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## Characteristics of Delirium in the Pediatric Intensive Care Unit Using the Dynamic Symptoms Model

*Características del delirium en la unidad de cuidado intensivo pediátrico utilizando el modelo de síntomas dinámicos*

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## ABSTRACT

**Background:** Delirium is considered a symptom of acute brain dysfunction occurring in the adult and pediatric population, which can be approached from the Dynamic Symptoms Model to have a complete view of its characteristics.

**Objective:** To describe the prevalence and characteristics of delirium in preschool-aged patients in the pediatric intensive care unit using the Dynamic Symptoms Model.

**Methodology:** Cohort study conducted in a pediatric intensive care unit in the city of Bogotá, Colombia. Patients between 6 months and 5 years were included. The sample size was 31 patients, and a literature review was conducted for understanding patient factors that are correlated with a higher rate of delirium. Delirium was diagnosed with the scale of evaluation of Preschool Confusion in Intensive Care (PsCAM-ICU) in Spanish version, which has a high specificity (94.8%), sensitivity (93.3%) and a reliability kappa statistic of 0.95.

**Results:** Delirium occurred in 25.8% of patients. The characteristics of these patients with delirium were: 62.5% had a primary diagnosis of acute respiratory infection and 37.5% had respiratory failure; 62.5% presented hypoactive and 37.5% hyperactive; bronchopulmonary dysplasia and bronchiolitis were the most common pathological antecedents, 50% received benzodiazepines, 33.3% narcotics, and 16.6% analgesics. Delirious patients had longer PICU (10 vs. 7 days), and hospital length of stay (7.5 vs. 2.2 days).

**Conclusion:** Presence of delirium in critically ill children is evidenced, whose characteristics are contained in the Dynamic Symptoms Model, therefore, from this perspective it is possible to identify it opportunely.

**Keywords:** Delirium, Preschool, Intensive Care Units, Pediatric, Behavioral Symptoms.

## RESUMEN

**Resumen:** El delirium es considerado un síntoma de disfunción cerebral aguda, presente en población adulta y pediátrica, la utilización de un modelo de enfermería permitió entender desde la investigación en enfermería las características del síntoma.

**Objetivo:** Describir la prevalencia de delirium en pacientes prescolares en unidad de cuidado intensivo pediátrico desde el modelo de los síntomas dinámicos.

**Metodología:** Estudio de cohorte realizado en una unidad de cuidados intensivos pediátricos de la ciudad de Bogotá, Colombia. Se incluyeron pacientes entre 6 meses y 5 años. El tamaño de la muestra fue de 31 pacientes, y se realizó una revisión de la literatura para comprender los factores del paciente que se correlacionan con una mayor tasa de delirio. El

delirio fue diagnosticado con la escala de evaluación de Confusión Preescolar en Cuidados Intensivos (PsCAM-UCI) en versión española, que tiene una especificidad (94,8%), sensibilidad (93,3%) y una fiabilidad estadística de kappa de 0,95.

**Resultados:** El delirium se presentó en un 25.8% de los pacientes, el diagnóstico primario de los pacientes positivos para delirium fue del 62.5% (5 pacientes) asociado a infección respiratoria aguda y un 37.5% (3 pacientes) asociado específicamente a falla respiratoria. El 62.5% presentó delirium hipoactivo y el 37.5% fue clasificado como delirium hiperactivo; la displasia broncopulmonar y la bronquiolitis fueron las patologías más comunes como antecedentes, el 50% de los pacientes recibieron benzodiazepinas, 33,3 % narcóticos y el 16,6% analgésicos. Los pacientes delirantes hospitalizados en la UCIP tenían una estancia prolongada (10 frente a 7 días) y estancia hospitalaria (7,5 frente a 2,2 días).

**Conclusión:** La presencia del Delirium en los niños críticamente enfermos es frecuente y, cuyas características están contenidas en el Modelo de Síntomas Dinámicos, por lo tanto, desde esta perspectiva es posible identificarlo oportunamente.

**Palabras clave:** Delirium. Preescolar, Unidad de cuidado intensivo. Síntomas dinámicos.

## INTRODUCTION

Delirium is considered a symptom of acute brain dysfunction(1), characterized by a disturbance of consciousness occurring with a fluctuating course of mental status, inattention, and impaired ability to receive, process, store, and recall information (2). Its etiology is the result of an interaction between multiple predisposing and precipitating factors related to the illness and treatment (3), and it can be divided into 3 subtypes: hyperactive, hypoactive and a combination of both types or mixed form (4,5); its main consequences are increased days of mechanical ventilation, stay and mortality in Intensive Care Unit (ICU) and hospital (6, 7, 8), and reduces cognitive (9) and physical recovery (10). Few studies show the real prevalence of delirium in critically ill children, which is likely to be around 10% (11) in Pediatric Intensive Care Unit (PICU). Such data may be underestimating the real prevalence, as few validated methods exist to diagnose delirium in children, and there is limited knowledge among healthcare professionals to recognize signs of delirium (12,13).

Further, from the perspective of delirium as a symptom it is possible to approach it from the Dynamic Symptom Model with its components of antecedents, experience, trajectories, conse-

quences and interventions (14), which are with the characteristics of delirium, mainly with the predisposing and precipitating factors of delirium, described in the DSM in the demographic, physiological, psychological, social and environmental backgrounds, and consequences of delirium categorized in the model on quality of life, function and survival. This model identified how the antecedents contribute to the development of delirium, and how nursing can recognize it and deliver interventions that mitigate it.

This study aimed to identify prevalence, characteristics and consequences of delirium in preschool patients in a pediatric intensive care unit from the dynamic symptoms model.

## METHODS

A Cohort study was conducted in a PICU. The study was conducted from February to May 2018. Patients who met the following inclusion criteria were included: Patients (boys and girls) aged between 6 months to 5 years and 11 months, with RASS scale score greater than or equal to -3, Spanish speaking patients, and whose parents signed consent to participate in this study. Patients with visual and auditory disorders, cognitive development deficits and who were in palliative care were excluded. The participants were included in this study in their admission to the ICU. The sample size was calculated based on the 10% cumulative incidence reported in the literature with a type I error rate fixed at 0.05 and adjustment for 10% loss, resulting in 31 patients, estimated and total amount admitted in this study. Delirium screening was carried out using the Preschool Confusion in Intensive Care PsCAM-ICU which is based on four characteristics. (Characteristic 1) Acute change or fluctuation in baseline mental status was determined using the degree of sedation with the Glasgow Coma Scale (RASS); (Characteristic 2) inattention was evaluated through a process of stages of visual and verbal stimuli, all patients were shown 10 cards consisting of alternate mirrors and elemental and colorful images, during which the researcher involved the patient saying: "Look, is this a car?" The evaluator slowly moved the cards in front of the child's face from left to right and vice versa to assess the patient's attention; (Feature 3) Alteration in level of consciousness, assessed using a Sedation (RASS). Feature 3 was "present" when the patient demonstrated an acute altered level of consciousness due to not being alert or agitated (Characteristic 4), Disorganized thinking, was determined by the presence of unregulated systems or behaviors among them: 1) inconsolability, 2) ignorance of the environment or parents / caregivers, and / or 3) an alteration of the sleep-wake cycle. The Ps-CAM-ICU demonstrated a specificity of 91% (95%



Figure 1. Register format

Ocurrencia del Delirium en la Unidad de Cuidado Intensivo Pediátrico.											
Formulario de Registro											
Código ID Paciente:		Dia: ____/____/2018		Iniciales Investigador: _____			Institución				
ubicación paciente:		<input type="checkbox"/> Medica <input type="checkbox"/> Quirurgico		<input type="checkbox"/> Ucip FSFB							
Edad: _____ (Meses)		Fecha de Nacimiento: _____		Peso: _____ Kg							
Diagnostico de admision: _____											
Antecedentes:					Complicaciones:						
<input type="checkbox"/> _____					<input type="checkbox"/> _____						
<input type="checkbox"/> _____					<input type="checkbox"/> _____						
<input type="checkbox"/> _____					<input type="checkbox"/> _____						
Laboratorios de Admisión						Uso preexistente de opioides		<input type="checkbox"/> Si <input type="checkbox"/> No			
Cardiovascular			Hematologia			Uso preexistente de sedación		<input type="checkbox"/> Si <input type="checkbox"/> No			
PAS		FC			Alto	Bajo	Dia Admisión: _____		Tiempo estadía UCIP		
PAD		FR					Dia Transferencia: _____				
Temp			Hgb				Alta Hospitalaria: _____		Tiempo estadía Hospitalización		
			WBC				Dia Intubación: _____		Tiempo Ventilacion mecanica		
Estado Acido base			PlaQ				Dia Extubacion: _____				
			Pt								
			Ptt								
PH											
Pco2											
Po2											
Quimica											
Sodio											
Potasio											
Calcio											
Glucosa											

Source: Authors.

Figure 2. Register Format

After applying the instrument and following the positive diagnosis for delirium, according to the child psychiatrist, appropriate measures were immediately taken alongside a non-participating team of the ICU as to modify the delirium triggering factors and treatment according to institutional protocol, mainly related to administration of haloperidol. Data analysis was carried out in the software Stata using descriptive statistics, observing frequencies and measures of central tendency, in order to evaluate prevalence of delirium in addition, correlational coefficient tests and independence tests such as (Chi Square) were performed to establish association of prevalence of delirium with characteristics of patients: Diagnosis of admission, ventilatory parameters

and medications ordered to the patient, in order to describe association in the presence of delirium and clinical conditions of patient at time of applying the instrument.

As for ethical considerations, this study met the criteria of the Ministry of Health, in accordance with resolution 8430/1993, (16) to be classified as a research without risk. The researchers in this study were certified to have completed and approved course of good clinical practices of NIDA Clinical Trials Network. In this study, the parents or legal representative were asked to give their consent in writing (17). Data confidentiality was maintained throughout the study.

## RESULTS

During the period between February and May 2018, 31 patients were enrolled in the study, consisting of 12 female participants (38.7%) and 19 male participants (61.3%), between the ages of 6 months and 5 years, with a mean age of 2.2 years and a standard deviation of 1.5 years. Primary admission diagnoses were associated with respiratory failure in 41.94% of cases, followed by infectious process in 6.45%.

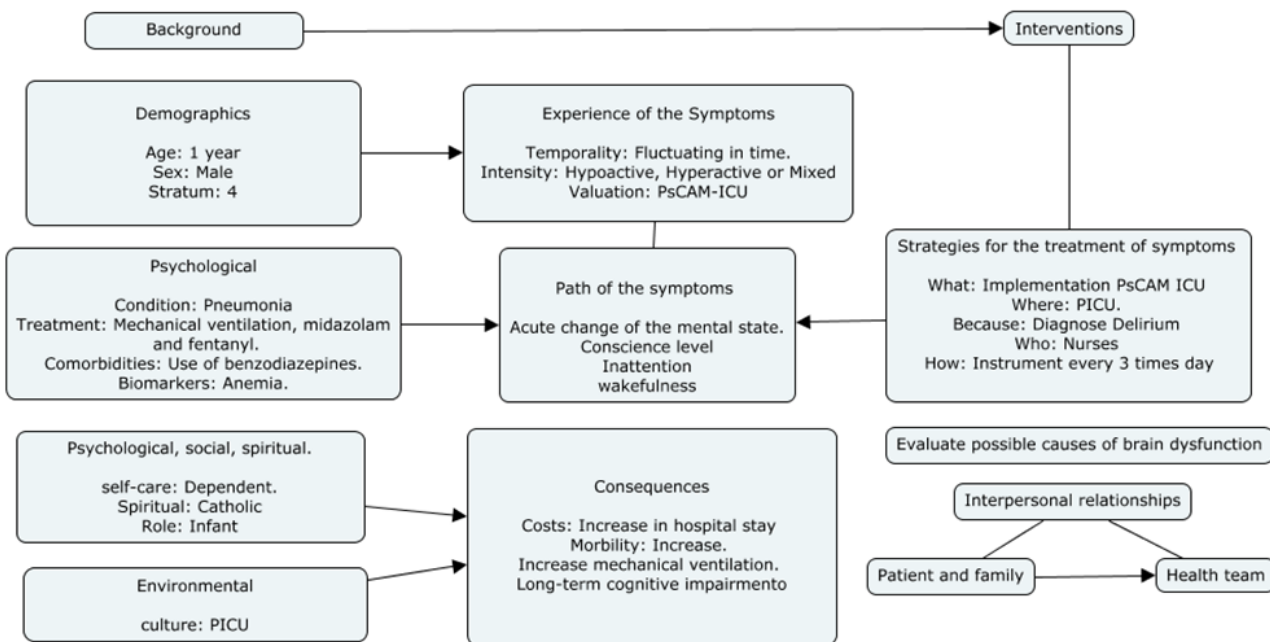
Delirium was observed in 25.8% of subjects (8 patients), of which 75% were male, and the primary diagnosis was acute respiratory infection in 62.5% and respiratory failure in 37.5%. Hypoactive delirium was observed in 62.5% of patients, characterized by sluggishness and lethargy; and hyperactive delirium in 37.5%, evidenced by lability, agitation, and refusal to cooperate with medical care.

In terms of patient history, in both delirious and non-delirious patients the most common medical conditions were bronchopulmonary dysplasia and bronchiolitis, each recorded in two patients in the sample. Based on the analysis of hospital length of stay, delirium patients showed a longer length of stay in the PICU with 10 days, compared to 7 days for patients without delirium. Furthermore, there was a longer pediatric hospital length of stay in delirious patients corresponding to 7.5 days, compared to 2.2 days for non-delirious patients. Of the delirium-positive patients, 50% had received pharmacological treatment involving benzodiazepines, 33.3% narcotics, and 16.6% analgesics. These factors were associated with the presence of delirium in critically ill pediatric patients.

Chi-square independence tests were run, which allowed establishing the level of association between the results provided by the instrument in each of its evaluators and the diagnosis provided by the psychiatrist. Therefore, according to the chi square, it can be said with 95% confidence that

the results of the instrument applied by each of the evaluators and the diagnosis of the specialist (Gold standard) regarding delirium are highly associated, with a p-average value of 0.001.

The results were analyzed based on the Dynamic Symptoms Model, which is applicable to acute conditions such as delirium. The model considers antecedents, experience, trajectory, consequences and interventions of the symptom. Demographic antecedents were present in the study patients: age, sex and socioeconomic status; physiological: diagnosis, treatment, comorbidities and biomarkers; psychological and social: self-care and role; and environmental: the PICU. These antecedents are predisposing and precipitating factors to the occurrence of delirium. The trajectory was hypoactive and hyperactive, and the consequences were longer length of stay in PICU and pediatric hospitalization. The description of the results according to model components is structured in Figure 2.



**Source:** Pinzon EY, Henao A. Validation of the PSCAM-ICU Instrument in its Spanish version. (Preschool Confusion Assessment Method for the Intensive Care Unit) (thesis). 2018.

**Figure 3.** Dynamic Symptoms Model and delirium Research source: presents the case of



## a patient who presented delirium, according to the aspects present in the model

This model facilitated identification of characteristics associated with delirium in pediatric critical patients, provide clinicians with who may be at higher risk for delirium, through association with these antecedents, and gives an overview of delirium approach when analyzing other components of experience, trajectory and consequences, so that appropriate interventions are determined.

## DISCUSSION

This study found that delirium is frequent in critically ill children, with incidence of 25.8%, similar to reported in other investigations between 15.9% and 44% (15,18–20). Being male and having less than 5 years of age, are common characteristics in critical pediatric patients, as reported in this study and according to what was found in the literature (15,18). However, two studies were found that reported delirium in children under two years of age predominantly (12,20).

Respiratory diseases are the main pathology suffered by children in critical condition with delirium, insomuch as in this study, acute respiratory infection was diagnosed to 62.5% of patients and respiratory failure in 37.5%; a similar situation was that reported by Traube et al. (20) the Netherlands, New Zealand, Australia, and Saudi Arabia. Patients: All children admitted to the pediatric critical care units on designated study days n = 994, who found a primary diagnosis involving respiratory disease in 42% of children with delirium.

Besides, hypoactive subtype is most common in critical pediatric patient, despite it is not easily detected. In this study, 62.5% of patients suffered hypoactive delirium, and 37.5% hyperactive delirium. In this sense, Smith et al. reported that the (15) study, where hypoactive delirium was the most prevalent motoric subtype in 64% and 81%, compared to hyperactive subtype into 7% and 19% of patients.

In this study, pharmacological treatment with benzodiazepines, narcotics, and analgesics, was common in children with delirium; the same as in investigations where significant association between administration of this medications and delirium (19) was established. In addition, the main consequence of delirium in this study was longer length of stay in the PICU and in the hospital. This finding its consistent with other studies where associated statistically significant of

delirium in critically ill children and length of stay were found, and therefore with increase in PICU costs (13,15,18,19).

Finally, analyzing delirium in critically ill children from the Dynamic Symptom Model, gives a complete view of delirium, with its antecedents, related to precipitating and predisposing factors, experience related to subtypes, fluctuating trajectory and consequences such as longer stay in PICU and in the hospital. This contribute to see delirium as a symptom of brain damage, which can affect cognitive development and therefore quality of life of pediatric critical patient.

## CONCLUSIONS

The presence of delirium in critically ill children, whose characteristics are similar to those reported in other research with children and adults is evident; this shows a real problem with serious consequences on the patients, their families and the health system, however, it is an avoidable problem.

One of the ways to prevent delirium is to opportunely monitor and identify it, as, Dynamic Symptoms Model provides a global perspective and serves as basis for designing specific interventions based on delirium analysis as a symptom of brain damage. From this perspective, nursing can make great contributions for applying this nursing theory, for delirium control in PICU.

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