

Implementation of the Paediatric Trigger Tool in a Pediatric Inpatient Unit

Implementação da *Paediatric Trigger Tool* em Unidade de Internação Pediátrica

Implementación de la *Paediatric Trigger Tool* en una Unidad de Hospitalización Pediátrica

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Resumo

Objetivo: Descrever a implementação da *Paediatric Trigger Tool* (PTT) para rastreamento de eventos adversos em unidade de internação pediátrica.

Método: Estudo descritivo de implementação, realizado em hospital universitário da região Centro-Oeste do Brasil. A implementação foi desenvolvida em cinco etapas, entre outubro de 2020 e fevereiro de 2021. Foram revisados 194 prontuários pediátricos de crianças e adolescentes hospitalizados por período ≥ 24 horas. Os eventos adversos identificados foram classificados de acordo com a escala do *National Coordinating Council for Medication Error Reporting and Prevention* (NCC/MERP).

Resultados: A aplicação da ferramenta possibilitou a identificação de 204 *triggers* e 64 eventos adversos, demonstrando factibilidade para a busca ativa de incidentes de segurança. O tempo médio de revisão foi de 20 minutos por prontuário e demandou uma equipe de três profissionais.

Conclusão: A ferramenta mostrou-se promissora para o monitoramento da segurança do paciente pediátrico e apoio às ações de gerenciamento de riscos.

Abstract

Objective: To describe the implementation of the *Paediatric Trigger Tool* (PTT) for tracking adverse events in a pediatric inpatient unit.

Method: This is a descriptive implementation study conducted in a university hospital in the Central-West region of Brazil. The implementation was carried out in five stages between October 2020 and February 2021. A total of 194 pediatric medical records of hospitalized children and adolescents with a length of stay ≥ 24 hours were reviewed. The adverse events identified were classified according to the *National Coordinating Council for Medication Error Reporting and Prevention* (NCC/MERP) scale.

Results: The application of the tool enabled the identification of 204 triggers and 64 adverse events, demonstrating its feasibility for the active search of safety incidents. The mean review time was 20 minutes per medical record and required a team of three professionals.

Conclusion: The tool proved to be promising for monitoring pediatric patient safety and supporting risk management actions.

Resumen

Objetivo: Describir la implementación de la *Paediatric Trigger Tool* (PTT) para el rastreo de eventos adversos en una unidad de hospitalización pediátrica.

Método: Estudio descriptivo de implementación, realizado en un hospital universitario de la región Centro-Oeste de Brasil. La implementación se desarrolló en cinco etapas, entre octubre de 2020 y febrero de 2021. Se revisaron 194 historias clínicas pediátricas de niños, niñas y adolescentes hospitalizados por un período ≥ 24 horas. Los eventos adversos identificados fueron clasificados de acuerdo con la escala del *National Coordinating Council for Medication Error Reporting and Prevention* (NCC/MERP).

Resultados: La aplicación de la herramienta permitió identificar 204 triggers y 64 eventos adversos, demostrando su factibilidad para la búsqueda activa de incidentes de seguridad. El tiempo promedio de revisión fue de 20 minutos por historia clínica y requirió un equipo de tres profesionales.

Conclusión: La herramienta se mostró prometedora para el monitoreo de la seguridad del paciente pediátrico y el apoyo a las acciones de gestión de riesgos.

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Descritores

Segurança do Paciente; Enfermagem Pediátrica; Eventos Adversos; Gestão de Riscos; Ferramentas de Rastreamento.

Descriptores

Seguridad del Paciente; Enfermería Pediátrica; Eventos Adversos; Gestión de Riesgos; Calidad de la Atención de Salud.

Data availability:

The study data are available in this article.

Introduction

A patient safety incident involving harm is termed an adverse event (AE). It comprises any event or circumstance resulting in verifiable, unnecessary, and, in most cases, avoidable harm to a patient receiving healthcare.⁽¹⁾

In the context of hospitalization, an AE constitutes an undesirable outcome, as it can lead to physical and/or psychosocial impairments, thereby impacting patients, families, healthcare professionals, and healthcare organizations.⁽²⁾

In pediatrics, the occurrence of AEs is particularly significant due to the inherent vulnerability of this population.⁽³⁾ The physical and emotional characteristics of children and adolescents make them more susceptible to healthcare-related harm compared to the adult population.⁽⁴⁾

International and national evidence underscores the magnitude of this issue. In Spain,⁽⁵⁾ a study conducted in a pediatric emergency unit found that 12.3% of 204 children experienced a healthcare-related safety incident; 82.1% of these events resulted in harm, and over 78% were deemed avoidable. In Brazil, although most pediatric patient safety-related events at a university hospital were classified as low severity (mild or moderate), more than 90% were considered avoidable.⁽⁶⁾

Despite the high frequency and preventability of AEs, their identification remains limited by weaknesses in reporting systems. Underreporting remains a significant challenge, linked to barriers such as a punitive culture, lack of awareness, absence of institutional feedback, and heavy workloads.⁽⁷⁾

A study conducted at a public hospital in the Central-West region revealed that only 24% of incidents were reported, particularly those involving surgical procedures and medication, underscoring the limitations of passive reporting systems.⁽⁷⁾

Supporting this picture, a Brazilian study on pediatric patient safety during blood component administration identified 18 incidents or AEs across 274 transfusions, with no formal reports filed during the period analyzed.⁽⁸⁾

Reporting systems are characterized as passive methods for identifying incidents and have limitations because they rely on spontaneous reporting by

professionals and capture only a fraction of the events that actually occur.⁽⁹⁾ This context highlights the need for active, systematic approaches to managing clinical risks.

Given these limitations, AE tracking tools such as the Paediatric Trigger Tool (PTT),⁽¹⁰⁾ emerge as strategies for active detection. Unlike passive methods, the PTT enables a retrospective search for potential healthcare-related harm through the structured review of medical records and the identification of triggers (cues), thereby enhancing safety monitoring and supporting improvement decisions within the pediatric context.

Tracking instruments like the PTT and the Global Trigger Tool,⁽¹¹⁾ underscore the importance of active methodologies for identifying AEs, particularly when passive systems prove insufficient.^(12,13) Conversely, active incident tracking analyses potentially require greater institutional investment than passive methods, justifying the need to establish an evidence base regarding the feasibility and coherence of implementing these active approaches.

Adopting the PTT falls within the scope of quality improvement interventions, as it structures risk surveillance and data generation for safe care management. In the pediatric hospital setting, this strategy can facilitate AE monitoring and the setting of priorities for risk management.⁽¹⁴⁾

In the unit under study, the absence of a structured method for the active detection of pediatric AEs, combined with a reliance on passive identification strategies, represented a significant gap in clinical risk management. Against this backdrop, the PTT was introduced as an improvement intervention aimed at enhancing patient safety monitoring, organizing the medical record review process, and generating data to guide future institutional actions for harm mitigation.

Thus, this study aimed to describe the implementation of the PTT for tracking AEs in a pediatric inpatient unit.

Methods

This is a descriptive study focused on improving the quality of care characterized as a Quality Improvement Project (QIP).⁽¹⁵⁾ It described the implementation

of the PTT as a strategy for screening for triggers and AEs in a pediatric inpatient unit. The rationale behind the classification as a QIP is that it introduces a structural change in the patient safety monitoring process.

Quality Improvement Projects are interventions planned to address healthcare-related issues, focusing on the implementation and monitoring of organizational changes within healthcare services. In this context, such initiatives contribute to enhancing clinical practice and patient safety management.⁽¹⁵⁾ Importantly, testing improvement proposals is a prerequisite for successful, lasting implementation.⁽¹⁶⁾ The scope of this study is precisely this testing phase.

In this study, the pilot implementation of the PTT was viewed as a quality improvement intervention, since it introduced a structural change to the unit's patient safety monitoring process. The logic behind testing the intervention was based on the premise that enhancing the capacity to detect healthcare-related harm yields consistent data for situational assessment, risk prioritization, and the planning of improvement actions.

The study was conducted within the framework of a Professional Master's Program in Sciences Applied to Hospital Care, linked to a university hospital at a federal university in Brazil's Central-West region. The research took place in the pediatric inpatient unit between October 2020 and February 2021.

The hospital has 105 beds, 14 of which are designated for pediatric medical inpatients. The unit's care team consists of seven nurses, 17 nursing technicians, and three nursing assistants. The teaching hospital setting is a key component of the intervention, given its dual role in patient care and education, and the nature of the clinical pediatric care environment, characterized by the absence of a pediatric intensive care unit, and the low volume of surgical cases.

Testing implementation corresponds to the use of the PTT as a systematic tracking strategy of AEs through structured medical record reviews. The PTT is recommended by the Institute for Healthcare Improvement (IHI) for the retrospective detection of AEs by identifying triggers associated with healthcare-related harm.⁽¹⁰⁾ Beyond identifying AEs, analyzing these triggers contributes to clinical risk management.⁽¹⁰⁾

The tool comprises five modules: General Care (11 screeners), Surgical Care (4), Intensive Care (1),

Medication (8), and Laboratory Test Results (15).⁽¹⁰⁾ In this study, the General Care, Medication, and Laboratory Test Results modules were applied. The Intensive Care and Surgical Care modules were excluded due to the unit's profile, as it lacks a Pediatric Intensive Care Unit and has a low volume of surgical patients. The selection of these modules was an adaptation of the implementation test to the local context, aiming for greater alignment with the unit's care profile and the clinical relevance of the triggers.⁽¹⁰⁾

Medical record reviews were conducted by two previously trained nurses, following IHI guidelines,⁽¹⁰⁾ and the identified cases underwent clinical validation by a pediatrician. This process followed a standardized protocol designed to distinguish confirmed AEs from clinical manifestations associated with the natural course of the disease, serving as a key strategy to enhance the standardization and reliability of the intervention.

Sample selection was based on IHI recommendations,⁽¹⁰⁾ which suggest analyzing 20 medical records per month, chosen by simple random sampling.⁽¹⁰⁾ Additionally, the number of records reviewed and the average analysis time served as indicators for the implementation test.

From a population of 608 eligible records, a final sample of 194 records was obtained, comprising the physical medical records of children and adolescents aged between 28 days and 16 years and 11 months who were hospitalized in the unit in 2019. Inclusion criteria covered records of patients with a length of stay of 24 hours or more, a defined clinical diagnosis, and a documented outcome (discharge, transfer, or death). Records were excluded if they involved hospitalizations exceeding six months, contained documentation inconsistencies, or belonged to different care modalities, such as surgical cases.

The process of testing the PTT implementation was structured in the following stages: tool selection, staff training, pilot testing, trigger tracking, and clinical validation of AEs.

Operational and descriptive indicators were used to characterize the tool's implementation.⁽¹⁷⁾ Operational indicators included the number of records reviewed, average analysis time per record, adherence to planned stages, staff training, and clinical validation of events.

Descriptive indicators included the total number of triggers identified, the proportion of patients with at least one trigger, the frequency of the main triggers, the proportion of triggers confirmed as AEs, and the classification of harm severity according to the National Coordinating Council for Medication Error Reporting and Prevention (NCC/MERP) scale.

In this study, the applicability and feasibility (including cost-effectiveness) of the PTT were not measured with use of a specific study design. These aspects were assessed through interpretive inferences drawn from the implementation experience.

Data derived from the identified triggers were analyzed descriptively using absolute and relative frequencies.

The trackers were organized according to the PTT modules: general care, medications, and laboratory results. Subsequently, the cases underwent clinical evaluation to determine their association with the occurrence of AEs. Confirmed AEs were classified using the⁽¹⁸⁾ NCC/MERP scale based on the severity of patient harm.

The NCC/MERP taxonomy,⁽¹⁸⁾ categorizes harm into increasing levels of severity: E (temporary harm requiring intervention), F (temporary harm prolonging hospitalization), G (permanent harm), H (intervention to sustain life), and I (death).

To minimize bias in event identification, data collection was carried out by a previously trained team comprising two nurses and a pediatrician, in accordance with IHI recommendations. A pilot test preceded the definitive data collection, allowing for consensus-based adjustments to the data extraction instrument and the validation of AEs in collaboration with the team's physician.

No formal calculation of inter-rater agreement was performed, which constitutes a methodological limitation to be considered. However, the analyses were conducted collaboratively, thereby mitigating this limitation.

We emphasize that the focus of this study was the process of testing the PTT implementation, aiming to facilitate its replication and/or adaptation in pediatric hospital settings. The detailed description of statistical results, including factors associated with the occurrence of triggers and AEs in pediatrics, was derived from a previously published study.⁽¹⁹⁾

The study was approved by the Research Ethics Committee (opinion number 3.603.794/2019; CAAE 07626019.5.0000.5541).

Results

In the review process, a total of 194 physical medical records were analyzed between October 2020 and February 2021. The average analysis time was approximately 10 to 20 minutes per record, highlighting an assessment of the tool's operational feasibility within the context studied.

During the application of the tool, triggers and AEs were identified, allowing for the characterization of key findings regarding the testing of PTT implementation in the studied care setting. The stages of the implementation process and the application of the tool are summarized in Chart 1.

Chart 1. Stages of testing the implementation of the Paediatric Trigger Tool (PTT) for adverse event screening and clinical risk management in a pediatric inpatient unit.

Implementation testing stages	Procedures implemented
Tool selection	Selection of the PTT for retrospective medical record review, based on the target population's clinical profile and the international recognition of the tool's developer (IHI).
Staff training	Training provided by one of the nurse reviewers using an online platform supplied by the IHI for identifying triggers and classifying events. This nurse subsequently trained the second reviewer.
Planning and pilot testing	Application of the PTT to five medical records to align the tracking criteria and the data recording spreadsheet.
Trigger tracking	Review of physical medical records and documentation of findings in a spreadsheet structured according to PTT modules and items, alongside the tabulation of patient demographic and clinical variables.
Clinical validation of adverse events	Consensus meetings involving the nurses and a pediatrician to confirm events and assign NCC/MERP categories.
Implementation testing conclusions	Measurement of the time required for the analysis of medical records and application results (descriptive analysis of triggers and AEs); team assessment regarding the tool's feasibility and relevance; presentation of the pilot testing results to leadership.

Source: Prepared by the authors and adapted⁽¹⁰⁾
IHI = Institute for Healthcare Improvement.

A total of 204 triggers were identified across the audited medical records. Among the patients/records evaluated (n=194), 107 presented at least one trigger during their hospital stay. The most frequent triggers were a

drop of more than 25% in hemoglobin or hematocrit levels and $\text{SpO}_2 < 85\%$, followed by a rise in urea and creatinine levels to more than twice the baseline value.

Of the total triggers identified, 64 were confirmed as AEs, with a predominance ($n=62$; 96.8%) of categories related to temporary harm according to the NCC/MERP classification. The main indicators derived from the tool's application are presented in Table 1.

Table 1. Operational indicators derived from the application of the Paediatric Trigger Tool in a pediatric inpatient unit.

Indicators	n (%)	
Medical records reviewed, n(%)	194(100)	
Total triggers identified	204	-
Mean triggers per medical record	1.05	Min: 0 Max: 6
Patients with at least one trigger (n=194), n(%)	107(55.2)	
Patients with a confirmed adverse event (n=194), n(%)	43(22.2)	

Source: research data.

The use of the PTT enabled the standardization of AE tracking, facilitating information organization and the traceability of findings. Beyond merely identifying events, PTT implementation structured a more systematic institutional risk monitoring process, which was presented to the relevant leadership. Additionally, the adoption of a clinical validation protocol helped distinguish healthcare-related events from expected clinical manifestations, adding greater rigor to the identification process.

Discussion

In the present study, the implementation of the PTT enabled the structuring of retrospective AE tracking in the pediatric unit. By organizing medical record reviews based on predefined criteria, the tool facilitated the generation of clinical information useful for situational assessment and risk management.⁽¹⁰⁾

Strategies such as this should be incorporated into risk management in healthcare services, particularly in teaching hospitals, which play a fundamental role in professional training and the promotion of a safety culture. This involves emphasizing the use of protocols, situational assessment, and continuous monitoring of care processes, as a weak safety culture poses a risk to patient care.⁽²⁰⁾

The implementation experience suggested the potential of using the PTT's as a structured tool for medical record review, as it standardized the stages of trigger identification, record analysis, and AE validation. Its primary practical contribution was transforming scattered clinical information from medical records into systematized data capable of supporting situational assessment and risk prioritization.^(15,21)

Thus, the triggers not only identify potential harm, but also guide the setting of priorities for interventions aimed at improving care quality.⁽²¹⁾

The PTT also proved relevant as an active surveillance strategy, enabling the identification of AEs through structured medical record reviews, independent of spontaneous reporting. This aspect is particularly important in contexts where passive reporting systems may be limited by underreporting.⁽²²⁾ Such scenarios are often associated with the persistence of punitive organizational cultures. Consequently, using this tool can foster a learning-oriented safety culture, where event identification is viewed as an opportunity to improve care processes.⁽²³⁾

Findings from the PTT application indicated a higher frequency of triggers related to laboratory abnormalities and respiratory clinical instability, such as a drop of more than 25% in hemoglobin or hematocrit, $\text{SpO}_2 < 85\%$, and urea and creatinine levels rising to more than twice the baseline value. These results suggest that the tool effectively flagged clinical conditions relevant to pediatric patient safety monitoring, particularly those associated with clinical deterioration, the need for intervention, and higher care complexity. This approach facilitates the planning of more targeted interventions, including the development of protocols, checklists, and educational strategies, and strengthens patient and family participation in care.^(22,24)

The findings also highlight the operational feasibility of the PTT, evidenced by an analysis time consistent with the IHI recommendations⁽¹⁰⁾ and the fact that it can be applied by a previously trained team. In institutional practice, the tool could be integrated into routine care through periodic medical record reviews, safety indicator monitoring, discussion of events in multidisciplinary meetings, and coordination with the Patient Safety Unit. This incorporation facilitates continuous risk monitoring and the definition of educational and preventive actions targeting identified

vulnerabilities. Operational feasibility and integration into the workflow are key factors for the intervention's sustainability. These aspects reinforce its potential to be incorporated into routine clinical practice as a tool to support risk management.⁽²⁵⁾

The PTT should not be viewed as a standalone strategy but rather as a component of an institutional safety system linked to other approaches, such as incident reporting systems, Root Cause Analysis, review of care processes, and continuing education. This integration enhances the institution's ability to recognize risk patterns, understand contributing factors, and plan more effective interventions. Studies show that active screening tools, such as the Global Assessment of Pediatric Patient Safety (GAPPS), offer greater sensitivity in identifying AEs compared to passive reporting systems,^(3,22) underscoring the importance of adopting multiple strategies for patient safety monitoring.

Key challenges observed during implementation include reliance on the quality of medical record documentation, the need to standardize clinical judgment among reviewers, and the time required for a thorough analysis of suspected cases. For future applications, it is recommended to expand training and calculate inter-rater agreement to strengthen the reliability of trigger identification and AE confirmation. Combining this with other methodologies, such as Root Cause Analysis, is also recommended, as the latter is considered effective for identifying systemic failures and proposing structural improvements to care processes.^(10,26) Furthermore, the impact of improvement interventions depends heavily on the implementation context and the presence of a robust safety culture.

Another limitation concerns the quality of medical record documentation. Incomplete, non-standardized, or unclear recorded information can hinder the identification of triggers and compromise the confirmation of AEs. This finding aligns with the literature, which identifies weaknesses in clinical documentation as an obstacle to effective patient safety monitoring and the replicability of the intervention in other settings.⁽²⁷⁾ In the context of the PTT, poor documentation reduces the tool's sensitivity and may lead to an underestimation of the occurrence of harm.

Finally, the PTT implementation must take place within an institutional context that values a safety culture, investment in professional training, and the strengthen-

ing of risk management practices. The description of implementation steps presented in this study can facilitate the tool's replication in other pediatric services, provided that local characteristics, the availability of trained staff, and the quality of clinical documentation are taken into account. More than simply reporting a screening experience, this study describes an organized strategy to monitor clinical risks and support improvements in pediatric patient safety.⁽¹⁵⁾

Conclusion

Given the high vulnerability of the pediatric population, the use of the PTT proved to be a promising strategy, showing potential for screening AEs and contributing to the systematic identification of risks and the strengthening of patient safety practices.

Pilot testing suggests the tool is applicable in pediatric units, as it fosters standardized medical record reviews, organized clinical data, and a foundation for quality improvement and risk management actions. The pilot implementation required three professionals: two nurses and one physician. The completeness of medical record documentation is also a factor to consider regarding the feasibility and actual application of the tool.

Furthermore, the experience demonstrated that incorporating PTT can support continuing education processes, bolster institutional safety indicators, and strengthen the safety culture within healthcare services.

However, its integration into daily work routines depends on institutional conditions, such as management support, investment in professional training, the availability of human resources, and the quality of clinical records, all of which were deemed essential for its effectiveness.

Thus, this study offers practical insights for implementing the PTT in pediatric units by describing the operational aspects, potential, and challenges associated with using the tool in a hospital setting.

Individual author contributions

Conceptualization, data curation, formal analysis, investigation, methodology and project administration:

Moraes RMR, Oliveira JLC. Writing – original draft: Moraes RMR, Maia MCW, Souza VS, Netto JMO, Bernardino FBS, Oliveira JLC. Writing – review & editing: Moraes RMR, Maia MCW, Souza VS, Netto JMO, Bernardino FBS, Oliveira JLC.

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