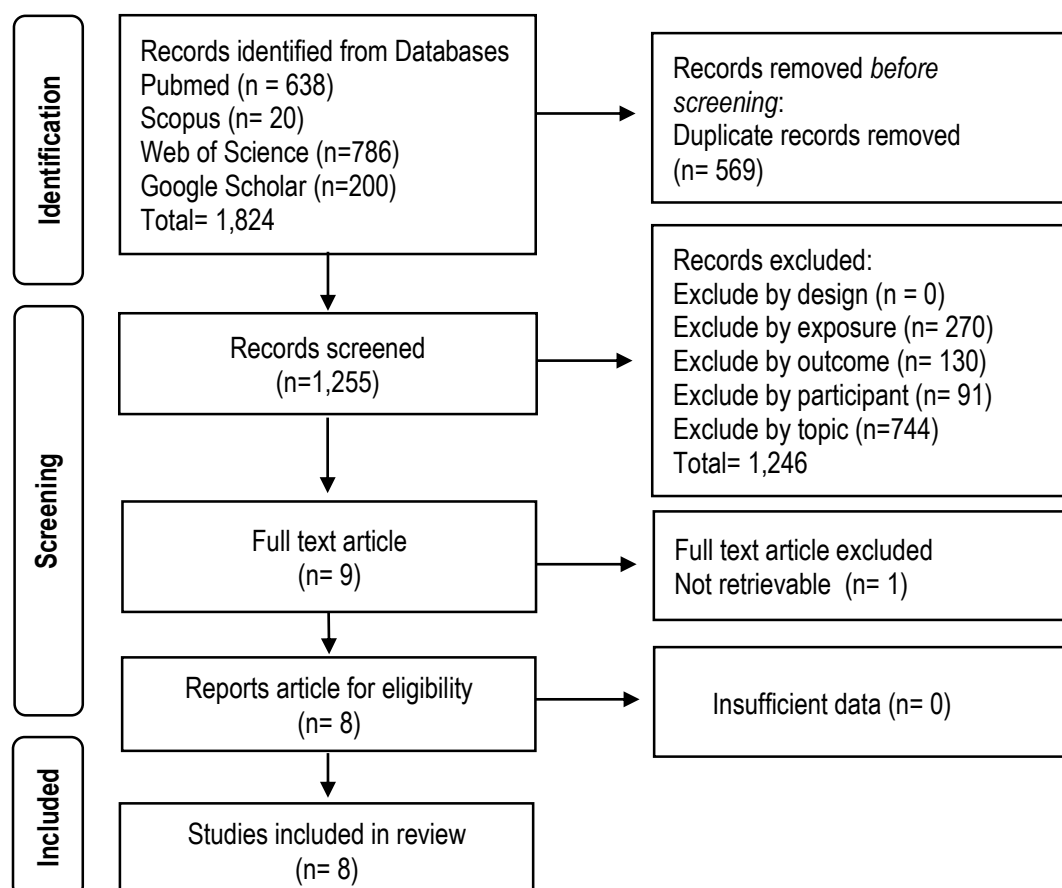


Figure of PRISMA Flowchart

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Table 1. Article Data Mapping Results

(Author, Year) (Country)	Purpose	Method	Sample Size	Results
(Zhu et al., 2022) (China)	Identifying risk factors for delirium and the magnitude of OR in the critically ill child population.	Meta-analysis	344 children	Developmental delay, mechanical ventilation, benzodiazepine use, anticholinergic use, age and PICU length of stay are independent risk factors for delirium in children in PICU. However, only a few articles were included in this study, which may lead to a certain bias and affect the analysing results. More large-sample, multicentre studies should be conducted to further explore and clarify the independent influencing factors of delirium in children in PICU and to provide guidance for clinical practice.
(Ge et al., 2021) (China)	Evaluate predisposing and precipitating factors for delirium in children in the PICU.	Case-control	162 children (81 cases, 81 controls)	Age, PRISM IV score, ICU retention time, metabolic dis-function, duration of infection, hypoxia, CRP and mechanical ventilation were the independent risk factors for ICU pediatric delirium. We suggest that active preventive measures should be taken to reduce the occurrence of ICU pediatric delirium.
(Fu et al., 2025) (China)	Identify clinical predictors and risk scores for pediatric delirium.	A prospective observational study	312 children	Binary logistic regression analyses revealed that the independent risk factors of delirium in critically ill children with MV included age ≤ 5 years, physical restraints, pediatric sequential organ failure assessment score, and lower pulse oximetry oxygen saturation (SpO ₂). This study may help develop intervention strategies to reduce the incidence of delirium in critically ill children with MV by targeting related risk factors.
(Dhingra, 2021) (India)	Analyze the incidence of delirium and its influencing factors using CAPD.	Cross-Sectional	75 children	Delirium is an acute neurological dysfunction characterized by fluctuating changes in consciousness, attention, and cognition, resulting from an underlying medical condition or its treatment. It is associated with increased morbidity and mortality in intensive care units and can lead to long-term cognitive impairment in survivors. Pediatric delirium (PD) occurs in as many as 25% of critically ill children. The pathophysiology of delirium is complex, and widespread screening for this entity is lacking.

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(Author, Year) (Country)	Purpose	Method	Sample Size	Results
(Nashit et al., 2025) (Pakistan)	Assess the prevalence of delirium and associated pharmacological factors.	A descriptive cross-sectional study	120 children	Delirium affected nearly one-quarter of critically ill children, with comorbidities, developmental delay, use of sedatives, and advanced respiratory as key risk factors. Cornell Assessment of Pediatric Delirium is a valuable tool for routine screening to enable early recognition and management of pediatric delirium. More multicenter studies are recommended for further validation.
(Lei et al., 2023) (China)	Examine the relationship between the PRISM score, sedation, and mechanical ventilation and the risk of delirium.	A prospective cohort study	289 children	Delirium is common in critically ill children in China and related to poor outcomes. Interventional studies are warranted to determine the best practices to reduce delirium exposure in at-risk children
(Dervan et al., 2020) (USA)	Identify the incidence of delirium and contributing clinical factors.	Retrospective cohort study.	2,630 patients	Delirium is common in the PICU, particularly among patients with length of stay greater than or equal to 48 hours. It is independently associated with patient characteristics and PICU exposures, including benzodiazepines. The role of delirium as an independent causal factor in patient outcome requires further investigation.
(Ista et al., 2023) (Multinational)	Synthesize global evidence on the incidence, risk factors, and prevention of delirium.	Systematic Review & Meta-analysis	80 studies	Of 1,846 abstracts, 24 studies were included. We identified 54 factors studied in univariate analyses, and 27 of these were associated with PD in multivariable analyses. In pooled analyses, greater odds of PD were associated with developmental delay (OR 3.98; 95% CI 1.54–10.26), need for mechanical ventilation (OR 6.02; 95% CI 4.43–8.19), use of physical restraints (OR 4.67; 95% CI 1.82–11.96), and receipt of either benzodiazepines (OR 4.10; 95% CI 2.48–6.80), opiates (OR 2.88; 95% CI 1.89–4.37), steroids (OR 2.02; 95% CI 1.47–2.77), or vasoactive medication (OR 3.68; 95% CI 1.17–11.60).

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Tabel 2. Summary of the Risk Factors related with Delirium in Children admitted to PICU

Risk Factor Category	Specific Risk Factor	Related Studies	Effect Size	Notes
Biological/Patient	Young age(<2 year old)	(Zhu et al., 2022; Ge et al., 2021; Lei et al., 2023; Dhingra, 2021; Dervan et al., 2020)	OR 3.34–5.12	The most consistent factor, younger age = higher risk
	Developmental delay	(Zhu et al., 2022; Ge et al., 2021; Fu et al., 2025)	OR 3.34–4.20	Strong predictor; Neurological condition impairing regulatory capacity
	Neurological Comorbidity/epilepsy	(Fu et al., 2025; Ge et al., 2021)	OR 2.02–3.7	Lowering the delirium threshold
	Severity of the disease (high PRISM/PIM)	(Lei et al., 2023; Dervan et al., 2020)	OR 2.20	More severely ill children have an increased risk of delirium
Clinical	Mechanical Ventilation	(Zhu et al., 2022; Lei et al., 2023; Dervan et al., 2020)	OR 4.11–6.02	The strongest risk & the most consistent
	Hypoxia	(Ge et al., 2021; Fu et al., 2025)	OR 2.69	Affects cerebral perfusion and cognitive function
	Metabolic Disorder (hyponatremia, hyperglycemia, hypocalcemia)	(Ge et al., 2021; Lei et al., 2023)	OR 2.4–3.73	Describes cellular stress and neurological dysregulation
	Length of stay in the PICU	(Dervan et al., 2020; Zhu et al., 2022)	Risk ↑ 1.1× per day	Indicators of disease progression and exposure to stressors in the PICU
Pharmacological	Benzodiazepin	(Zhu et al., 2022; Nashit et al., 2025; Ge et al., 2021)	OR 2.89–5.05	The most significant precipitating factor in many studies
	High Dosage Opioid	(Nashit et al., 2025; Fu et al., 2025)	Not all yield OR	High usage increases sedation, thereby leading to delirium
	Anticholinergic	(Ge et al., 2021; Nashit et al., 2025)	Not available	Effects on the acetylcholine system regulating attention

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Risk Factor Category	Specific Risk Factor	Related Studies	Effect Size	Notes
Environmental	Sleeping disorder	(Dhingra, 2021; Fu et al., 2025)	Not available	Sensory stressors cause disorientation The findings are strong, but confounding may occur (agitation → restraint → delirium) Significant environmental factors
	Physicals restrain	(Zhu et al., 2022; Liu, 2023)	OR 4.67–5.86	
	Light & noise exposure	(Dhingra, 2021; Ista et al., 2023)	Not available	
Intervention/Equipment	Repeated invasive procedures	(Ge et al., 2021; Fu et al., 2025)	Not available	Procedural stress can precipitate delirium Deep sedation results in reduced mobilization, thereby increasing the risk of delirium
	Continuous sedation therapy	(Lei et al., 2023; Nashit et al., 2025)	OR varies	

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Table 3. Summary of Risk of Bias Assessment Using the JBI Critical Appraisal Checklist

(Author)	Study Design	JBI Score	Percentage	Category
(Fu et al., 2025)	Prospective Cohort	9/11	82%	High
(Lei et al., 2023)	Prospective Cohort	8/11	72%	High
(Dervan et al., 2020)	Retrospective Cohort	7/11	63%	Medium
(Ge et al., 2021)	Case-Control	8/10	80%	High
(Zhu et al., 2022)	Case-Control (Meta-analytical Data)	9/10	90%	High
(Dhingra, 2021)	Cross-Sectional	6/8	75%	High
(Nashit et al., 2025)	Cross-Sectional	7/8	87%	High
(Ista et al., 2023)	Systematic Review & Meta-analysis	11/11	100%	Very High

DISCUSSION

Findings from this systematic review confirm that delirium is a common and serious clinical problem in children admitted to the Pediatric Intensive Care Unit (PICU). Various studies report a wide range of delirium prevalence, between 24.9–83.8%, Influenced by variations in population characteristics, screening methods, and intensity of care (Fu et al., 2025; Nashit, Haque, Mirza, Habib, Shahid, Ahmed, & Jurair, 2025). An incidence of 26% reported in a large prospective study in China further reinforces that delirium represents a consistent global burden among critically ill pediatric populations (Lei et al., 2023). Therefore, routine and systematic screening should be an integral part of standard PICU care.

Screening instruments play a crucial role in identifying delirium. The Cornell Assessment of Pediatric Delirium (CAPD) is the most widely used tool due to its high reliability and ease of application across the full pediatric age range (Nashit et al., 2025; Fazio, Daverio, Masola, D'Angelo, Frison, Zaggia, & Amigoni, 2022). Other instruments such as pCAM-ICU, psCAM-ICU, and SOS-PD are used in specific age groups and clinical contexts, while the Richmond Agitation Sedation Scale (RASS) serves as an initial assessment before delirium evaluation (Dervan et al., 2020; Pinzón-Casas, Soto-Trujillo, Camargo-Agón, Henao-Castaño, Gualdrón, & Bonilla-González, 2021). Consistent use of validated instruments is essential to improve diagnostic accuracy and expedite management.

Non-modifiable risk factors such as young age and developmental delay are consistently identified as contributors to delirium. Children under 5 years particularly those under 2 years have a higher risk of developing delirium, while children with

developmental delay have up to a fivefold increased risk (Nashit et al., 2025; Dervan et al., 2020). This vulnerability is attributed to limited cognitive capacity, making children more prone to disorientation and autonomic dysregulation in highly stressful environments such as intensive care.

Mechanical ventilation is the most dominant risk factor across studies. Meta-analyses report odds ratios ranging from 3.78 to 6.02, and delirium prevalence reaches 83.8% in children who undergo mechanical ventilation for more than 24 hours (Ge et al., 2021; Zhu et al., 2022; Fu et al., 2025). This elevated risk is associated with sedation requirements, sleep disruption, discomfort from intubation, hypoxia, and other physiological stressors. The presence of a dose–response relationship between ventilation duration and delirium further strengthens the importance of ventilator liberation strategies and early extubation (Zhu et al., 2022).

Pharmacological factors also significantly contribute to delirium. Benzodiazepines are the strongest determinants, with OR 4.10–5.05 (Ista et al., 2023; Zhu et al., 2022). Other sedatives such as opioids (OR 2.88), steroids (OR 2.02), vasoactive agents (OR 3.68), and antiepileptics also increase delirium risk (Ista et al., 2023). A prospective study, demonstrated a strong dose–response pattern: the higher the benzodiazepine exposure, the greater the risk of delirium (OR 1.8 → 3.4 → 9.7). These findings reinforce the importance of conservative sedation strategies and the use of non-benzodiazepine agents such as dexmedetomidine (Dervan et al., 2020).

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The severity of illness and physiological factors also play significant roles in precipitating delirium. Factors such as metabolic dysfunction (OR 3.73), hypoxia (OR 2.69), high PRISM IV scores (OR 2.20), elevated CRP, and prolonged infections are strong predictors of delirium (Ge et al., 2021). These findings support theories of neuroinflammation, impaired cerebral perfusion, and metabolic dysfunction as core mechanisms underlying delirium. Higher risk is also seen in younger children and those with developmental impairment (Nashit et al., 2025; Dervan et al., 2020; Zhang, Tang, Falsaperla, & Zhang, 2025).

From a non-pharmacological perspective, the use of physical restraints appears as a significant determinant with OR 4.67–5.86 (Ista et al., 2023; Fu et al., 2025; Kim, Jeong, & Choi, 2024). Forced immobilization increases anxiety and stress, triggering disorientation in children. Conversely, psychosocial interventions such as watching television, listening to music, or playing demonstrate protective effects (Molina et al., 2017). A simple cognitive stimulation could reduce delirium risk by up to fourfold. Psychosocial interventions reduced delirium risk by 4.22 times (Dhingra, 2021; Lei et al., 2023).

PICU and hospital length of stay are also associated with delirium. A length of stay ≥ 48 hours increases risk, while delirium itself prolongs hospitalization, creating a cyclical and mutually reinforcing relationship (Lei et al., 2023). Some studies also report increased mortality among children with delirium, although the influence of underlying disease severity cannot be overlooked (Traube, Silver, Gerber, Kaur, Mauer, Kerson, & Greenwald, 2017; Zhu et al., 2022). Additionally, delirium may lead to long-term neurocognitive consequences, particularly in younger children.

Methodologically, the studies included in this review encompass diverse designs, including meta-analyses, prospective studies, and retrospective cohorts, with large sample sizes and validated diagnostic instruments (Zhu et al., 2022; Lei et al., 2023; Ge et al., 2021). This diversity strengthens the reliability of the findings, although heterogeneity in populations and methodologies remains an important limitation.

Clinically, these findings underscore the importance of implementing a comprehensive approach to delirium prevention. Prevention protocols should include twice-daily screening,

minimizing benzodiazepine use, optimizing ventilator management, reducing physical restraint use, enhancing family involvement, and ensuring routine delivery of daily psychosocial interventions (Ista et al., 2023; Lei et al., 2023). The primary focus should be directed toward modifiable factors with substantial potential to reduce delirium incidence.

Further research is needed to evaluate preventive interventions through randomized controlled trials. Longitudinal studies on long-term neurocognitive outcomes and characterization of delirium subtypes in children are also essential to strengthen the evidence base (Dervan et al., 2020). Additionally, a deeper understanding of the biological mechanisms of delirium in children is needed to develop more effective treatments and prevention strategies.

Overall, delirium in PICU children is a multifactorial condition with significant impact on cognitive function, length of stay, and mortality. A multimodal approach integrating pharmacological strategies, non-pharmacological interventions, environmental modification, and family support is the most effective strategy to reduce delirium risk and improve long-term outcomes (Ista et al., 2023; Chaiyakulsil & Thadahirunchot, 2023). This review highlights that delirium is not merely a transient complication but a serious condition requiring systematic attention and management across all pediatric intensive care settings.

This systematic review provides several important implications for nursing practice in the Pediatric Intensive Care Unit (PICU). First, delirium screening should be performed routinely at least twice daily using validated instruments such as the Cornell Assessment of Pediatric Delirium (CAPD) to ensure early detection and prompt management. Second, the use of benzodiazepines should be minimized and replaced with conservative sedation strategies or non-benzodiazepine agents, as these medications represent the most consistent and significant risk factors for delirium. Third, optimization of ventilation strategies through ventilator liberation programs, close monitoring of sedation, and avoiding prolonged mechanical ventilation can significantly reduce delirium risk. Fourth, creating a PICU environment that supports sleep hygiene, including noise reduction, appropriate lighting, and minimizing nighttime interruptions, is essential to maintain

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circadian rhythm and prevent delirium. Fifth, family involvement in patient care should be optimized, including providing opportunities for light cognitive stimulation (storytelling, music, or reality orientation), as this approach has been shown to exert protective effects against delirium in children. The use of physical restraints should be avoided unless absolutely necessary, with priority given to non-pharmacological approaches to manage agitation and ensure patient comfort.

This systematic review has several methodological strengths that enhance the validity of its findings. First, all included articles are recent studies published between 2020 and 2025, reflecting the most up-to-date developments regarding delirium in PICU children. Second, all studies used internationally validated delirium diagnostic instruments such as CAPD, pCAM-ICU, psCAM-ICU, and RASS, increasing measurement accuracy and consistency. Third, the geographic scope of the studies is broad, including Asia, the Americas, and multinational populations, providing a global understanding of delirium risk factors. Additionally, risk-of-bias assessment was conducted using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist, ensuring included studies possessed acceptable methodological quality.

However, this review also has limitations. Most included studies employed observational designs such as cohort and case-control studies, limiting the ability to establish definitive causal relationships. There was also substantial heterogeneity across studies regarding populations, delirium assessment tools, definitions of exposure variables, and effect-size reporting, limiting the feasibility of conducting a meta-analysis. Several studies did not fully report confounding factors such as variations in sedation use, ventilation status, or comorbid conditions, requiring cautious interpretation. Furthermore, differences in clinical characteristics and PICU settings across countries may limit generalizability to all pediatric populations.

CONCLUSION

This systematic review demonstrates that delirium in children admitted to the PICU is a significant complication with a high incidence and meaningful consequences, including prolonged length of stay, increased morbidity, and risk of long-

term developmental impairment. Several consistent determinants contribute to delirium, including the use of sedatives and analgesics, mechanical ventilation, high severity of illness, repeated invasive procedures, sleep disruption, immobilization, and inadequate nutrition. Early identification of these factors is crucial to prevent delirium and reduce its clinical impact. Prevention efforts such as optimizing sedation management, enhancing family involvement, applying non-pharmacological approaches, and performing routine delirium monitoring with validated instruments should be integral components of PICU standards of care. These findings emphasize the need for greater attention to delirium as a key indicator of safety and quality in pediatric critical nursing care.

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