

IMPACT OF AN EARLY RECOGNITION SYSTEM OF PEDIATRIC CLINICAL DETERIORATION

IMPACTO DE UM SISTEMA DE RECONHECIMENTO PRECOCE DE DETERIORAÇÃO CLÍNICA PEDIÁTRICA

IMPACTO DE UN SISTEMA DE RECONOCIMIENTO TEMPRANO DEL DETERIORO CLÍNICO PEDIÁTRICO

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ABSTRACT

Objective: to analyze the impact of implementing an Early Recognition System (ERS) on the clinical deterioration of the Pediatric Alert Score (PAS) in a pediatric hospital setting. **Method:** a quantitative, descriptive, and prospective study was carried out in a public pediatric hospital in Bahia, Brazil, from July/2019 to July/2020. Twenty-nine nurses participated in the study, and 71 cases of patients who presented clinical deterioration during the study period in the two pilot units were analyzed. For data analysis, descriptive statistics were applied. **Results:** regarding the service, after the implementation of the ERS, there was a decrease in the absolute number of cases of deterioration, medical calls by the nurse, interventions by the team, and deaths among the cases that deteriorated. For part of the nurses, the ERS promoted changes in the assessment, communication with physicians, and the general routines of the service. **Conclusion:** the impact of the Early Recognition System on the clinical deterioration of the PAS, implemented in the hospital, was considered positive from the perspective of the service and the nurses.

Descriptors: Clinical Deterioration; Early Warning Score; Hospitalized Child; Pediatric Nursing; Patient Acuity.

RESUMO

Objetivo: analisar o impacto da implantação do Sistema de Reconhecimento Precoce (SRP) de deterioração clínica do Escore Pediátrico de Alerta (EPA), em um cenário hospitalar pediátrico. **Método:** estudo quantitativo, descritivo, prospectivo, realizado em hospital público pediátrico na Bahia, Brasil, de julho/2019 a julho/2020. Participaram do estudo 29 enfermeiros e se analisaram-se 71 casos de pacientes que apresentaram deterioração clínica durante o período do estudo nas duas unidades piloto. Para análise dos dados, aplicou-se a estatística descritiva. **Resultados:** em relação ao serviço, após a implantação do SRP, houve queda em números absolutos dos casos de deterioração, das chamadas médica pelo enfermeiro, das intervenções pela equipe e no número de óbitos entre os casos que deterioraram. Para parte dos enfermeiros, o SRP promoveu mudanças na forma de avaliação, na comunicação com o médico e nas rotinas gerais do serviço. **Conclusão:** o impacto do Sistema de Reconhecimento Precoce de deterioração clínica do EPA implantado do hospital foi considerado positivo, na perspectiva do serviço e dos enfermeiros.

Descritores: Deterioração Clínica; Escore de Alerta Precoce; Criança Hospitalizada; Enfermagem Pediátrica; Gravidade do Paciente.

RESUMEN

Objetivo: analizar el impacto de la implementación del Sistema de Reconocimiento Temprano (SRT) del deterioro clínico del *Pediatric Alert Score* (PAS) en un ámbito hospitalario pediátrico.

Método: estudio cuantitativo, descriptivo, prospectivo, realizado en un hospital pediátrico público de Bahía, Brasil, de julio/2019 a julio/2020. Participaron del estudio 29 enfermeros y se analizaron 71 casos de pacientes que presentaron deterioro clínico durante el período de estudio en dos unidades piloto. Para el análisis de datos se aplicó estadística descriptiva.

Resultados: en cuanto al servicio, después de la implementación del SRP, hubo una disminución en los números absolutos de casos de deterioro, de llamadas médicas de

enfermera, de intervenciones del equipo y del número de muertes entre los casos que empeoraron. Para parte de los enfermeros, el SRT promovió cambios en la forma de evaluación, en la comunicación con el médico y en las rutinas generales del servicio. **Conclusión:** el impacto del Sistema de Reconocimiento Temprano de deterioro clínico implementado en el hospital fue considerado positivo, desde la perspectiva del servicio y de los enfermeros.

Descriptores: Deterioro Clínico; Puntuación de Alerta Temprana; Niño Hospitalizado; Enfermería Pediátrica; Gravedad del Paciente.

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INTRODUCTION

Clinical deterioration can be defined as the status of compromised hemodynamic stability, marked by physiological decompensation, accompanied by objective or subjective findings. It is considered one of the main contributing factors to hospital mortality, whose recognition is generally supported by contextual factors and variations in practice.⁽¹⁾

The early recognition of clinical deterioration in the hospital setting requires theoretical and practical knowledge of health professionals about how this phenomenon presents itself, ability to make a clinical judgment of the patient's health status, and systematic and judicious evaluation and intervention to prevent progression to clinical worsening or cardiac arrest.⁽²⁾

Late recognition of a patient's clinical deterioration can result in unfavorable outcomes, in addition to negatively influencing hospital quality indicators. A late intervention to a potentially serious patient can significantly increase the length of hospital stay, reflect on the bed occupancy rate, and directly affect the mortality rate.⁽³⁾

In this perspective, instruments were developed to help nurses systematize the early recognition of clinical deterioration at the bedside and alert the team to the need for urgent care. These instruments are known internationally as Pediatric Early Warning Systems (PEWS).⁽⁴⁾

In Brazil, some PEWS or Pediatric Early Warning Scores, as they are called, have already been validated and published in the main databases, among which are the Brighton Pediatric Early Warning for the Brazilian context (BPEWS-Br)⁽⁵⁾ and the Pediatric Alert Score (PAS).⁽⁶⁾ The BPEWS-Br and the PAS include three assessment components (neurological,

respiratory, and cardiovascular), whose purpose is to track signs of clinical worsening early for the appropriate interventions.^(5,6)

The BPEWS-Br is a score of English origin, validated for the Brazilian context, with a score that varies between zero and 13. At a cutoff point ≥ 3 , the instrument achieved a sensitivity of 73.9%, a specificity of 95.5%, a Positive Predictive Value (PPV) of 73.3%, a Negative Predictive Value (NPV) of 94.7%, and an accuracy of 91.9%.⁽⁵⁾ The PAS is derived from the BPEWS-Br, and its score varies between zero and 11. For the recognition of clinical deterioration, the instrument has a Content Validation Index (CVI) of 97%, and, at the cutoff point ≥ 3 , a sensitivity of 73.6%, a specificity of 95.7%, a PPV of 83%, a NPV of 92.7%, an accuracy of 93.6%, and a reproducibility of 95%.^(6,7) These numbers demonstrate the ability of these tools to identify signs of clinical worsening when properly applied by the health professionals.

In the study scenario, the PAS was implemented with a flow of actions and a set of evaluation indicators to organize and monitor an Early Recognition System (ERS) of pediatric clinical deterioration. The purpose of the ERS is to guide the multidisciplinary team, bearing in mind that the isolated implementation of the score, dissociated from the care algorithm and evaluation indicators, might not be enough to guide patient management by the health team, monitor the impact of the system and improve the quality of care provided in the face of clinical worsening.^(6,7,8)

The action flow, linked to the PAS severity levels, has four levels of care: score measurement, immediate action, monitoring, and reassessment. Among the evaluation indicators traced in the scenario studied, the following stand out: request for transfer to more complex units, cardiorespiratory arrest in the wards, medical call by the nurse for evaluation in the wards, interventions made by the team, number of deaths and feedback from nurses about the ERS.^(6,7,8)

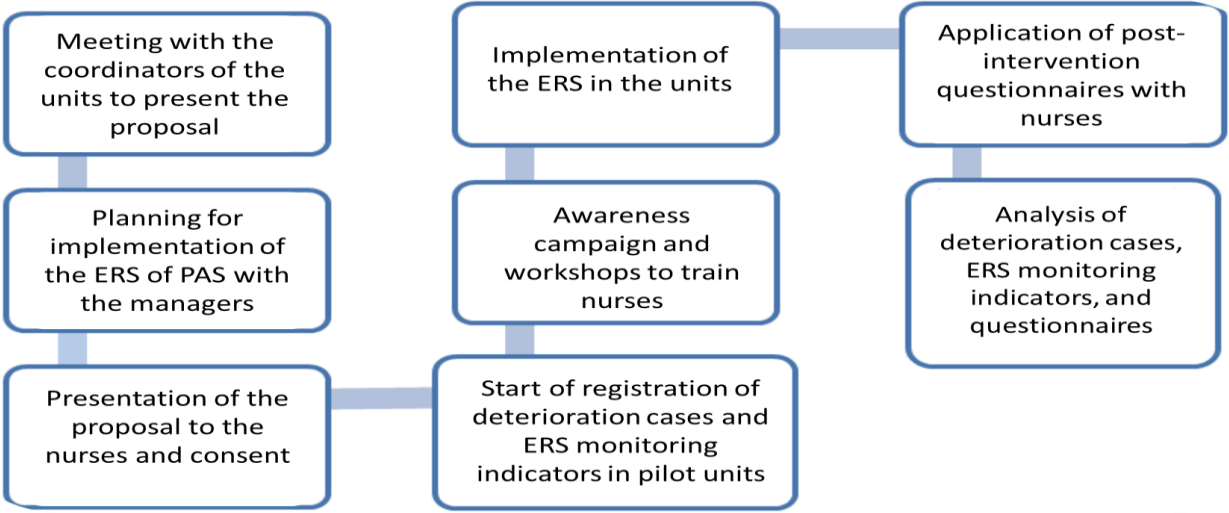
OBJECTIVE

To analyze the impact of implementing an Early Recognition System (ERS) on the clinical deterioration of the Pediatric Alert Score (PAS) in a pediatric hospital setting.

METHOD

A quantitative, descriptive, prospective study was developed to analyze the impacts of the implementation of the Early Recognition System (ERS) of the Pediatric Alert Score (PAS), from the perspective of the service and the nurses working in a pediatric hospital scenario. The flowchart of the research steps is shown in Figure 1.

Figure 1. Flowchart of the study steps, Feira de Santana (BA), Brazil, 2020.



The study was carried out at the *Hospital Estadual da Criança* (HEC), located in Feira de Santana, Bahia, Brazil. The HEC is a reference unit for caring for mothers and children in Bahia. It was founded in 2010 and had 240 beds distributed in pediatrics, neonatology, and maternity specialties.

At the HEC, the ERS was planned and implemented in the clinical-surgical, emergency, and Pediatric Intensive Care Units by the medical and nursing coordinators of these units. However, for this study, two clinical-surgical units were selected as a pilot units, with 29 beds each, in order to monitor the implementation process of the ERS systematically, the cases of deterioration that occurred throughout the process, and the indicators used for system evaluation.

To guide the implementation steps of the ERS of the PAS in the hospital context, an action plan was developed based on the 5W2H quality tool in order to guarantee the conduction of the process. The 5W2H contemplates seven words in English: What, Where, Who, Why, When, How, and How Much.⁽⁹⁾ To better guide the process, an operational manual was prepared containing an action plan about the implementation of the ERS in the studied context.

A total of 29 nurses participated in the study, 26 of whom were assistants, and three were nursing coordinators of the clinical-surgical hospitalization units. Nurses in the pilot units were trained to apply the PAS, the flow of actions, and recording the ERS evaluation and monitoring indicators.

The inclusion criterion adopted was to be a nurse in the inpatient units that served as pilot settings, excluding professionals who were away from the service during the data collection period, due to leave and vacations.

During the ERS implementation process, the nurses registered 71 cases of clinical deterioration measured by the PAS, during the data collection period, in the selected pilot units. There were no exclusion criteria for these patients, as all cases of deterioration recorded by the nurses were included in the study. These cases were analyzed to collect indicators for evaluating the impact of the ERS on the service.

The data collection took place from July/2019 to July/2020 through documentary research, the records of cases of clinical deterioration by nurses, hospital management reports, and the application of instruments to assess the impact on the service and in practice clinic of the nurses participating in the research.

The pre-implantation follow-up period was from July/2019 to December/2019, and the post-implantation period was from January/2020 to July/2020. After implementing the ERS, patients admitted to the pilot units were evaluated twice a day by the on-duty nurse and classified according to the PAS, triggering or not the flow of actions, as needed.

Four instruments were used in the collection: the PAS, with the respective flow of actions; the follow-up form for cases of clinical deterioration in the two pilot units; the ERS impact assessment questionnaire by nurses; and the ERS impact assessment form for the service.

The nurses' training was carried out over three months before the implementation of the ERS in the hospital. They were trained to assess and recognize the warning signs of clinical deterioration, apply the PAS, and follow the flow of actions built for the service. The training was conducted in a theoretical-practical format through workshops, dialogued expository classes, video shows, and dispersion periods for applying the PAS in children hospitalized in the services.

To analyze the impact of the ERS, descriptive statistics were applied to the data relating to cases of clinical deterioration monitored in the pilot units and to the ERS monitoring indicators drawn from the perspective of the service and nurses. Data were electronically computed and processed using MedCalc® Statistical Software version 20.007 (MedCalc Software Ltd, Ostend, Belgium; <https://www.medcalc.org>; 2021). Nominal qualitative variables were presented using absolute and relative frequencies. The study's qualitative data (open responses to the questionnaires applied to nurses) were categorized and presented in frequencies. The presentation of data was done through tables.

This study is part of the research project entitled "*Reconhecimento da deterioração clínica pediátrica no contexto hospitalar da saúde da criança no município de Feira de Santana - Bahia*", approved by the Research Ethics Committee of the State University of Feira de Santana, under CAEE nº: 79484117.2.0000.0053, and funded by the MCTIC/CNPq call Nº 28 /2018, process No. 405101/2018-0.

RESULTS

Impact of the Early Recognition System on pediatric clinical deterioration from the perspective of the service

Table 1 describes six indicators designed for monitoring the ERS and the respective impact from the service perspective.

Table 1. Distribution of indicators of the ERS monitored before and after implementation from the perspective of the service. Feira de Santana (BA), Brazil, 2020.

Variables	Before the ERS (n=41)	%	After the ERS (n=30)	%
Recorded deterioration cases	41	57.7	30	42.3
Deaths in the cases followed	16	39	11	36
Transfer to ICU				
Yes	30	73.1	28	93.3

No	11	26.9	02	6.7
CPRs in the ward	02	50	02	50
Calls from nurses to physicians				
Yes	41	100	25	83.3
No	00	00	05	16.7
Intervention by the team				
Yes	41	100	27	90
No	00	00	03	10

Impact of the Early Recognition System on pediatric clinical deterioration from the perspective of nurses.

The data about the ERS evaluation and monitoring indicators and the respective impact from the nurses' perspective are described in Table 2.

Table 2. Distribution of indicators of the ERS monitored after the implementation from the nurses' perspective. Feira de Santana (BA), 2020.

Variables*	N (29)	%
Evaluation by the nurse		
Greater accuracy of assessments	16	55.2
Standardization of assessments	16	55.2
Warning for critically ill patients	10	34.5
Assistance in the conduct of the team	10	34.5
Security in assessments	03	10.3
No changes perceived	02	6.9
Communication with the physician		
Improved communication and more effective communication	07	24.1
Resistance of the medical team to calls from the nurse	06	20.6
No changes perceived	06	20.6
Ease of communication	06	20.6
Language standardization	02	6.9
General changes in the service routine		
Agility in the evaluation	14	48.3
No changes perceived	08	25.8
Quality of care	05	17.2
Organization of care	04	13.7
Service effectiveness	02	6.9

*Each nurse registered more than one answer in each variable.

Notably, of the 29 nurses participating in the study, three were coordinators of the pilot units and, therefore, were also asked about the usefulness of the ERS in the care management process. For them, the ERS improved the autonomy of nurses in the face of decision-making about the clinical worsening of patients and enabled the use of PAS results as one of the

indicators of quality of care for patients in deterioration, providing the planning of investments in necessary improvements.

DISCUSSION

Careful and systematic assessment to recognize and intervene in the patient's clinical deterioration must be guided by protocols and instruments based on scientific evidence and appropriate to the care context. Adopting a system for early recognition of clinical deterioration in the hospital context can be of great importance in preventing unfavorable outcomes for patients and health services.

Deteriorating children can progress to Cardiorespiratory Arrest, with a poor prognosis and high morbidity and mortality rate.^(10,11) In contrast, children who deteriorate in a hospital environment show noticeable signs that PEWS can display before they get worse,⁽¹¹⁾ which reveals the importance of using these tools to support early screening for cardiorespiratory deterioration and CPR prevention.

Thus, early warning systems are important for early recognition and response to deteriorating patients.^(2,4) They seek to structure the assessment, identification, and interventions in cases of clinical worsening to avoid associated complications and promote the safety of care provided to hospitalized patients.^(2,4,6)

It is recommended that, in the pediatric context, systems for early recognition of clinical deterioration be multifaceted and consist of an alert score linked to a flow of actions, a well-trained team, adequate resources, and systematic audits in order to constantly evaluate the process, aiming to improve the care provided by the team and ensure patient safety.^(6,7) In this sense, the ERS of the PAS was implemented to improve the process of identifying and intervening in clinical deterioration in pediatric patients and positively impact quality assistance in the study scenario.

Regarding the impact of the ERS, from the perspective of the service, the study showed a reduction in cases of deterioration and the number of pre-and post-implantation deaths since the drop in transfers to the ICU was minimal, and the number of CPA in the ward of the units has not changed. Based on the findings, it is impossible to state that the alterations were associated with the ERS, as this is a descriptive data analysis. However, studies claim significant changes in indicators after implementing pediatric clinical deterioration early warning tools.

Pediatric early warning scores can improve service indicators in a multifactorial way, since, through them, it is possible to systematize care through the application of the instrument and algorithm, in addition to enabling the evaluation and monitoring of the patient through a protocol for scheduling care, including ICU beds,⁽¹²⁾ since these scores are considered predictors of admission to intensive care.⁽¹³⁾ In addition, alert systems can generate savings for the hospital when compared to the cost of unplanned ICU transfers.⁽¹²⁾

Regarding the impact of early warning systems on mortality rates, a prior study concluded that implementing a pediatric alert score does not significantly reduce mortality rates.⁽¹⁴⁾ In contrast, a review study identified a reduction in both clinical deterioration events

and mortality after the implantation of a PEWS.⁽¹⁵⁾ Researchers call attention to the fact that mortality should not be the most important indicator to evaluate the effectiveness of a PEWS.⁽¹⁶⁾

Regarding ICU transfer, a systematic review points out that there is not enough evidence that early warning systems significantly reduce transfers to the ICU.⁽¹⁷⁾ When evaluating the readmission of pediatric patients in the ICU, a study highlighted that the readmission rate was low (about 2.5%). However, ICU readmissions can be beneficial for the patient in preventing injuries and clinical worsening.⁽¹⁸⁾

Still referring to the impact of the ERS on the service, there is a reduction in phone calls from nurses to physicians for medical evaluations and interventions by the team. There are records that pediatric early warning scores can empower nurses, as they feel more capable of assessing critical patients and discussing the case with the physician,⁽¹⁹⁾ which may have contributed to the reduction of these indicators after ERS implementation in the routine evaluation.

Concerning the impact of the ERS from the perspective of nurses, many stated changes in the way of evaluating, communicating with the physician, and in the routine of the service in general. They highlighted major changes in the accuracy and standardization of assessments and signaled improvement and more effectiveness in communication. Nurses trained in applying the PEWS have improved technical skills, confidence in communicating important clinical findings to physicians, and greater autonomy in decision-making.⁽²⁰⁾

Some nurses reported that there is still resistance in responding to the calls from nurses for evaluation on the part of some physicians. Nurses may feel ignored by physicians when they communicate an aggravation situation.⁽²¹⁾ The hierarchical relationship between physicians and nurses can be an obstacle to the good applicability of a PEWS, both at the time of the call and at the medical conduct, after communication by the nurse and in the general adherence to the instrument.⁽¹⁹⁾

A study investigated how nurses use alert scores to detect injuries, act on patient deterioration and ensure safety. It was concluded that professionals trust and base their actions on alert scores, and that the clinical experience is essential in accurately identifying aggravation of clinical findings.⁽²¹⁾

Introducing a PEWS in the service routine improves communication between the team members.⁽¹⁹⁾ Authors reinforce the importance of human resources in the applicability of the PEWS, along with social and organizational factors. Communication, teamwork, and staff training are necessary factors for the proper scaling of the instrument and consequent reduction in patient mortality.⁽²¹⁾

Nurses' use of early warning systems is influenced by trust, culture, and previous experiences. The high workload, availability of resources, and difficulty for the medical team to assess the patient within a timely response time are obstacles to applying PEWS in the view of nurses.⁽²²⁾ Thus, it is necessary to plan actions so that the alert scores are included in routine interdisciplinary care.

More research should be conducted to develop an adaptable PEWS framework tailored to local resources and context. The operational impact of implementing the PEWS on certain indicators should be studied, such as the rate of clinical deterioration, length of stay, hospital

morbidity, mortality, resource utilization, interdisciplinary communication, staff and patient satisfaction, and cost-effectiveness.⁽¹⁵⁾

Pediatric early warning scores, such as the PAS, can be used to improve patient safety in many aspects, in line with the goals implemented by the World Health Organization.⁽²³⁾ However, its use must be linked to a system capable of detecting and intervening promptly in clinical worsening, and for this, the involvement of human and management resources is mandatory. In addition, it is necessary to design and monitor indicators to assess the impact of these systems.

As a limitation of this research, the failures of some records and the impossibility of stating that the changes that occurred were significant and are due to the implementation of the ERS given the study design, stand out. Until the conclusion of this research, there were few publications in the national and international scenarios on the impact of ERS on clinical deterioration in the hospital context that could support the discussion of the results, which raises the need for further studies on this topic.

CONCLUSION

The impact of the Early Recognition System on pediatric clinical deterioration, comprising the PAS, the flow of actions, and the quality monitoring and assessment indicators was considered positive, both from the service and the nurses' perspectives.

After the implementation of the ERS, the nurses reported changes in clinical assessments, communication with the physician, and general service routines. Regarding the service, there was a decrease in the absolute number of cases of deterioration, in medical calls by the nurse, in interventions by the team, and in the number of deaths among the cases that deteriorated.

The relevance of this study focuses on the perspective that analyzing the results of the implementation of a deterioration ERS can help to monitor and improve the quality of care provided to hospitalized pediatric patients, strengthen interdisciplinary communication, promote the empowerment of nurses in the evaluation and recognition of clinical deterioration, standardize the management of clinical deterioration in the hospital scenario, in addition to expanding the scientific production on this topic, which is still scarce in the country.

CONTRIBUTIONS

All authors contributed equally to designing the research project, collecting, analyzing, and discussing data, as well as writing and critically reviewing the content, with intellectual contribution, and approving the final version of the study.

CONFLICT OF INTERESTS

None to declare.

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