



## PEDIATRIC DELIRIUM IN INTENSIVE CARE SETTING: A REVIEW OF RECOGNITION AND PREVALENCE

*Patricia Savrimuthu, Putri Yubbu\**

### Abstract

Delirium is defined as an etiologically nonspecific organic cerebral syndrome characterized by concurrent disturbances of consciousness and attention, perception, thinking, memory, psychomotor behavior, emotion, and the sleep-wake schedule. It is typically marked by rapid changes in mental status that fluctuate throughout the day, with the duration being variable and the degree of severity ranging from mild to severe. Unlike adults, pediatric delirium (PD) is often an under-recognized neuropsychiatric disorder in pediatric critical care despite being commonly reported in this population. The prevalence of delirium is estimated at 10-30% in pediatric intensive care units (PICU) and 49-66% in surgical or cardiac PICUs. It is a serious condition in PICU, where critically ill children are exposed to a variety of stressors such as pain, medications, and invasive procedures. PD has been linked to high rates of morbidity and mortality as well as prolonged ICU stays with the consequence of increased hospitalization costs. Patients who are at increased risk of delirium include those with infections, metabolic disorders, hypertension, pain, and medication withdrawal. Younger age groups and underlying developmental delay are also risk factors among children admitted to PICU. The under-diagnosis of this condition in PICU is likely due to a lack of awareness of PD and its overlapping symptoms with other clinical manifestations related to pain, sedation, or withdrawal syndrome, which pose challenges in diagnosing PD accurately. In recent years, several delirium rating scales have been developed and validated as screening tools. Increased use of routine screening improves diagnostic accuracy and implementation of treatment. This review introduces PD and focuses on its prevalence, recognition and brief management in pediatric intensive care setting.

**Keywords:** Delirium, Pediatric, Intensive Care Unit  
**DOI:** 10.51407/mjpc.v31i1.328

**Received:** 28 August 2024; **Accepted revised manuscript:** 15 April 2025; **Published online:** 30 April 2025

### Introduction

Delirium is an acute confusional state primarily with a disturbance of consciousness. It is characterized by an acute onset and fluctuating course, reduced awareness and impairments in attention, changes in cognition such as memory deficits and disorientation, language disturbances, and hallucinations and delusions, all with a pathophysiological cause [1]. It typically develops over a short period, ranging from hours to days, and tends to fluctuate in severity throughout the day. It is commonly associated with underlying medical conditions, such as infections, metabolic disturbances, drug intoxication or withdrawal, or neurological disorders. Delirium is prevalent among hospitalized patients, particularly in intensive care settings, and is associated with increased morbidity and mortality if not promptly recognized and managed [2].

Pediatric delirium shares many similarities with delirium in adults but also has some unique characteristics due to the developmental differences in children. Like in adults, pediatric delirium typically presents with an acute onset and fluctuating course,

often over hours to days. Pediatric delirium can manifest as changes in behavior and cognition. Children may appear irritable, agitated, or withdrawn. They may also experience disorientation, confusion, or memory deficits.

Similar to adults, pediatric delirium can be caused by various medical conditions, including infections, metabolic disturbances, medication side effects, or neurological disorders. Additionally, factors such as hospitalization, surgery, or traumatic experiences may contribute to delirium in children. The hypermetabolic state associated with delirium may impair recovery from critical illness, the agitated behaviors associated with hyperactive delirium

*Department of Pediatrics, University Putra Malaysia, Faculty of Medicine and Health Science, 43400 Serdang, Selangor Darul Ehsan, Malaysia.*

#### **\*Corresponding Author:**

Putri Yubbu, Department of Pediatric, Faculty of Medicine and Health Science, Universiti Putra Malaysia, Serdang 43400, Malaysia

**Tel:** +60389472610 **Email:** putri7237@gmail.com

impede care, and the psychological effects may be traumatic to the children [3].

Early recognition and intervention are essential to address the underlying causes and manage symptoms effectively, thereby minimizing potential complications and improving outcomes for affected children.

To diagnose delirium in the pediatric setting, a child's premorbid neurocognitive stage and language abilities must be taken into account. Neither DSM-5 nor ICD-10 include a definition of delirium specific to pediatrics, hence, multiple validated tools for assessing pediatric delirium have recently been developed and used to detect delirium in intensive care settings [4].

### Definition of Delirium

Delirium derived from the Latin word de-lira (out of the track), is a neuro- cognitive disorder due to a somatic illness or its treatment. The brain can react to illness, particularly critical illness, with several responses of which the more important are sickness behavior, fever, epilepsy, catatonia, delirium, refractory agitation, and coma [3].

By critical illness it is meant a life-threatening failure of the brain, heart or major organs. Sickness behavior is the behavioral repertoire displayed by humans and other mammal species in response to infection, trauma, oncological problems, and their treatment. This behavior is characterized by loss of interests and appetite, emotional irritability, tiredness, and an increased need for sleep [3].

According to DSM-5 (American Psychiatric Association, 2013) the essential features of delirium are:

- A disturbance of attention or awareness
- This disturbance is accompanied by changes in cognition that cannot be better accounted for by another pre-existing neurocognitive disorder (e.g., mental retardation, dementia)
- The condition develops in a short period of time, hours or days, and often fluctuates during the

day, typically worsening in the evening ("sundowning"); and

- There are indications from the patients' history, examination or laboratory results that the disturbance is probably the result of a medical condition or its treatment.

Whereas ICD-10 (World Health Organization, 2015) defines delirium as an etiologically nonspecific organic cerebral syndrome characterized by concurrent disturbances of consciousness and attention, perception, thinking, memory, psychomotor behavior, emotion, and the sleep-wake schedule. The duration is variable and the degree of severity ranges from mild to very severe.

### Prevalence of Delirium in PICU

Pediatric delirium, although less studied compared to adult delirium, is increasingly recognized as a significant issue in paediatric care settings. Delirium in children can occur in various clinical settings including pediatric intensive care units (PICUs), general pediatric wards, emergency departments, and post-anesthesia care units. The prevalence of pediatric delirium varies depending on the population studied, the setting, and the tools used for assessment as reported in multiple studies [5–12]. However, it's generally estimated to occur in approximately 10% to 30% of critically ill children admitted to PICUs [2].

A multi-institutional point prevalence study conducted across 25 PICUs in multiple countries establishes delirium is a frequent complication in critically ill children, with a point prevalence of 25% across these institutions. The prevalence of delirium was 53% in children who needed MV possibly because of higher degree of illness and more exposure to sedatives. The study also discovered the highest rate of delirium among patient with underlying infection or inflammatory illnesses [13]. In other studies, a higher prevalence of pediatric delirium was reported in post-surgical ICU (66%) or following cardiac bypass surgery (49%) [14–16].

Table 1. Prevalence of Pediatric delirium worldwide

| Author                    | Scale      | Country  | Prevalence |
|---------------------------|------------|----------|------------|
| Pinzón-Casas E, 2021 [5]  | ps-CAM ICU | Spain    | 25.8%      |
| Smith H, 2011 [6]         | psCAM ICU  | US       | 13.2%      |
| Traube C, 2014 [7]        | CAPD       | US       | 20.6%      |
| Fazio P, 2022 [8]         | CAPD       | Italy    | 54%        |
| Matshuishi Y, 2019 [9]    | ps-CAM ICU | Japan    | 54%        |
| Lei L, 2022 [10]          | CAPD       | China    | 26.0%      |
| Kim H, J 2019 [11]        | CAPD       | Korea    | 42.1%      |
| Chaiyakulsil C, 2023 [12] | CAPD       | Thailand | 41.7%      |

### Risk Factor of Pediatric Delirium

There is a growing body of evidence indicating a correlation between the severity of illness and PD. Specifically, the severity of the disease serves as a significant risk factor for delirium with critical illness being the primary cause of severe delirium.

A comprehensive review of the literature reveals that pediatric ICU patients are at increased risk of delirium, particularly those with infections, metabolic disorders, hypertension, pain, and medication withdrawal. Moreover, iatrogenic factors such as mechanical ventilation, restraints, sleep disturbance, catheters, and Intravenous lines contribute to the development of delirium in this population [17].

There are also other non-modifiable risk factors has been associated with pediatric delirium such as younger age group, mostly those who are less than 2 years old [18].

Developmental delay is also has been found to be an identifiable risk factor among children admitted to PICU. Their baseline condition of an atypical brain may render them more susceptible to the toxic and metabolic impacts of critical illness, potentially

through various pathways commonly linked with delirium [19].

### Clinical Characteristic of Pediatric Delirium

Features of delirium that are particularly prominent in the pediatric population include irritability, affective lability, agitation, sleep wake disturbance, and fluctuations of symptoms. In contrast, delusions, hallucinations, speech disturbances, and memory deficits are less commonly seen in children [20].

Unique features of PD include developmental regression with loss of previously acquired skills, inability of the usual caregiver to console the child, and reduced eye contact with the usual caregiver. Schievelde and Janssen also described the "inconsolable child" as a red flag for delirium. A child who is agitated, breathing against the ventilator, and receiving escalating doses of sedating medications, should be delirious until proven otherwise [20].

Delirium in the pediatric population can be classified based on the psychomotor state into hypoactive (decreased physical activity, apathetic and uninterested), hyperactive (agitated and/ or aggressive behavior) and mixed delirium [4] The types of delirium has been tabulated in Table 2.0.

Table 2.0 Types of delirium, symptoms and consequences

| Sub- groups  | Hyperactive delirium                                                                   | Hypoactive delirium                        | Mixed Delirium                                                                                                                                                                 |
|--------------|----------------------------------------------------------------------------------------|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Symptoms     | -Anxious                                                                               | -Quiet                                     | -Mixture of symptoms of hyper- and hypoactive delirium<br><br>-The child may show symptoms of hyperactive delirium and a short time later have symptoms of hypoactive delirium |
|              | -Fretful                                                                               | -Sluggish                                  |                                                                                                                                                                                |
|              | -Agitated                                                                              | - Inattentive                              |                                                                                                                                                                                |
|              | -No eye contact                                                                        | -No eye contacts<br>-Withdrawn             |                                                                                                                                                                                |
| Consequences | -Risk of extubation or self-removal of intravenous cannula and other medical equipment | -Less probably that the child harms itself |                                                                                                                                                                                |

(Source: Monica Yvon Holberg, 2021)

Certain features are more prominent in children, which necessitates a unique approach to the pediatric delirium examination. For example, in a preverbal child, the examiner might forgo formal bedside tests of attention and instead assess inattentiveness by observing poor eye contact or difficulty with engagement. Caregiver involvement can prove very helpful in making this diagnosis.

### Sequelae of Pediatric Delirium

Research on the sequelae of PD remains in its infancy. Unlike in adults, research has not yet shown that an

episode of PD increases mortality independently of illness severity. However, a diagnosis of PD is associated with longer hospital stays [22]. Furthermore, one-third of patients discharged from a PICU meet criteria for post-traumatic stress disorder (PTSD) three months after discharge. Since PTSD symptoms can occur even in children who lack conscious memory of the trauma, delirium is a likely contributor to this finding [23].

Early studies comparing generally medically hospitalized children to critically ill children show that critically ill children have impaired visual and

spatial memory, as well as impaired attention, suggesting that an episode of PD may affect long-term brain function [24].

### Overlap Of Behavioral Cues in Pain, Sedation, Withdrawal Syndrome and Delirium

Admission to a pediatric intensive care unit (PICU) exposes a child to a series of painful and stressful events. The effects of these events are commonly managed by the administration of analgesics

(opioids) or sedatives (benzodiazepines). While adequate analgesia and sedation help reduce the stress response and improve clinical and psychological outcomes, inadequate analgesia and sedation will lead to pain, pain-induced agitation or undersedation, and possibly accidental extubation or removal of vascular access devices. Overuse of analgesic and sedative agents, on the other hand, can lead to oversedation, prolonged ICU stays, longer ventilation times, drug tolerance, and dependence [21].

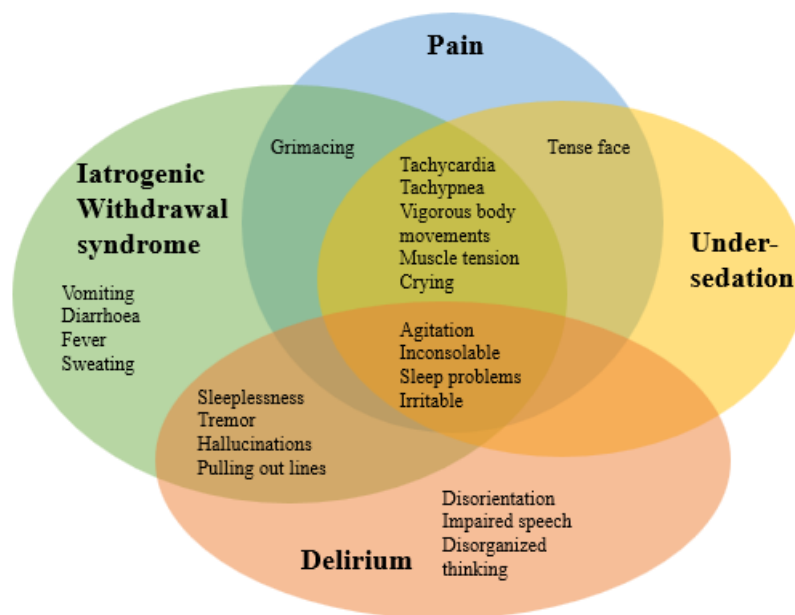


Figure 1. Overlap of Behavioral Cues in Pain, Sedation, Withdrawal Syndrome and Delirium  
(Source: Adapted from M. Van Dijk, 2011)

Iatrogenic withdrawal symptoms (IWS) and delirium could be identified as side effects of prolonged analgesia and sedation [21]. Both are considered concepts of non-pain-related distress in critically ill children. However, it may be difficult to discriminate between iatrogenic withdrawal syndrome, pain and delirium in a critically ill child because the behavioral cues will overlap in part. There are standardized assessment tools available among the majority of PICUs to assess for pain, such as a pain score, and for withdrawal symptoms, such as the Withdrawal Assessment Tool (WAT-1) and delirium using screening scales, such as Cornell Assessment of Pediatric Delirium (CAPD) and other PD screening scales which will be further elaborated in this review.

### Diagnosing Pediatric Delirium

There are a number of challenges associated with accurately and systematically diagnosing PD. The symptoms of PD can be subtle, vary depending on

the developmental stage, and are complicated by developmental variability. Many of the symptoms used to make a diagnosis of PD might overlap with a number of other conditions, such as pain, distress, or drug withdrawal [25].

The gold standard for diagnosing delirium is having a pediatric psychiatrist consult and assess the child for the signs and symptoms delineated by the American Psychiatric Association's (APA) DSM [1]. However, this is time-consuming and labor-intensive and may work for managing delirium in the agitated child, but it is not suitable for broad-based screening or research on prevalence. As diagnosis depends upon referral to psychiatry, many children with hypoactive or mixed delirium may go unrecognized [19].

The involvement of the caregiver is necessary for making a diagnosis. However, the caregiver may not always be easily accessible, which can complicate the

process. Furthermore, the challenges of communication with preverbal or nonverbal children complicate the diagnosis of delirium. It relies heavily on closely observing behavioral symptoms.

Therefore, an ideal screen for delirium must be made simple, quick, applicable to children of all ages and cognitive levels, and can be administered by non-psychiatrists multiple times a day. It must be flexible for use with intubated and non-intubated children and would not require child cooperation. It would detect all delirium subtypes and take advantage of the ICU staff's ongoing observation of the patient [19].

In recent years, several delirium rating scales have been developed and validated as screening tools. Its increased use as routine screening thereby improves diagnostic accuracy and the implementation of treatment.

### Assessment of Pediatric Delirium

There are several types of PD screening scales designed to assess delirium in children across various age groups and clinical settings. They comprise various method of screening such as observational, parents/caregivers report, self-report and some are combination of all methods.

### Observational Method

- Pediatric Confusion Assessment Method for the Intensive Care Unit (pCAM-ICU):  
Adapted from the CAM-ICU for adults, the pCAM-ICU assesses delirium in critically ill pediatric patients using observable criteria such as altered mental status, inattention, and disorganized thinking [16].
- Pediatric Anesthesia Emergence Delirium (PAED) Scale:  
Specifically designed to assess delirium in children emerging from anesthesia, the PAED Scale evaluates agitation, restlessness, and disorientation using observational criteria.

### Parent/Caregiver Report Method

These methods involve obtaining information from parents or caregivers about the child's behavior and cognitive function.

- Sophia Observation Withdrawal Symptoms Scale (SOS):

Used to assess withdrawal symptoms in neonates and infants, the SOS relies on caregiver report to detect signs of agitation, irritability, and tremors [25].

### Self-Report Method

These tools are designed for older children and adolescents who can provide self-reported information about their symptoms.

- Pediatric Confusion Assessment Method for the Emergency Department (pCAM-ED):  
Developed for use in the emergency department, the pCAM-ED assesses delirium in adolescents using self-reported and observational criteria.

### Combined method

Some screening tools combine multiple assessment methods, such as observational, caregiver report, and self-report, to comprehensively evaluate delirium in pediatric patients. These tools aim to increase the sensitivity and specificity of delirium detection.

- Cornell Assessment of Pediatric Delirium (CAPD):  
The Cornell Assessment of Pediatric Delirium (CAPD) scale is specifically designed for use in pediatric populations, taking into account the unique developmental and behavioral characteristics of children [7]. The scale assesses a broad range of symptoms and behaviors associated with PD, including alterations in consciousness, cognition, and psychomotor activity, and is easily applied to a broad range of age groups (0–21 years old) of children, especially the non-verbal group.

CAPD incorporates both observational and caregiver-reported items to assess delirium in pediatric patients across a wide age range. Its comprehensive nature allows for a more thorough evaluation of delirium symptoms compared to scales that focus on specific domains. The CAPD is designed to be user-friendly and practical for use in clinical settings, allowing for efficient screening and assessment of PD by healthcare providers.

Among all the tools available, CAPD is one of the ideal assessment tools for PD, which is feasible and can be easily administered in PICU settings. It is quickly and easily scored by nurses at the bedside and does not need a psychiatrist's evaluation.

Table 3.0: Pediatric Delirium Screening Scale

|                                  | PAED             | pCAM-ICU                  | psCAM-ICU                 | CAPD                      |
|----------------------------------|------------------|---------------------------|---------------------------|---------------------------|
| PICU/ICU Population              | Med/Surg         | Med/ Surg,                | Surg,cardiac              | General                   |
| Age (Year)                       | 1-17             | ≥5                        | 0.5-5                     | Birth-21years             |
| Include Mechanical Ventilations? | No               | Yes                       | Yes                       | Yes                       |
| Include development delay?       | No               | No                        | No                        | Yes                       |
| Type of Delirium                 | Hyperactive      | Hyperactive<br>Hypoactive | Hyperactive<br>Hypoactive | Hyperactive<br>Hypoactive |
| No. of questions or domains      | 5                | 4                         | 4                         | 8                         |
| Administering provider           | Anesthesiologist | Nurses/Physician          | Nurses/Physician          | Nurses/Physician          |

### Management of Pediatric Delirium

Minimizing the risk factors is a logical and important approach in preventing the onset of PD. Non pharmacological interventions appear to have been successful in several studies [26].

#### Nonpharmacological

Non-pharmacological management plays a crucial role in the comprehensive care of PD, aiming to mitigate symptoms and promote recovery without relying solely on medication.

Environmental modifications by creating a calm and familiar environment can help reduce agitation and confusion in pediatric patients with delirium. This may involve minimizing noise, providing adequate lighting, maintaining consistent routines, and encouraging visits from family members for reassurance [2].

Regularly reorienting the child to their surroundings, time, and situation can help enhance their awareness and reduce disorientation. Simple cues such as using clocks, calendars, and familiar objects can aid in reorientation efforts.

Encouraging mobility and engaging in age-appropriate physical activities promotes sensory stimulation, maintain muscle strength, and improve overall well-being. Physical therapy interventions tailored to the child's capabilities can be beneficial in preventing functional decline associated with prolonged bed rest [27].

Establishing a regular sleep schedule, maintaining a quiet and comfortable sleep environment, and implementing relaxation techniques can improve

sleep quality and promote restorative rest, which is essential for cognitive function and overall recovery.

Family involvement and emotional support to both the child and their caregivers can contribute to a sense of security and comfort. Educating families about delirium and involving them in decision-making can also help alleviate anxiety and promote coping strategies.

#### Pharmacological

Before initiating pharmacological treatment, it's essential to identify and address any underlying medical conditions or factors contributing to delirium, such as infections, metabolic disturbances, or medication side effects. Common deliriogenic medications, including anticholinergic agents, benzodiazepines, and opioids, should be minimized, substituted, and tapered accordingly.

Medications may be used to target specific symptoms of delirium, such as agitation, hallucinations, or sleep disturbances. The choice of medication depends on the predominant symptoms and the individual needs of the child.

Generally, pharmacologic intervention is recommended when the patient is distressed by the symptoms that impose a safety concern, but there are no agents with Food and Drug Administration of USA approval for delirium treatment in either adults or children.

Antipsychotics have been clinically shown to address delirium symptoms in adults and are widely used. In a retrospective study of 84 children aged 6–18 years, antipsychotic drugs such as haloperidol and

droperidol were found to be helpful in controlling symptoms of delirium in the pediatric patients [23].

### Implementation of Delirium Assessment Tools as Routine Practice in Intensive Care Setting

Accurate diagnosis, prevention, and treatment of PD remain significant challenges. Despite its known impact on critically ill children, PD is often under-recognized in PICUs worldwide due to its fluctuating nature and overlap with other clinical symptoms such as pain, sedation, or withdrawal. A lack of standardized screening tools and limited awareness among healthcare providers further exacerbates this underdiagnosis.

The absence of routine PD screening in many countries means the condition is frequently overlooked, leading to delayed interventions. This results in poorer outcomes, including prolonged ICU stays, increased morbidity, and mortality. Standardized assessment tools, such as the Cornell Assessment of Pediatric Delirium (CAPD) scale, are available for identifying PD and are reliable for use in PICU settings. The validated CAPD scale is designed for all age groups of children with developmental variabilities and for all types of delirium. The CAPD is designed to give nurses a quick and easy way to screen for pediatric patients who are at risk of delirium [7]. Several countries have translated the scale into various languages and culturally adapted it to their local settings [28,29]. A Malay version of the CAPD is available and preliminary testing has demonstrated its feasibility and reliability for use in Malaysian PICU settings [30]. This will promote the application of the scale among PICU clinicians to diagnose pediatric delirium. This makes it easier for their nurses to apply the tool to children admitted to the PICU.

Implementing the CAPD scale, like the pain score and withdrawal assessment tool(WAT-1), as a routine assessment of PD in PICUs will improve recognition and provide early diagnosis of PD, allowing appropriate treatment and preventive measures.

### Conclusion

Pediatric delirium is increasingly recognized as a significant issue in pediatric intensive care units. The reported prevalence of delirium in PICU varies, with more than 50% in surgical or cardiac intensive care settings. It has been linked to high rates of morbidity and mortality as well as prolonged ICU stays with the consequence of increased cost of hospitalization. The under-diagnosis of this condition is likely due to a lack of awareness of PD and its overlapping symptoms related to pain, sedation, or withdrawal syndrome,

which pose challenges in diagnosing PD accurately. The availability of validated and reliable assessment tools for pediatric delirium improves recognition and early diagnosis in the pediatric population.

### References

- [1] American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. American Psychiatric Association Publishing 2022.
- [2] Schievelde JNM, Strik JJMH. Pediatric Delirium: A Worldwide PICU Problem. *Crit Care Med*. 2017;45:746–7. doi: 10.1097/CCM.0000000000002275
- [3] Schievelde JNM, Janssen NJJF. Delirium in the Pediatric Patient: On the growing awareness of its clinical interdisciplinary importance. *JAMA Pediatr*. 2014;168:595. doi: 10.1001/jamapediatrics.2014.125
- [4] Silver G, Traube C, Kearney J, et al. Detecting pediatric delirium: development of a rapid observational assessment tool. *Intensive Care Med*. 2012;38:1025–31. doi: 10.1007/s00134-012-2518-z
- [5] Pinzón-Casas E, Soto-Trujillo M, Camargo-Agón L, et al. Preschool Confusion Assessment Method for the Intensive Care Unit–Spanish (psCAM-ICU-S): Cross-Cultural Adaptation and Validation in Colombia. *Front Pediatr*. 2021;9. doi: 10.3389/fped.2021.749522
- [6] Smith HAB, Boyd J, Fuchs DC, et al. Diagnosing delirium in critically ill children: Validity and reliability of the Pediatric Confusion Assessment Method for the Intensive Care Unit. *Crit Care Med*. 2011;39:150–7. doi: 10.1097/CCM.0b013e3181feb489
- [7] Traube C, Silver G, Kearney J, et al. Cornell Assessment of Pediatric Delirium: A Valid, Rapid, Observational Tool for Screening Delirium in the PICU. *Crit Care Med*. 2014;42:656–63. doi: 10.1097/CCM.0b013e3182a66b76
- [8] Fazio PC, Daverio M, Masola M, et al. Italian Version of the Cornell Assessment of Pediatric Delirium: Evaluation of the Scale Reliability and Ability to Detect Delirium Compared to Pediatric Intensive Care Unit Physicians Clinical Evaluation. *Front Pediatr*. 2022;10. doi: 10.3389/fped.2022.894589
- [9] Matsuishi Y, Hoshino H, Shimojo N, et al. Verifying the Japanese version of the Preschool Confusion Assessment Method for the ICU (psCAM-ICU). *Acute Medicine & Surgery*. 2019;6:287–93. doi: 10.1002/ams2.413

- [10] Lei L, Li Y, Xu H, et al. Incidence, associated factors, and outcomes of delirium in critically ill children in china: a prospective cohort study. *BMC Psychiatry*. 2023;23:925. doi: 10.1186/s12888-023-05406-3
- [11] Kim HJ, Kim DH. Factors associated with Pediatric Delirium in the Pediatric Intensive Care Unit. *Child Health Nursing Research*. 2019;25:103–11. doi: 10.4094/chnr.2019.25.2.103
- [12] Chaiyakulsil C, Thadahirunchot T. Implementation and effectiveness of a delirium care protocol in Thai critically ill children. *Acute and Critical Care*. 2023;38:488–97. doi: 10.4266/acc.2023.00045
- [13] Traube C, Silver G, Reeder RW, et al. Delirium in Critically Ill Children: An International Point Prevalence Study. *Crit Care Med*. 2017;45:584–90. doi: 10.1097/CCM.0000000000002250
- [14] Patel AK, Biagas K V., Clarke EC, et al. Delirium in Children After Cardiac Bypass Surgery. *Pediatric Critical Care Medicine*. 2017;18:165–71. doi: 10.1097/PCC.0000000000001032
- [15] Meyburg J, Dill M-L, Traube C, et al. Patterns of Postoperative Delirium in Children\*. *Pediatric Critical Care Medicine*. 2017;18:128–33. doi: 10.1097/PCC.0000000000000993
- [16] Smith HAB, Gangopadhyay M, Goban CM, et al. The Preschool Confusion Assessment Method for the ICU. *Crit Care Med*. 2016;44:592–600. doi: 10.1097/CCM.0000000000001428
- [17] Ista E, Traube C, de Neef M, et al. Factors Associated With Delirium in Children: A Systematic Review and Meta-Analysis. *Pediatric Critical Care Medicine*. 2023;24:372–81. doi: 10.1097/PCC.0000000000003196
- [18] Holberg MY, Larsen MH, Mariussen KL, et al. Delirium in children under two years of age admitted to intensive care units – a systematic review. *Sykepleien Forskning*. 2021;e-85808. doi: 10.4220/Sykepleienf.2021.85808en
- [19] Silver G, Traube C, Gerber LM, et al. Pediatric Delirium and Associated Risk Factors: A single-center prospective observational study. *Pediatric Critical Care Medicine*. 2015;16:303–9. doi: 10.1097/PCC.0000000000000356
- [20] Schievelde JNM, Lousberg R, Berghmans E, et al. Pediatric illness severity measures predict delirium in a pediatric intensive care unit. *Crit Care Med*. 2008;36:1933–6. doi: 10.1097/CCM.0b013e31817cee5d
- [21] Anand KJS, Willson DF, Berger J, et al. Tolerance and Withdrawal From Prolonged Opioid Use in Critically Ill Children. *Pediatrics*. 2010;125:e1208–25. doi: 10.1542/peds.2009-0489
- [22] Alvarez R V., Palmer C, Czaja AS, et al. Delirium is a Common and Early Finding in Patients in the Pediatric Cardiac Intensive Care Unit. *J Pediatr*. 2018;195:206–12. doi: 10.1016/j.jpeds.2017.11.064
- [23] Turkel SB, Tavaré CJ. Delirium in Children and Adolescents: Valid and Reliable Delirium Monitoring for Critically Ill Infants and Children. *J Neuropsychiatry Clin Neurosci*. 2003;15:431–5. doi: 10.1176/jnp.15.4.431
- [24] Fiser DH. Assessing the outcome of pediatric intensive care. *J Pediatr*. 1992;121:68–74. doi: 10.1016/S0022-3476(05)82544-2
- [25] Ista E, te Beest H, van Rosmalen J, et al. Sophia Observation withdrawal Symptoms-Paediatric Delirium scale: A tool for early screening of delirium in the PICU. *Australian Critical Care*. 2018;31:266–73. doi: 10.1016/j.aucc.2017.07.006
- [26] Tabet N, Howard R. Non-pharmacological interventions in the prevention of delirium. *Age Ageing*. 2009;38:374–9. doi: 10.1093/ageing/afp039
- [27] Kim K, Jeong JH, Choi EK. Non-pharmacological interventions for delirium in the pediatric population: a systematic review with narrative synthesis. *BMC Pediatr*. 2024;24:108. doi: 10.1186/s12887-024-04595-4
- [28] Simonsen BY, Lisby M, Traube C, et al. The Cornell Assessment of Pediatric Delirium: Translation and inter-rater reliability in a Danish pediatric intensive care unit. *Acta Anaesthesiol Scand*. 2019;63:900–4. doi: 10.1111/aas.13369
- [29] Barbosa M dos SR, Andrade LB, Duarte M do CMB, et al. Translation and cross-cultural adaptation of the anchor points of the Cornell Assessment of Pediatric Delirium scale into Portuguese. *Critical Care Science*. 2023;35. doi: 10.5935/2965-2774.20230165-en
- [30] Savrimuthu P, Yubbu P, Abdul Ghani AS. Translation and Validation Of The Malay Version Of Cornell Assessment Of Pediatric Delirium (CAPD) Scale In The Paediatric Intensive Care Unit. *Master thesis Book, UPM*. 2024.