Factors Associated with Triggers and Adverse Events in Pediatrics

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Factores asociados con desencadenantes y eventos adversos en pediatría

Fatores Associados aos Triggers e Eventos Adversos em Pediatria

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Highlights

- Este estudo avaliou triggers e eventos adversos em pacientes pediátricos.
- Mais de 50% dos pacientes apresentaram pelo menos um trigger.
- Os triggers mais comuns incluíam queda na hemoglobina e saturação de oxigênio.
- A gestão de riscos é crucial na segurança de pacientes pediátricos.

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Abstract

Introduction: The frequent occurrence of adverse events during hospital admission demands proactive means of risk management, including checking trackers/triggers. **Objective:** To verify the factors associated with triggers and adverse events in pediatric hospitalization. **Material and Methods:** Cross-sectional research based on the Institute for Healthcare Improvement (IHI) methodology, through the application of the Pediatric Trigger Tool (PTT) to a sample (n= 194) from medical records of pediatric patients from a hospital in the Center-West of Brazil. Descriptive, inferential statistical analysis and Poisson regression were performed. **Results:** More than half (n=107; 55.15%) of patients had at least one trigger upon admission. 204 triggers were identified, with the highest occurrence of a drop in hemoglobin/hematocrit (9.80%), a drop in oxygen saturation (9.80%) and an increase in kidney function markers (9.20%). Of the total triggers, 64 (31.37%) adverse events were confirmed, which were mostly classified as temporary damage requiring patient support (65.62%). The length of stay (p-value=0.004) and the nature of the hospitalization (p-value<0.001) were variables associated with the occurrence of triggers. Character of hospitalization and admissions from other institutions were predictors of the occurrence of triggers and adverse events. **Discussion:** The study found 31.37% of triggers resulting in harm to the patient, early detection is essential in pediatric patient safety, prolonged hospitalizations are linked to infections and adverse events, patient transfers require rigorous and effective safety measures. **Conclusions:** Prolonged hospitalizations and children admitted via transfer deserve attention to triggers and/or adverse events.

Keywords: Adverse Events; Risk Management; Tracking; Patient Safety; Pediatric Nursing.

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Factores asociados con desencadenantes y eventos adversos en pediatría

Resumen

Introducción: La frecuente aparición de eventos adversos durante el ingreso hospitalario exige medios proactivos de gestión de riesgos, incluida la verificación de rastreadores/disparadores. **Objetivo:** Verificar los factores asociados a desencadenantes y eventos adversos en la hospitalización pediátrica, **Material y Métodos:** Investigación transversal basada en la metodología Institute for Healthcare Improvement (IHI), mediante la aplicación del Pediatric Trigger Tool (PTT) a una muestra (n= 194) de historias clínicas de pacientes pediátricos de un hospital del Centro-Oeste de Brasil. Se realizaron análisis estadísticos descriptivos, inferenciales y regresión de Poisson. **Resultados:** Más de la mitad (n=107; 55,15%) de los pacientes presentaron al menos un desencadenante al ingreso. Se identificaron 204 desencadenantes, con mayor incidencia de descenso de la hemoglobina/hematocrito (9,80%), descenso de la saturación de oxígeno (9,80%) y aumento de los marcadores de función renal (9,20%). Del total de desencadenantes, se confirmaron 64 (31,37%) eventos adversos, los cuales en su mayoría fueron clasificados como daños temporales que requirieron apoyo del paciente (65,62%). La duración de la estancia (p-valor=0,004) y la naturaleza de la hospitalización (p-valor<0,001) fueron variables asociadas con la aparición de desencadenantes. El carácter de la hospitalización y los ingresos de otras instituciones fueron predictores de la aparición de desencadenantes y eventos adversos. **Discusión:** El estudio encontró que el 31,37% de los desencadenantes resultan en daño al paciente, la detección temprana es esencial en la seguridad del paciente pediátrico, las hospitalizaciones prolongadas están vinculadas a infecciones y eventos adversos, los traslados de pacientes requieren medidas de seguridad rigurosas y efectivas. **Conclusiones:** Las hospitalizaciones prolongadas y los niños ingresados vía traslado merecen atención a los desencadenantes y/o eventos adversos.

Palabras Clave: Eventos Adversos; Gestión de Riesgos; Seguimiento (Tamizaje); Seguridad del Paciente; Enfermería Pediátrica.

Fatores Associados aos Triggers e Eventos Adversos em Pediatria

Resumo

Introdução: A ocorrência frequente de eventos adversos durante a internação hospitalar demanda meios proativos de gerenciamento de riscos, incluindo a verificação de rastreadores/triggers. **Objetivo:** Verificar os fatores associados aos triggers e eventos adversos na internação pediátrica, **Material e Métodos:** Pesquisa transversal embasada na metodologia do Institute for Healthcare Improvement (IHI), por meio da aplicação do Paediatric Trigger Tool (PTT) a uma amostra (n=194) de prontuários de pacientes pediátricos de um hospital do Centro-Oeste do Brasil. Foi realizada análise estatística descritiva, inferencial e regressão de Poisson. **Resultados:** Mais da metade (n=107; 55,15%) dos pacientes apresentou pelo menos um trigger na internação. Foram identificados 204 triggers/gatilhos, com maior ocorrência de queda de hemoglobina/hematócrito (9,80%), queda de saturação de oxigênio (9,80%) e aumento de marcadores de funções renais (9,20%). Do total de gatilhos, 64 (31,37%) eventos adversos foram confirmados, os quais foram classificados majoritariamente como dano temporário com necessidade de suporte ao paciente (65,62%). O tempo de internação (p-valor=0,004) e o caráter da internação (p-valor<0,001) foram variáveis associadas à ocorrência de triggers. Caráter de internação e admissões provenientes de outras instituições foram preditores na ocorrência de triggers e eventos adversos. **Discussão:** O estudo encontrou 31,37% dos triggers resultando em danos ao paciente, a detecção precoce é essencial na segurança do paciente pediátrico, internações prolongadas estão ligadas a infecções e eventos adversos, transferências de pacientes exigem medidas de segurança rigorosas e eficazes. **Conclusões:** Internações prolongadas e crianças admitidas via transferência merecem atenção a triggers e/ou eventos adversos concretizados.

Palavras-Chave: Eventos Adversos; Gestão de Riscos; Rastreamento; Segurança do Paciente; Enfermagem Pediátrica.

Introduction

In pediatric hospitalization, offering safe and quality care to children and/or adolescents and families, considering the clinical, sociocultural, and organizational context, faces numerous challenges due to the greater vulnerability to the incidence of adverse events (AE). This arises from intrinsic factors – such as stages of growth and development – and anatomical and pathophysiological aspects peculiar to this clientele[1]. Furthermore, elements such as work organization and management can favor the occurrence of incidents and AEs in pediatrics, evidenced by the avoidability of a high proportion of these occurrences[2].

A Brazilian study carried out in Ceará found an occurrence of adverse events reported as never events and deaths in newborns aged > 28 days of 7.5% and children aged between 5-11 years of 5%[3]. Still in Brazil, over a period of six years (2008-2013) 3,330 adverse reactions were observed in children, with 28% of suspected reports of adverse drug reactions involving children under the age of one, and almost 30% of reports involving off-label medication[4]. In Mexico, in a pediatric hospital, 81% of adverse drug reactions were considered serious, 0.7% with sequelae and 1.10% resulting in death[5].

The incidence, severity and preventability of AEs are factors that justify better risk management, including in pediatric hospitalization[6]. To this end, AE and trigger investigation tools are instruments that qualify risk management and can contribute to patient safety, whether pediatric or not[7]. Trigger is defined as a signal word/tracker or clue that helps a particular reviewer find an AE or situation that could favor its occurrence. In turn, AE is an incident that results in harm to the patient[8].

There are various ways of investigating AEs in hospital institutions, which are supported by various detection techniques, including: review of the patient's medical records; analysis of severity, mortality and morbidity indices; verification of voluntary reporting systems; direct observation and evaluation of patient advocate systems[7-9]. A recent literature review 7 that analyzed 13 primary studies pointed out that the most frequent methods/instruments for retrospective chart review to assess the incidence and preventability of AEs in hospitals were the Harvard Medical Practice Study , the Canadian Adverse Event Study , O Quality in Australian Health Care Study and the Global Trigger Tool . The relevance of these tools is precisely due to the persistent low reporting of adverse events in healthcare organizations, motivated especially by fear,[9] therefore, they are means that can bring risk management closer to the healthcare reality, which is dynamic and complex.

Knowing which patients are more susceptible to triggers and AEs and sensitive to the use of screening tools, can contribute robustly to scientific and clinical-managerial advancement in the scenario of risk management and pediatric patient safety, as this is a clientele with particularities of care and greater susceptibility to the occurrence of incidents. Therefore, this study aimed to answer the following questions: what are the factors associated with triggers and adverse events during pediatric hospitalization? And what are the triggers associated with adverse events during pediatric hospitalization? Therefore, the objective was to verify the factors associated with the occurrence of triggers and adverse events in hospitalized children.

Materials and methods

Cross-sectional, analytical, and retrospective study. It was carried out in the pediatric inpatient unit of a medium-sized public university hospital in the Central-West region of Brazil. The unit studied is

referenced in the state for the treatment of chronic, rare, and infectious diseases and has 14 hospital beds for clinical-surgical patients linked exclusively to the Unified Health System.

The population consisted of the totality (N=608) of physical records from patients who were hospitalized in the sector in 2019. To achieve the objectives of the study, the minimum necessary sample size was calculated, using the following expression[10].

$$n = \{z2 * p * (1 – p) * N\}/\{ e2 * (N – 1) + z2 * p * (1 – p)\}$$

Where, Z is obtained from the standardized normal distribution table, considering a confidence coefficient of 95%, that is, Z = 1.96; a sampling error of 5.00% (e = 0.05); the proportion will be considered 50% (p =0.50) to estimate the largest possible n; and the population size N = 608. Therefore, the minimum sample size according to the applied equation was 236.

The sampling process used was simple random. There were 42 losses, with it being impossible to replace the sampling units due to the worsening of the current COVID-19 pandemic, which made it impossible to continue collecting on-site data.

Data collection took place from October 2020 to February 2021, following the IHI methodology. 8 20 medical records were chosen randomly and proportionally per month, with fortnightly cutoff points. According to institutional standards, each researcher should use 20 physical records at a time in the collection unit, and they would have to request them within 72 hours, meaning there would be no time for new collections. Therefore, the final sample consisted of 194 (82% of the sized) medical records.

The inclusion criteria were medical records of children with a hospital stay of at least 24 hours and an age greater than or equal to 28 days and less than or equal to 16 years, 11 months and 29 days; clinical diagnosis; with an outcome of: hospital discharge, transfer or death. The following exclusion criteria were adopted: medical records of children with a hospital stay of more than six months (due to data collection being unfeasible); incomplete medical records regarding demographic and clinical data; medical records not located; patients admitted to a day hospital and surgical patients (aiming for a homogeneous sample).

Triggers and adverse events were tracked through the application of the Pediatric Trigger Tool (PTT),[8] and a form to extract demographic and clinical variables from patients. The PTT tool contains five modules consisting of triggers/cues ranging from 1 to 15 trackers. The triggers are inserted in the following modules, namely: General care (11 trackers), Surgical Care (04 trackers), Intensive care (01 tracker), Medication (08 trackers) and Laboratory Test Result (15 trackers)

Considered as a variation of the Global Trigger Tool (GTT) more appropriate for pediatric clientele, the Pediatric Trigger Tool (PTT) is a structured chart review tool recommended by the Institute for Healthcare Improvement (IHI). which seeks to measure the occurrence of damage in hospital institutions using specific triggers for pediatric patients to identify AE triggers, as well as confirm the occurrence of these events[8]. The PTT provides pediatric teams with metrics regarding the incidence of damage related to care, allowing them to manage weaknesses and implement improvements in safety and quality of care, systematically monitoring proposed strategies[8].

Due to the well-defined profile of the pediatric clientele under study, which has non-critical clinical specificity, the module trackers were used: General Care, Medication and Laboratory Test Results. The

Intensive Care and Surgical Care modules were also not used due to the profile of the unit's patients (few surgical patients) and the hospital, which does not have a Pediatric Intensive Care Unit.

They were considered as dependent variable triggers identified by the PTT, confirming adverse events and severity of harm to the patient.

The following were delimited as independent variables: age, sex, main medical diagnosis (grouped by categories according to ICD-10 - International Classification of Diseases), length of stay, nature of hospitalization (elective, emergency, or transfer) and clinical outcome (medical discharge, transfer or death). To obtain these variables, a retrospective review of physical records was considered in a random manner as recommended by the IHI.

In accordance with the IHI methodology,[8] The data collection team consisted of two master's degree nurses and a pediatrician, who were previously trained, through the online course platform provided by IHI, with theoretical aspects of the methods and application instructions. Due to the complexity of analyzing adverse events, and to compare data collected by reviewers as well as the difficulty in differentiating AEs with events from the natural course of the disease and/or morbidities presented by the patient, a medical professional is needed, who works on reviewing tracker forms, as recommended by the tool[11]. Therefore, the pediatrician on the collection team, in agreement with the PTT, carried out the evaluation validations.

Before data collection, a pilot test was carried out in August 2020, with the entire research team with medical records that were not used in the database. In this test, inconsistencies were identified regarding the way the spreadsheet was filled out, which were adjusted, and doubts were resolved consensually and collectively. The data collection instrument used was an Excel ® spreadsheet prepared by the researcher with the relevant data from the PTT tool and the aforementioned variables.

According to the methodology used, when an AE is tracked and confirmed, there is a classification of types of damage related to assistance, through the use of the National Coordinating Council (NCC) for Medication Error Reporting and Prevention (MERP),[12] which classifies an error according to the severity of the result , divided into five categories: Category E: temporary harm to the patient and necessary intervention; Category F: temporary harm to the patient and initial or prolonged hospitalization ; Category G: permanent damage to the patient; Category H: intervention necessary to sustain life; Category I: patient death[12].

To verify associations between outcomes and independent variables, the crude prevalence ratio with their respective confidence intervals and the chi -square test were considered. Subsequently, the adjusted prevalence ratios were determined, using the multiple Poisson regression model with robust variance, where the variables that presented a p value ≤ 0.20 in the chi -square test were initially inserted into the model, and only those that had a p value < 0.05 and remained there after analysis. Because some variables did not present a normal distribution, it was decided to use non-parametric tests and the Poisson regression model with robust variance. All statistical analyzes were carried out using Rstudio® software version 2022.7.2.0 and Stata ® version 14, with all intervals having a confidence level of 95% and tests having a significance level of 5%, with the data stored in Zenodo[13].

All research ethics standards in force in Brazil, as set out in National Health Council Resolution No. 466/2012, were complied with. The project was approved by the Research Ethics Committee (CAEE: 07626019.5.0000.5541) of the institution where the study was carried out and approved under opinion 3,603,794/2019.

Results

The characteristics of the patients (n=194) regarding sex, age and reason for hospitalization are described in Table 1. In the association analysis of socio-clinical variables in relation to the occurrence or not of triggers, the following variables were significant: length of stay, character of hospitalization and outcome.

Table 1 presents the characteristics of the patients in terms of sex, age, and clinical condition. In the association analysis of socio-clinical variables in relation to the occurrence or not of triggers, the variables length of hospitalization, character of hospitalization, type of discharge and severity were significant.

Table 1 – Socioclinical characteristics of hospitalized pediatric patients, regarding the occurrence or not of triggers. Midwest Brazil, 2019 (n=194)

Variables	Yes		No		
	%	(n=107)	%	(n=87)	p-value
Sex					0,4076
Feminine	49.53	(53)	42.53	(37)	
Masculine	50.47	(54)	57.47	(50)	
Age					0,5636
Greater than and equal to 6 years	47.66	(51)	42.99	(51)	
Less than 6 years old	52.34	(56)	38.32	(56)	
Length of stay					0,004
Greater than and equal to 6 days	60.75	(65)	39.08	(34)	
Less than 6 days	39.25	(42)	60.92	(53)	
CID Hospitalization					0,9203
Urinary	24.30	(26)	24.14	(21)	
Respiratory	7.48	(8)	3.45	(3)	
Autoimmune and/or genetic	12.15	(13)	9.20	(8)	
Gastrointestinal	11.21	(12)	11.49	(10)	
Neurological	5.61	(6)	11.49	(10)	
Cardiovascular	22.43	(24)	24.14	(1)	
Endocrine	7.48	(8)	9.20	(8)	
Metabolic	4.67	(5)	3.45	(3)	
Sexual Violence	1.87	(two)	1.15	(1)	
Integumentary	0.93	(1)	1.15	(1)	
Infectious	1.87	(two)	1.15	(21)	
Character of hospitalization					< 0,001
Elective	4.67	(5)	20.69	(18)	
Transferred	23.36	(25)	10.34	(9)	
Urgency/Emergency	71.96	(77)	68.97	(60)	
Outcome					0,010
Improved High	85.05	(91)	97.70	(85)	
Transfer	14.02	(15)	2.30	(two)	
Death	0.93	(1)	0.00	-	

Source: data from the author's master's thesis; Chi -square statistical test for p-value calculation.

Of the total number of patients (n=194), 55.15% and 22.16% presented, respectively, at least one trigger and/or adverse event during their hospitalization. Table 2 illustrates the quantitative measurements of patients who did or did not present triggers and adverse events.

Table 2 – Minimum, maximum, median, interquartile range for quantitative variables: age, length of stay and the occurrence or not of Triggers, adverse events, and degree of severity of adverse events among hospitalized pediatric patients. Midwest Brazil, 2019 (n=194)

Variables	Patients with Triggers							
	Yes (n=107)				No (n=87)			
	Min	Max	Median	Q3 - Q1 (IQR)	Min	Max	Median	Q3 - Q1 (IQR)
Age in years	1	16	5.00	10.00 - 2.00 (8)	1	16	5.00	11.00 - 2.00 (9)
Total length of stay	1	74	7.00	11.50 - 4.00 (7.5)	1	126	5.00	8.50 - 3.00 (5.5)

Variables	Patients with Adverse Events							
	Yes (n=43)				No (n=151)			
	Min	Max	Median	Q3 - Q1 (IQR)	Min	Max	Median	Q3 - Q1 (IQR)
Age in years	1	16	4	10.00 - 2.50 (8.5)	1	16	6.00	11.00 - 2.00 (9)
Total length of stay	1	74	10.00	14.50 - 4.50 (10)	1	126	5.00	9.00 - 3.00 (6)
Degree of Severity	0	6	2.00	3.50 - 2.00 (1.5)	0	3	0.00	1.00 - 0.00 (1)

** IQR - Interquartile range: Q3, 3rd quartile (upper, 75%) and Q1, 1st quartile (lower, 25%).*

In the total sample of patients (n=194), 204 triggers for adverse events were identified, that is, several patients presented more than one trigger. Of these, 64 (31.37%) adverse events were confirmed.

Table 3 presents the frequency of trigger types by PTT modules. It was verified that the triggers with the greatest occurrence were a drop in hemoglobin, a drop in saturation and an increase.

Table 3 – Frequency of triggers in pediatric hospitalization, by modules of the Pediatric Trigger Tool (PTT), Central-West, Brazil, 2019.o of renal markers

Triggers Identified by PTT modules	% (n)	% (n)
General Care	100 (66/66)	32.35 (66/204)
Tissue damage	18.18 (12)	5.88 (12)
Hospital readmission < 30 days	3.03 (2)	0.98 (2)
Unplanned admission	1.52 (1)	0.49 (1)
Abnormal cranial image	3.03 (2)	0.98 (2)
Cardiac and/or respiratory arrest	1.52 (1)	0.49 (1)
Diag. pulmonary embolism/thrombosis	1.52 (1)	0.49 (1)
Complications	19.70 (13)	6.37 (13)
Transfer	21.21 (14)	6.86 (14)
SPO2 < 85%	30.30 (20)	9.80 (20)

Triggers Identified by PTT modules	% (n)	% (n)
Medicines	100 (38)	18.63 (38/204)
Vit K except routine in RN	28.95 (11)	5.39 (11)
Glucagon / Glucose 10%	2.63 (1)	0.49 (1)
Antihistamines	10.53 (4)	1.96 (4)
Antiemetics	7.89 (3)	1.47 (3)
Bolus colloid or crystalloid _	23.68 (9)	4.41 (9)
Abrupt suspension of medication	26.32 (10)	4.90 (10)
Laboratory Test Result	100 (100)	49.02(100/204)
INR >5 or APTT >99	2.00 (2)	0.98 (2)
Transfusion	14.00 (14)	6.86 (14)
Drop >25% in Hb or Hct	20.00 (20)	9.80 (20)
Urea and Creatinine >2x basal	19.00 (19)	9.31 (19)
Na+ <130 or >150	4.00 (4)	1.96 (4)
Hypoglycemia (<3mmol/L or <54mg/ dL)	9.00 (9)	4.41 (9)
Hyperglycemia (>12mmol/L or 216 mg/ dL)	13.00 (13)	6.37 (13)
Nosocomial pneumonia	3.00 (3)	1.47 (3)
Platelets < 100,000	6.00 (6)	2.94 (6)
Positive blood culture	2.00 (2)	0.98 (2)
Event not identified by trigger	8.00 (8)	3.92 (8)

Regarding the severity of confirmed adverse events (n=64), the most significant were those in category E (65.62 %), that is, they led to temporary harm to the patient with necessary intervention (Table 4).

Tabela 4 – Grau de severidade dos Eventos Adversos (EA) confirmados entre pacientes pediátricos hospitalizados. Centro-oeste, Brasil, 2019. (n=64)ais

AE Severity Degree	%	n(64)
E = Temporary harm to the patient and necessary intervention	65.62	42
F = Temporary harm to the patient and initial or prolonged hospitalization requirement	31.25	20
G = Permanent harm to the patient	-	-
H = Intervention required to sustain life	3.12	two
I = Death	-	-

Analysis was carried out with the variables sex, age, which were used as adjustment, length of stay and nature of hospitalization. Thus, Table 5 shows length of stay and character of hospitalization for the occurrence of triggers and as predictors of adverse events.

Table 5 – Gross Prevalence Ratio (GPR) and Adjusted Prevalence Ratio (APR), for the occurrence of triggers and events socio-clinical variables of hospitalized pediatric patients, Midwest Brazil, 2019

Variables	Yes	No	p-value*	G.PR		A.PR	
	% (n=107)	% (n=87)		R.P [IC(95%)]	p-value*	R.P [IC(95%)]	p-value*
Sex			0.4076				
Masculine	50.47 (54)	57.47 (50)		1			
Feminine	49.53 (53)	49.53 (37)		0.85 [0.62; 1.17]	0.336		
Age			0.5636				
Less than 6 years old	52.34 (56)	38.32 (41)		1			
Greater than and equal to 6 years	47.66 (51)	42.99 (46)		1.12 [0.82; 1.53]	0.472		
Length of stay			0.004				
Greater than or equal to 6 days	60.75 (65)	39.08 (34)		1		1.00	
Less than or equal to 6 days	39.25 (42)	60.92 (53)		1.62 [1.17; 2.25]	0.004	1.44[1.04; 2.02]	0.030
Nature of hospitalization			< 0.001				
Elective	4.67 (5)	20.69 (18)		1		1,00	
Transferred	23.36 (25)	10.34 (9)		0.54 [0.30; 0.97]	0.040	0.39 [0.21;0.72]	0.003
Urgency/Emergency	71.96 (77)	68.97 (60)		0,92 [0.66; 1.29]	0.645	0.61 [0.46; 0.80]	< 0.001
Adverse Event	% (n=43)	% (n=151)					
Sex			0.3961				
Masculine	60.46 (26)	51.65 (78)		1			
Feminine	39.53 (17)	48.34 (73)		1.81[0,93;1,25]	0.305		
Age			0.2967				
Less than 6 years old	41.86 (18)	52.32 (79)		1			
Greater than and equal to 6 years	58.14 (25)	47.68 (72)		0.91[0.78;1.06]	0.229		
Length of stay			0.1151				
Greater than 6 days	62.79 (27)	47.68 (72)		1			
Less than 6 days	37.21 (16)	52.32 (79)		1.14[0.98;1.33]	0.082		
Nature of hospitalization			0.0525				
Elective	4.65 (2)	13.91 (21)		1		1	
Transferred	27.91 (12)	14.57 (22)		1.20[1.031;1.39]	0.018	0.70[0.53;0.94]	0.016
Urgency/Emergency	67.44 (29)	71.52 (108)		0.80[0.62;1.04]	0.098	0.86[0.74;1.006]	0.061

**p-value of the chi -square statistical test; crude prevalence and adjusted prevalence ratio. **p-value for ratio*

In the multiple Poisson regression analysis, the variables that showed significance with a p-value < 0.05 were: length of stay and character of hospitalization, with length of stay less than 6 days being 1.44 times the prevalence of length of stay of less than 6 days for a trigger to occur. The character of hospitalization by transfer was 0.39 times the prevalence in relation to the character of elective hospitalization, and the urgency and emergency nature was 0.61 times the prevalence of the character of elective hospitalization for the occurrence of a trigger.

As for the occurrence of an adverse event, the nature of hospitalization by transfer was 0.70 times the prevalence of the nature of elective hospitalization.

Discussion

It was found that, of the total of 204 triggers identified, 64 (31.37%) were incidents that caused some harm to the patient. This finding corroborates an Indian retrospective study evaluating triggers in pediatric patient records, using the methodology adapted from the GTT, which detected 35% of confirmed adverse events[14]. Linking the findings of the present study to related literature, we agree with the assumption that early detection of patient safety incidents is one of the pillars of safe health care, even because adverse events involve management, therapeutic and medication processes[2].

Regarding the damage caused by AEs, most were classified in the least serious category. This result is equal to the study carried out in the United States, where the Global Assessment of Pediatric Patient Safety (GAPPS), which showed 52.7% of incidents fell in this same category6. Another Indian study using the adapted GTT detected severity levels distributed in categories E (58.80%), F (23.62%), G (12.08%), H (4.95%) and I (0 .55%)[10]. Considering the basic literature and that this classification considers an increasing level of severity of the adverse event, in the sample studied, events of greater severity were infrequent, however, 3.12% of the events required necessary intervention to sustain life, which is enough to justify policies, tracking programs and safety strategies for pediatric patients.

The previous reference is reinforced by research carried out in a pediatric hospital in Ottawa, which demonstrated that 87.9% of the total of 29 children admitted suffered an AE considered preventable with prolongation of related symptoms, with management problems and therapeutic errors as the main causes[2]. In this sense, an integrative review study in care quality and patient safety indicates the wide use of tools that improve the safety culture and risk management in institutions, given that there are still weaknesses in safe care in healthcare units[15].

Medical record review studies have proven to be effective in detecting adverse events and are currently considered the "gold standard" for identifying incidents of harm, with the Pediatric Trigger Tool methodology being used to investigate adverse events using trackers in the search for incidents with damage[7]. In the analysis of the medical records of this survey, a drop in hemoglobin, a drop in saturation and an increase in kidney function markers were the prevalent triggers , an aspect that is in line with the results of a study carried out in an Argentine children's hospital using the GTT tool, which showed triggers related to care: (58.3%); the use of medications: (26.78%); and microbiology: (14.88%), the most common AEs being a drop in saturation, procedural complications, use of antiemetics and positive blood culture[16].

A recent literature review reported that the drop in hemoglobin can occur up to the 3rd day of hospitalization and that this is a multifactorial event, with possible causes: the constant withdrawal of blood for tests, dilution of patients' blood when administering medications and a reduced erythrocyte production, characterizing itself as an adverse event[17].

Elevated renal biomarkers signal the possibility of kidney injury and impaired kidney function. There are a multitude of drugs considered nephrotoxic that should be used with caution by those with chronic kidney disease. In this aspect, the increase in serum creatinine and urea levels can be characterized as an adverse drug event if the therapy used is inadequate[18].

Among the highest frequency of triggers during hospitalization were patients with a diagnosis related to the urinary system, who are often affected by previous complex chronic circumstances and renal organic fragility, which makes them more susceptible to damage[18].

In addition to the complexity imposed by the process of children's growth and development itself, a study carried out in a Mexican hospital in highly complex locations showed a greater occurrence of incidents related to factors such as: excessive work, including bureaucratic work, lack of adherence to protocols, lack of experience and skills of professionals, which foster an environment conducive to its occurrence[19].

Among the diagnostic groups listed, cardiovascular diseases (22.43%) stood out in this study, as they are harmful diseases that still occupy a prominent place in morbidities among public health problems in Brazil, Chronic Diseases Non-Communicable Diseases (NCDs) are responsible for a high proportion of deaths, notably among individuals with lower income and education. The prevalence of these diseases is linked to the growing consumption of ultra-processed foods, a sedentary lifestyle and childhood obesity. These conditions, in turn, increase the risk of dyslipidemia, hypertension, diabetes and cardiovascular disease. Effectively tackling NCDs requires multidisciplinary and preventive approaches[20].

This study showed a hospitalization period of more than six days, which is worrying, as the longer hospitalization time was associated with a greater chance of incidents such as bloodstream and urinary tract infections, which could result in damage to the patient[6].

This reference reinforces that discharge planning and coordination between the hospital and the health network are relevant to achieving higher levels of safety in the care of pediatric patients[1].

Still on the extra time of hospitalization (> 20 days), a retrospective Nigerian study carried out in three teaching hospitals reinforced the need for greater bed rotation to optimize the production of health services, since the longer, the hospital stay is the risk for infections, adverse events and morbidity and mortality increases[21].

In Brazil, a retrospective study carried out in two public general teaching hospitals revealed that 99% of AEs could have been avoided. These AEs resulted in a 65.7% increase in patients' length of stay and were responsible for 11.8% of readmissions[22]. This allusion reinforces the importance of investing in proactive risk management strategies, such as tracking triggers, since, according to the data from the present study, a considerable portion of triggers were confirmed as AEs.

It is possible that patients from other institutions have a greater chance of triggers occurring when compared to elective patients, given the burden of incidents that have already occurred in other services in the face of other care behaviors and the prolonged itinerary in health services and given the failures in administrative activities. The literature highlights the existence of a greater risk of adverse events during patient transfer[23], being more aggravating in those who have some type of instability.

Due to the harmful potential of admissions of patients from other institutions, the need to implement means/instruments that can guarantee safety in the transition process of pediatric patient care is reinforced[24], mediated by effective actions associated with the adoption of barriers of security to the assistance system that can prevent risk situations and adverse events[23]. This is why structured documents have been increasingly used when transferring patients, aiming to influence the organizational safety culture[25]. In the pediatric context, this is very relevant because it can increase the risk of events such as: hemodynamic or ventilatory decompensation, due to the management that involves transport, depending on the degree of organic dysfunction presented by the patient.

The clinical severity of urgent and/or emergency admissions requires specialized care from the team, highlighting the chronic condition profile of patients at the research hospital as an aggravating factor for the greater occurrence of AEs. A Canadian study carried out in 6 large pediatric hospitals showed a higher occurrence of AEs in urgency and emergency units, highlighting the importance of knowing and developing strategies aimed at reducing the incidence of AEs through practices focused on patient safety and minimization of harm, promoting a culture of patient safety[2].

The greater probability of adverse events occurring in patients from other institutions possibly arises from the complexity of the transfer process, being subject to numerous failures, as it is related to continuity of care. The implementation of effective actions and protocols associated with safety barriers can prevent risky situations and possible incidents of harm, resulting in a reduction in incidents and deaths related to adverse events affecting care transfers[26].

Hospitalization of less than or equal to 6 days was evidenced as a predictive factor (1.44 times) for the occurrence of Triggers to the detriment of hospitalization of more than or equal to 6 days, reducing the length of stay can reduce the occurrence of adverse events, and is indicated as long as there are no risks to the patient in order to avoid early discharge and readmission[27], as prolonged hospitalization brings numerous risks such as nosocomial infections, bacterial resistance, and mortality[28].

The use of trigger screening tools helps health professionals and managers identify weaknesses and outline strategies to improve quality in care processes[7], and qualified the care and management process. The PTT tool is an important care quality management instrument, described in international literature as a reliable tool for identifying triggers and adverse events in the pediatric context[8].

Contributions to the Field of Nursing

The use of the PTT tool is of great value for nursing and health, as it rationalizes risk management and, therefore, can promote safer pediatric care. By systematically knowing the risks of triggers and adverse events inherent to the clientele, nurses can implement care management in a more assertive way.

Study Limitations

Although it is not a psychometric scale but a tool with very consolidated clinical elements, that is, it does not necessarily involve judgment/opinion, a translated and adapted version of the Pediatric Trigger Tool was not found for the Portuguese language and in use in Brazil, and this, although it is a limitation of the study, is also a sign for future investigations.

The possible underestimation of the triggers verified, due to the poor quality of some records, is a limitation of this study, a possible bias that may exist, this is a systematic bias, there are systematic biases based on the medical diagnosis, for example, age or other feature in detecting an adverse event by a human reviewer during data collection using the tool. Multivariable regression analysis would also be relevant to confirm the prediction of the nature of hospitalization. However, the density of data, innovation of the study and potential for instrumentation regarding risk management in pediatrics possibly overcome these limitations.

However, although another limitation of this study is not having investigated other aspects related to care and work in the pediatric investigation unit, it is considered that the information arising from this type of analysis can be increased by others, such as, for example, resources available, the workload of professionals, the complexity of patients and the professional practice environment.

Conclusion

It is concluded that the length of stay < 6 days and the nature of the hospitalization via urgency/emergency were associated with the occurrence of triggers in pediatric hospitalization. Transfer was also a predictor of the confirmed occurrence of adverse events. Therefore, prolonged hospitalizations and children admitted via transfer, in addition to those who enter the hospital non-electively, that is, via urgency/emergency, deserve attention to the occurrence of triggers and /or adverse events.

The prevalent triggers were a drop in hemoglobin or hematocrit, a drop in oxygen saturation and an increase in kidney function markers. Around a third of the total triggers identified were confirmed as adverse events, which is important evidence in the proactive management of healthcare risks in pediatrics. Regarding the degree of severity of confirmed adverse events, those involving temporary damage to the child/adolescent, requiring intervention, were those with the highest concentration.

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