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Point Prevalence of Pediatric Intensive Care Unit Delirium and Associated Risk Factors at Kenyatta National Hospital, Nairobi City County, Kenya

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Abstract

Pediatric ICU delirium remains an understudied component in the provision of care to critically ill children that can lead to increased ICU stay, increased cost of care, and consequent debilitating post-discharge neurological deficits. Delirium is an acute disturbance of mental state presenting with reduced awareness of one's environment and cognitive abilities. Screening for delirium remains essential for identifying risk factors and guiding management. The objective of the study was to determine the point prevalence of pediatric ICU delirium at Kenyatta National Hospital and to identify associated risk factors. The observational study was conducted over 17 weeks at Kenyatta National Hospital and included 51 patients, recruited at various time points. The observations began with sedation scoring using the Standard Richmond Agitation-Sedation Scale; patients who scored above -4 were then assessed using the Cornell Assessment of Pediatric Delirium Tool (CAPD). A score above 9 on the CAPD tool indicates delirium. Data from the questionnaire were collated in Microsoft Excel and exported to GraphPad Prism 10 for further analysis. In the Study, 71% (n = 51) of the patients presented with Delirium. The sex distribution showed that 20 participants (39.2%) were male and 31 (60.8%) were female. Mortality and mechanical ventilation are significantly associated with delirium (p = 0.013 and p = 0.019, respectively). This indicates the need for an adopted tool to screen children admitted to the intensive care unit for delirium, enabling early intervention. There is also a need to strengthen clinical practice in the Pediatric Intensive Care Unit by adopting routine delirium screening. In terms of education and policy, delirium should be included in pediatric critical care training for both nurses and physicians.

Keywords: *Point Prevalence, Pediatric Intensive Care Unit Delirium, Risk Factor*

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1. Introduction

Delirium is a state of cognitive disturbance and reduced awareness of the environment (Henao Castaño & Pinzon Casas, 2020). Delirium is defined as an acute neurologic dysfunction characterized by fluctuation in cognition and awareness, which may result from a disease or exposure to pharmacologically active substances such as drugs, alcohol, and toxic substances. It is a temporary state that resolves with the removal of iatrogenic factors (Traube, Silver, Reeder, et al., 2017).

Globally, there has been a focus on pediatric delirium, with areas of concern being its definition and symptoms, how to diagnose delirium, and identification of risk factors, modifiable and non-modifiable (Turkel, 2017). Some modifiable risk factors include the hospital environment (e.g., noise and sleep-wake cycle disruption), pain management, and sedation. Requirements for invasive mechanical ventilation, cognitive and behavioral disabilities, critical illness, comorbid and impaired nutritional status explain the non-modifiable hazard aspects associated with the development of ICU delirium (Dechnik & Traube, 2020). There needs to be interventional studies to determine the best practice to limit at-risk children's exposure to delirium. Optimizing the hospital environment by reducing noise and minimizing sleep disruption has been shown to reduce the incidence of delirium. In addition, adequate pain control has been shown to decrease the need for sedation (Dechnik & Traube, 2020).

Intensive Care unit delirium in children has been related to unfavorable outcomes such as longer time in the critical care unit, longer ventilation time, and generally increased cost of care (Silver et. al., 2015). A study done by Chani Traube et al. (2016) showed an 85% increase in pediatric Intensive Care Unit costs for patients who developed delirium. The results were based on observations made among 464 patients in a 15-week study. A retrospective study (Mody et al., 2018), to determine any relationship between benzodiazepine and delirium in children, researchers found that exposure to benzodiazepine led to the occurrence of delirium in seriously ill children. The study recommended that a benzodiazepine-sparing approach be used in children. Studies have also shown an independent association between delirium and in-hospital mortality (Traube, Silver, Gerber, et al., 2017a).

The Society of Critical Care Medicine developed an ICU liberation bundle, a systematic approach to mitigate post-intensive care unit effects in patients. The elements of the collection were Pain evaluation, prevention and management, B Element: Trials of spontaneous Awakening and Breathing, C Element: Sedation and analgesia choice, D Element: Assessing, Preventing and Managing Delirium, E Element: Early Mobilization and Exercise, F Element: Family Centered Care (Walz et al., 2020). The Liber Action project aimed to evaluate the effectiveness of early screening for delirium, reduced benzodiazepine sedation, and early mobilization as interventions to optimize outcomes in critically ill children and improve quality of life after ICU admission (Di Nardo et al., 2021). The findings favored the feasibility of the interventions, even in workforce-constrained pediatric Intensive Care units (Di Nardo et al., 2021). Delirium can be prevented by promoting a day-night cycle through maintaining a routine that includes active daytime activities and nighttime sleep, and by minimizing exposure to deliriogenic medications. A systematic review of 21 studies in South Africa was conducted to examine the evidence of risk factors for pediatric delirium in hospitalized children. The findings were similar to previous studies done in developed countries that put severely ill, mechanically ventilated children at high risk for developing delirium, as well as those with developmental delay. The review revealed the nature of delirium, which is characterized by fluctuating symptoms, with most events occurring at night (Holly et al., 2018).

Delirium in children has not been extensively studied due to the lack of a standard tool for assessing delirium in this population. European Society of Pediatric and Neonatal Intensive Care endorsed the use of the Corneille Assessment of Pediatric Delirium (CAPD) as a screening tool for delirium in children (Silver et al., 2012). There is currently no study in Kenya that shows the prevalence of pediatric ICU delirium. Kenyatta National Hospital is the national

referral hospital and therefore receives pediatric patients in need of critical care from lower-level hospitals and, at times, from private hospitals.

The global point prevalence of intensive care unit delirium in children at 25% (Traube et al., 2017). Some studies have shown a prevalence of 56% in children under 2 years old and 35% in children between 2 and 5 years old (Bettencourt & Mullen, 2017). Pediatric ICU delirium prolonged mechanical ventilation duration, increased hospital length of stay, and increased overall care costs. Traube et al. (2017) found that ICU delirium in children increased mortality. There is no routine screening for ICU delirium in the Pediatric Intensive Care Unit at Kenyatta National Hospital; therefore, the prevalence is unknown. There is currently no existing pediatric ICU delirium screening tool in use. This, therefore, means that the prevalence of pediatric delirium is unknown, as are the unit-specific predisposing risk factors. Patients who develop delirium are missed, and this could lead to debilitating post-intensive care syndrome (PICS). PICS can be defined as an impairment of physical, cognitive, and mental status resulting from critical illness and intensive care unit admission. This condition leads to limitations in the patient's daily life and a reduced quality of life (Manning et al., 2018). At the KNH pediatric ICU and, for the most part, in the Main ICU, there is continuous activity during both the day and night shifts, including nursing care, doctors' ward rounds, and other patient-related activities within the unit, so patients have no quiet time for sleep. This further disrupts patients' sleep cycles, increasing their risk of delirium. This research will provide empirical data on the prevalence of ICU delirium among admitted children, explore its associated risk factors, and determine whether there is a correlation between delirium and mortality among children admitted to Kenyatta National Hospital's pediatric Intensive Care Unit. The following objectives guided the study:

1. To determine the point prevalence of ICU delirium in critically ill children admitted to the pediatric critical care unit

2. To determine the associated risk factors of pediatric ICU Delirium in critically ill children admitted at the Kenyatta National Hospital

3. To determine outcomes in the critically ill children who develop ICU Delirium at Kenyatta National Hospital

2. Literature Review

2.1 Prevalence of ICU delirium in children

The actual occurrence of ICU delirium in children is unknown due to limited screening using validated tools. The prevalence is estimated to range from 10% to 60% (Staveski et al., 2021). There has been little research on pediatric ICU delirium due to a lack of screening tools, which could provide clarity on its prevalence. Some studies have reported an overall prevalence of 25%, whereas this report reports an incidence of 49% in the pediatric cardiac intensive care unit. This can be attributed to critical illness factors and the post-operative environment. The limitations of the pediatric study include its retrospective design, small number of participants, and very narrow inclusion criterion. An international multicenter point prevalence study by Traube et al. (2017) found that 25% of critically ill children met criteria for delirium using validated screening tools. Similar prevalence rates have been reported in other regions; a study in Spain using the pCAM-ICU and CAPD tools found a delirium prevalence of approximately 20% (Turon et al., 2020). An integrative review of pediatric ICU delirium literature further

supports these findings, reporting a prevalence range of 17%-25% and an average duration of 2 days (Meyburg et al., 2021). These consistent findings justify using a 20% expected prevalence in the study's sample size calculation.

2.2 Delirium Risk Factors

Some of the identified risk factors for Pediatric ICU delirium include patient age. Studies have shown children aged 2 - 12 years have a higher risk of developing delirium in comparison with those less than 2years and older than 12years (Meyburg et al., 2018). More studies have shown higher pediatric ICU prevalence of up to 57 %, with the most affected ranging in age between 4 years and 46 months (Alvarez et al., 2018).

Admission diagnosis plays a crucial role in predisposing children to delirium within the pediatric intensive care unit setting (Gupta et al., 2020). Children admitted for respiratory illnesses, neurological disorders, or sepsis may exhibit an elevated susceptibility to delirium onset when compared to their counterparts admitted for other medical conditions (Gupta et al., 2020). The severity of the underlying illness, as quantified by metrics such as the Pediatric Risk of Mortality score or the Pediatric Logistic Organ Dysfunction score, has been positively correlated with the incidence of delirium (Yöntem et al., 2021). Furthermore, specific diagnostic categories, such as traumatic brain injury or oncologic diagnoses, have been independently linked to an augmented risk of delirium, underscoring the need for increased vigilance and targeted preventive measures in these patient subpopulations (Reiter et al., 2021). Admission diagnoses have shown increased incidence of delirium in patients who had respiratory failure with hypoxemia requiring mechanical ventilation at 44.94 % and those with infections at 32% (Patel et al., 2017). The state of being hypoxemic itself leads to an altered level of consciousness due to brain hypoxia. Metabolic and electrolyte disturbances have also been shown to independently increase the risk of pediatric ICU delirium (Ge et al., 2021).

One of the most modifiable risk factors is exposure to sedative medications, which are commonly administered in PICUs to manage pain, anxiety, and facilitate mechanical ventilation. Sedatives such as benzodiazepines and opioids have been strongly associated with increased delirium risk. Benzodiazepines, in particular, exert depressive effects on the central nervous system and disrupt regular sleep-wake cycles and cognitive functioning. Meyburg et al. (2021) and Traube et al. (2017) both report a positive correlation between cumulative sedative exposure and the incidence and duration of delirium episodes. These medications may also contribute to hypoactive delirium presentations, which are more easily overlooked. Therefore, implementing sedation-sparing strategies, such as minimizing benzodiazepine use, incorporating non-pharmacological comfort measures, and utilizing alternative agents like dexmedetomidine, can significantly reduce delirium risk.

The cumulative anticholinergic burden from medications such as diphenhydramine, atropine, and certain antiemetics or antipsychotics may increase the likelihood of delirium, particularly when used alongside other sedative or psychoactive drugs. Although pediatric-specific data are limited, studies in adult ICUs have consistently demonstrated this association, and emerging pediatric studies suggest a similar trend (Silver et al., 2015; Turon et al., 2020). Awareness of the anticholinergic load in critically ill children can help clinicians make more judicious pharmacologic choices and mitigate avoidable contributors to delirium.

Mechanical ventilation is a well-established risk factor for the development of pediatric ICU delirium, primarily due to its associated physiological and psychological stressors. Children on mechanical ventilation often require deep sedation, are subjected to frequent invasive procedures, and experience disrupted sleep–wake cycles, all of which contribute to delirium onset. The process of intubation itself, as well as prolonged dependence on a ventilator, can lead to disorientation, anxiety, and sensory deprivation or overload. Additionally, mechanically ventilated patients are more likely to receive high doses of sedatives and analgesics, particularly benzodiazepines and opioids—both of which are independently associated with delirium (Traube et al., 2017). The inability to communicate or interact normally due to endotracheal tubes may also result in frustration and cognitive disturbance, particularly in young children. Studies have shown that the duration of mechanical ventilation is positively correlated with the incidence and severity of delirium in pediatric patients (Turon et al., 2020). These findings support the adoption of ventilator weaning protocols, sedation minimization strategies, and early mobility initiatives to help reduce the delirium burden among ventilated children.

The use of physical restraints in pediatric intensive care settings, though sometimes deemed necessary for patient safety, has been linked to an increased risk of delirium. Restraints are often used to prevent children from dislodging life-sustaining devices, such as endotracheal tubes, central venous catheters, or catheters. However, restraint use may lead to heightened agitation, fear, and sensory disorientation, especially in children who cannot comprehend the reason for being physically restricted. This distress can precipitate or exacerbate delirium symptoms, particularly in patients already vulnerable due to sedation, illness severity, or impaired communication. Furthermore, the psychological impact of restraints, including feelings of helplessness and anxiety, may contribute to hyperactive or mixed-type delirium presentations (Turon et al., 2020). Frequent use of restraints may also necessitate higher doses of sedatives or antipsychotics, creating a compounding effect that further increases delirium risk. As such, minimizing restraint use through alternatives such as increased monitoring, family presence, and non-pharmacological calming strategies is a critical step in pediatric delirium prevention.

The intensive care unit is a busy environment characterized by constant machine beeping, nursing procedures, doctors' ward rounds, and constant lighting. This disrupts the patient's circadian rhythm, leading to sleep deprivation. This lack of quality sleep in children is a key contributor to delirium. Adequate sleep in children improves attention, behavior, and overall psychological and physical well-being. A lack of sleep cycles in children admitted to the intensive care unit affects behavior and neurocognitive development. Inadequate total sleep time and sleep disruption have been shown to contribute to the development of delirium (Calandriello et al., 2018).

3. Materials and Methods

A prospective observational study design was employed. The target population comprised all children aged 1 month to 13 years admitted to the PICU during the study period who met the inclusion criteria. Patients with pre-existing cognitive impairments or severe neurological disorders that precluded reliable delirium assessment were excluded. Children are admitted to the intensive care unit. The study was conducted over 17 weeks at Kenyatta National Hospital and included 51 patients recruited at various times. The observations began with sedation

scoring using the Standard Richmond Agitation-Sedation Scale; patients who scored above -4 were then assessed using the Cornell Assessment of Pediatric Delirium Tool (CAPD). A score above 9 on the CAPD tool indicates delirium. Data from the questionnaire were collated in Microsoft Excel and exported to GraphPad Prism 10 for further analysis. Gaussian/Normal distribution of quantitative variables was tested by the D'agostino and Pearson's omnibus normality test and the Shapiro-Wilk normality test. Two-sided Fisher's Exact test was used to assess the significance of the associations between categorical demographic variables from 2x2 contingency tables. The confidence intervals for the risk ratios were determined using the Koopman asymptotic score. For all analyses, statistical significance was assessed at $p < 0.05$.

4. Results and Discussion

4.1 Point Prevalence of Pediatric ICU Delirium

Out of the 51 children included in the study, 36 were diagnosed with delirium based on CAPD assessments during their ICU stay, resulting in a point prevalence of 70.6%. The remaining 15 children (29.4%) did not meet the criteria for delirium throughout their admission.

4.2 Associated Risk Factors for Pediatric ICU Delirium

The relationship between selected patient characteristics and the occurrence of delirium was assessed using Fisher's exact test. Relative risk (RR) with 95% confidence intervals was also calculated to determine the strength of association. Mechanical ventilation was also significantly associated with delirium ($p = 0.019$). Among those who developed delirium, 21 (58.3%) were mechanically ventilated, compared with 14 (93.3%) without delirium. The relative risk of 0.64 (95% CI: 0.49–0.89) indicated that children on mechanical ventilation were at lower risk of delirium, highlighting a strong association between ventilation and delirium. Other factors, such as sex ($p = 0.347$), age ($p = 0.077$), length of ICU stay ($p = 0.751$), and use of physical restraints ($p > 0.999$), were not associated with delirium in this study.

Table 1: Association of Delirium with independent variables

Independent Variable			*Fisher's Exact*		
	Delirium	*No Delirium*	*p-value*	*Relative Risk (RR)*	*95% CI*
Sex					
Female	20 (55.6%)	11 (73.3%)	0.347	0.81	0.56 – 1.17
Male	16 (44.4%)	4 (26.7%)			
Age (months)					
0–60	24 (64.9%)	13 (92.9%)	0.077	0.69	0.52 – 0.99
>60	13 (35.1%)	1 (7.1%)			
Days in Unit					
0–7 days	24 (66.7%)	9 (60.0%)	0.751	1.10	0.76 – 1.72
>7 days	12 (33.3%)	6 (40.0%)			
Mechanical Ventilation					
Yes	21 (58.3%)	14 (93.3%)	0.019	0.64	0.49 – 0.89
No	15 (41.7%)	1 (6.7%)			
Physical Restraint					
Yes	4 (11.1%)	2 (13.3%)	>0.999	0.93	0.41 – 1.40
No	32 (88.9%)	13 (86.7%)			

4.3 Association of Delirium and Outcomes

Mortality was significantly associated with delirium (p = 0.013). Among patients who died, 10 (27.8%) had delirium compared to 10 (66.7%) without delirium. The relative risk of 0.59 (95% CI: 0.35–0.89) indicated that patients with delirium were less likely to die compared to those without delirium.

Table 2: Association of Delirium and Outcomes

Independent Variable		*Delirium*	*No Delirium*	*Fisher's Exact p-value*	*Relative Risk (RR)*	*95% CI*
Mortality	Dead	10(27.8%)	11(73.3%)	0.013	0.59	CI: 0.35 – 0.89
	Alive	26(72.2%)	4(26.7%)			

4.4 Association of Delirium with Prescribed Sedatives and Anticholinergics

The association between administration of selected medications and the occurrence of delirium was evaluated using Fisher's exact test. None of the medications assessed demonstrated a statistically significant association with delirium at the $p < 0.05$ threshold.

The proportion of children with delirium was generally high across nearly all medication categories, ranging from 68.4% among those who received phenytoin to 93.8% among those who received diazepam, fentanyl, glycopyrrolate, or atropine. However, all comparisons yielded p-values greater than 0.05, indicating that the observed differences were not statistically significant.

Notably, Dexmedetomidine had the lowest p-value (p = 0.083), suggesting a possible association, though it did not reach statistical significance.

Table 3: Association of Delirium with prescribed sedatives and anticholinergics

Medication	*Delirium*	*No Delirium*	*Fisher's Exact p-value*
Phenytoin	13 (68.4%)	6 (31.6%)	0.766
Phenobarbitone	14 (70.0%)	6 (30.0%)	0.344
Diazepam	15 (93.8%)	1 (6.3%)	0.514
Midazolam	13 (76.5%)	4 (23.5%)	0.822
Lorazepam	15 (88.2%)	2 (11.8%)	0.352
Levetiracetam	11 (73.3%)	4 (26.7%)	0.405
Morphine	14 (87.5%)	2 (12.5%)	0.878
Fentanyl	15 (93.8%)	1 (6.3%)	0.514
Dexmedetomidine	11 (78.6%)	3 (21.4%)	0.083
Ketamine	14 (77.8%)	4 (22.2%)	0.627
Glycopyrrolate	15 (93.8%)	1 (6.3%)	0.514
Atropine	15 (93.8%)	1 (6.3%)	0.514

4.5 Discussion of Findings

The primary goal of this study was to determine the point prevalence of pediatric ICU delirium. This study found that delirium was common in the study population, placing the burden at the upper end of what has been reported globally. Traube et al. (2017), in an extensive multicenter cohort study across 25 PICUs, reported a 44% prevalence among critically ill children, whereas Smith et al. (2016) observed rates of approximately 25-30% in their multicenter sample. Similarly, Alvarez et al. (2018) found a prevalence of approximately 49% in pediatric patients in cardiac intensive care. The relatively higher proportion in the present study may be explained by contextual factors, such as variations in sedation practices, limited staffing ratios, and the absence of standardized delirium screening protocols, which may delay recognition and the implementation of preventive strategies. In determining the risk factors associated with pediatric ICU delirium, the analysis demonstrated that mechanical ventilation was significantly associated with the development of delirium, consistent with previous multicenter studies that have identified intubation and ventilatory support as strong contributors to delirium in critically ill children (Smith et al., 2016; Traube et al., 2017). The physiological stress of invasive ventilation, combined with frequent sedation, disrupted sleep-wake cycles, and heightened environmental stimulation, may partly explain this relationship.

Mortality also showed a statistically significant association with delirium; however, unlike most studies in which delirium has been linked with an increased risk of death (Traube et al., 2017; Ely et al., 2004), the current findings suggested a lower likelihood of mortality among children with delirium compared to those without. This unexpected direction of association could be due to the small sample size or the influence of unmeasured confounders, such as illness severity. Other variables, such as gender, age, length of ICU stay, and use of physical restraints, were not significantly associated with the outcome in this cohort. This contradicts prior research, which found that younger age and physical restraints increase the likelihood of delirium (Silver et al., 2015; Patel & Kress, 2012).

5. Conclusion

This study found that pediatric ICU delirium is a common complication in critically ill children admitted to Kenyatta National Hospital, affecting more than two-thirds of patients. The findings highlight delirium as an urgent clinical concern in the local context, with prevalence rates similar to or higher than those reported internationally. Mechanical ventilation was identified as a significant risk factor for delirium, underscoring the importance of iatrogenic factors in shaping outcomes. Interestingly, mortality showed a statistically significant association, although in the opposite direction from that observed in most published studies, a finding that could be attributed to sample size limitations or unmeasured confounding factors. Other factors, such as gender, age, length of ICU stay, and physical restraint, were not significantly associated with delirium in this cohort. These results provide local evidence for the body of knowledge on pediatric delirium, underscoring the need for routine delirium screening, judicious sedation and ventilation practices, and the implementation of delirium prevention and management bundles in the Kenyan pediatric critical care setting. Future multicenter studies with larger sample sizes are warranted to validate these findings and explore effective interventions to reduce the burden of delirium in children.

6. Recommendations

Based on this study's findings, there is a need to strengthen clinical practice in the Pediatric Intensive Care Unit by implementing routine delirium screening. The incorporation of validated tools, such as the Cornell Assessment of Pediatric Delirium (CAPD), into daily patient assessments would enable early recognition and timely intervention. In addition, sedation protocols should be reviewed to minimize unnecessary use of benzodiazepines and other high-risk sedatives, while emphasizing daily sedation interruption, careful titration, and use of alternative strategies where appropriate. Particular attention should also be paid to mechanically ventilated children, who were found to be at higher risk of developing delirium. Evidence-based interventions such as early mobilization, structured ventilator weaning, and family engagement in the care process should therefore be prioritized to reduce this burden and improve patient outcomes.

In terms of education and policy, delirium should be included in pediatric critical care training for both nurses and physicians. Nursing and medical curricula should emphasize the assessment, prevention, and management of delirium, supplemented with simulation-based training to enhance competence. At the institutional level, policies should mandate the inclusion of delirium screening in routine PICU quality indicators, supported by clear guidelines for prevention and management.

Finally, this study highlights areas for future research. Larger multicenter studies across diverse Kenyan Pediatric Intensive Care Units (PICU) are needed to validate the current findings and provide a broader epidemiological picture. Further investigation into the long-term neurocognitive and psychosocial outcomes of children who develop delirium would be valuable in understanding its actual burden. Interventional research is also warranted to test the effectiveness of delirium prevention bundles, sedation minimization strategies, and family engagement in reducing incidence and improving outcomes. In addition, qualitative studies involving both families and healthcare providers could provide insights into contextual factors, barriers, and facilitators to effective delirium management in resource-limited environments.

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