Original article

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Implementation of the Pediatric Early Warning Score for the early identification of clinical deterioration in an Argentine hospital

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ABSTRACT

Introduction. Unexpected clinical deterioration in hospitalized pediatric patients can precede serious events and unscheduled transfers to the pediatric intensive care unit (PICU). Early warning scales, such as the Pediatric Early Warning Score (PEWS), aim to facilitate its early detection. The objective was to implement PEWS use in at least 50% of hospitalized patients and to describe clinical variables associated with unscheduled transfers.

Population and methods. A quasi-experimental before-and-after study was conducted at a pediatric hospital between April 2024 and January 2025. A SAFE (Situational Awareness for Everyone) situational awareness protocol was implemented, along with the use of the PEWS, staff training, briefings, and debriefing sessions. The study included patients aged 1 month to 18 years who were admitted to the PICU unscheduled. Adherence to PEWS documentation and associated clinical variables were evaluated.

Results. A total of 104 unscheduled transfers were recorded (46 pre-intervention, 58 post-intervention). The groups were comparable in terms of age, comorbidities, days before transfer, length of stay in the PICU, and PIM3. Adherence to the PEWS was 58.6% in the post-intervention phase, increasing to 100% by the end of the period. The median PEWS score for unscheduled transfers was 6 (IQR 3-7). No differences were observed in the need for intervention within the first hour in the PICU or in mortality.

Conclusion. The implementation of the PEWS was feasible and exceeded the proposed target. It had no clinical impact at this stage, but the high adherence achieved is key for future evaluations of effectiveness and sustainability.

Keywords: *clinical deterioration; pediatrics; hospitalization; quality improvement.*

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INTRODUCTION

Hospitalized pediatric patients may experience unexpected clinical deterioration, which often requires urgent life-saving interventions. This can lead to increased morbidity and mortality. These events are often preceded by a phase of deterioration that may go unnoticed and serve as a precursor to cardiopulmonary arrest (CPA).[1-5] According to various publications, mortality from in-hospital pediatric CPA outside the pediatric intensive care unit (PICU) can range from 50% to 67%.[1]

It has been observed that nearly one-third of unscheduled transfers to the PICU were associated with adverse events, and 35% of these were considered preventable.[2] The frequency of unscheduled patient transfers to the PICU serves as a measure of patient safety and a quality indicator.[1]

Early detection of clinical deterioration in hospitalized patients improves the quality of medical care.[3,6] To this end, various scales have been developed to assess patients and predict clinical deterioration quickly. The Pediatric Early Warning Score (PEWS) is based on three aspects: respiratory, cardiovascular, and behavioral, with each assessed element assigned a specific score.[3] Numerous studies, both prospective and retrospective, have been conducted that support the use of this tool internationally.[1-6] Evidence of its implementation at the local level is scarce and lacks clear results.[1,3]

Our objective was to implement PEWS use in at least 50% of patients on pediatric inpatient wards at a pediatric hospital in Argentina from April 2024 to January 2025. Secondarily, clinical variables associated with unscheduled transfers were described in an exploratory manner.

POPULATION AND METHODS

Design

A non-controlled, quasi-experimental before-and-after study was conducted.[7] The protocol for identifying clinical deterioration was implemented as a quality improvement measure in response to a new standard of care in inpatient wards. The analysis focused on patients who experienced an unscheduled transfer to the PICU, which is considered an adverse event; therefore, the results should be interpreted accordingly.

The study was conducted in two phases. During the pre-intervention phase (April to June 2024), a situational assessment was performed, and baseline data on unscheduled admissions to the PICU were collected. Medical staff were also trained on the SAFE protocol[8] (Situational Awareness for Everyone) and the PEWS scoring system,[3] as well as on the use of huddles (brief, structured meetings aimed at identifying potential risks).[8] The SAFE protocol establishes a situational awareness model based on these brief clinical exchange meetings. The PEWS assesses behavior and cardiovascular and respiratory status, with scores ranging from 0 to 3 based on severity, and the total score is obtained by summing the components. Two points were added for patients who had recently received nebulizer therapy and/or were post-surgical with persistent vomiting.[3]

The post-intervention phase ran from July 2024 to January 2025. During this phase, the SAFE protocol and the PEWS score were implemented in clinical practice, and adherence was assessed via direct observation and documentation in the medical record. The latter was recorded by the inpatient ward physician responsible for the patient, at least once per shift and in the event of relevant clinical changes, and was integrated into the routine clinical assessment. The project coordination team supervised the quality of the records.

Population

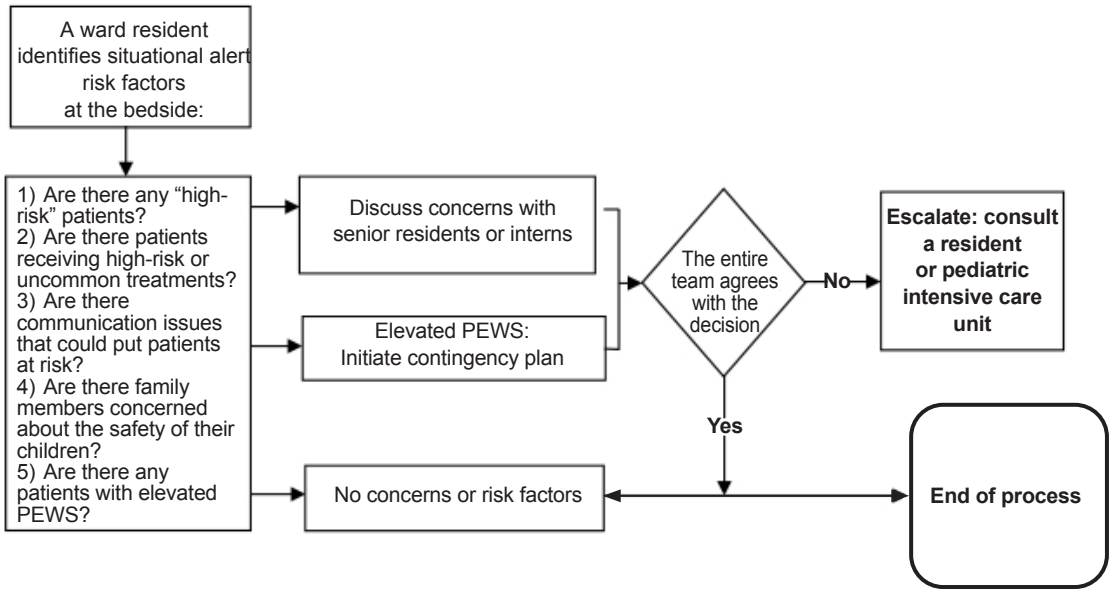
The study was conducted in the inpatient wards of a general children's hospital. All patients aged 1 month to 18 years who required transfer to the PICU at any time during their hospitalization, during the study period, were consecutively included. Patients in palliative care with limitation of therapeutic effort were excluded. An unscheduled transfer was defined as an episode of unexpected clinical deterioration in a patient in an inpatient ward requiring transfer to the PICU. Scheduled transfers are those previously evaluated due to progressive clinical deterioration or, on a preventive and/or elective basis, following a surgical procedure.

Intervention

A flowchart was used as the starting point for situational awareness (*Figure 1*).

The ward physician used a 5-question assessment to identify patients at risk of clinical deterioration. Upon detection of at least one criterion (control patient, infrequent therapy, communication problem, family concern)[8] or a high PEWS score (≥4),[3] the ward physician was required to report the situation to the senior

Figure 1. Diagram of brief, structured meetings designed to identify potential risks (huddles)



resident or the attending physician, to reach a consensus on clinical management. If the treating team agreed on a clinical course of action, the process ended; otherwise, the care strategy was modified by activating contingency measures, among which transfer to the PICU was an option.

Implementation strategies

To implement this protocol, physicians with permanent clinical duties on call (residents, interns, and chief residents) were identified as key actors, selected for their roles and their cross-sectional shift coverage. To mitigate surveillance biases, the protocol was incorporated into routine practice through standardized training.[9] The approach used by the SAFE program was applied: 45-minute educational sessions designed to explain the importance and characteristics of situational awareness and the early detection of clinical deterioration, as well as the usefulness of a scoring system to assess it objectively. These sessions were held on different days and at different times to reach as many physicians as possible. Evidence on the implementation and impact of early detection of clinical deterioration in patients, as well as on monitoring tools, was presented. Laminated copies of the PEWS score (*Table 1*) and the huddle protocol were posted in every inpatient ward and in the intensive care unit. Four post-intervention debriefing sessions were held with the residents responsible for on-call shifts, during which the causes and actions taken regarding unscheduled PICU transfers were discussed.

Sample

In 2023, a total of 500 admissions were recorded, of which 204 came from the general ward. Since the PEWS was not part of the institutional standard of care at the start of the study and was not used systematically, the objective was set at achieving 50% adherence; a sample size of 100 patients was calculated based on the difference in proportions, with a precision of 10% and a confidence level of 95%, assuming a 5% attrition rate. The choice of a 50% target was made because quality improvement efforts seek realistic goals that can be achieved within a specified timeframe.[10]

Statistical analysis

A descriptive analysis of the variables was performed, presenting the corresponding number and percentage for qualitative variables and the mean and standard deviation, or the median and interquartile range, for quantitative variables, depending on whether they were normally distributed.

For the bivariate analysis of PEWS adherence, we planned to use the chi-square test or Fisher's exact test. For the analysis of quantitative variables (unplanned transfer to the PICU), Student's *t-test* or the Wilcoxon rank-sum test was used (depending on whether the normality criteria were met), as well as analysis of variance to compare multiple means. *P*-values less than 0.05 were considered significant.

For data analysis, the statistical software STATA 13.0 for Mac (StataCorp, 4905 Lakeway Dr, College Station, TX 77845) was used.

Bioethical considerations

This study was approved by the Ethics Committee and the Hospital Teaching and Research Department and registered in the Research Projects Registry of the Autonomous City of Buenos Aires under number 12 294.

RESULTS

A total of 104 unscheduled transfers from the inpatient ward to the PICU were recorded, of which 46 (44%) occurred during the baseline period and 58 (56%) during the implementation period. The median age of patients transferred during the baseline period was 15.5 months (IQR 5-40) and, after implementation, 16.5 months (IQR 6-98), p = 0.607. A similar gender distribution was observed in both periods. The presence of comorbidities was similar in both groups: 28 (60.9%) in the baseline group and 32 (55.2%) in the implementation group, p = 0.690. The most common comorbidities were respiratory in etiology (24%, n = 15) and neurological sequelae (24%, n = 15). Those with oncological conditions ranked third.

Regarding the length of hospital stay before transfer to the PICU, the median in the baseline group was 2 days (IQR 1-6) and in the implementation group, 1.5 days (IQR 1-5), p = 0.708. Regarding the length of stay in the PICU, 7.5 (IQR 4-12) vs. 8 (IQR 4-14) days were observed in the baseline and implementation periods, respectively (p = 0.660). The PIM3 score in the baseline group was 1.53 (IQR 0.6-3.95) and 0.72 (IQR 0.46-3.98) in the implementation group; p = 0.24 (*Table 2*).

Adherence to PEWS use was 58.6% (n = 34/58) during the implementation period, compared to zero (0/46) in patients who were transferred unscheduled during the baseline period. We observed a progressive and sustained increase in adherence to the scale over the weeks, achieving registration of all (n = 6) patients in the last month of the study (*Figure 2*). The median PEWS score for patients who required unscheduled transfers was 6 (IQR 3-7).

The number of interventions required within the first hour was 33 (71.4%) in the baseline group and 43 (74.1%) in the implementation group; p = 0.826. Of all patients in the study period, 70 did not undergo the PEWS assessment, while 34 did. Within the group that did not receive a PEWS assessment, 50 (71.4%) required interventions within the first hour of admission to the PICU; while in the group with a recorded PEWS, 26 (76.5%) required them; p = 0.644. A total of 9 patient deaths were recorded: 4 (8.7%) during the baseline period and 5 (8.6%) during the implementation period. Only 1 of these patients had a PEWS assessment at the time of transfer; the remaining 8 did not.

Table 1. Indications according to Pediatric Early Warning Score

PEWS score	Indication
0-2	Follow-up in 4 hours Continue the current plan and follow up
3-4	Repeat PEWS in 60 minutes Check in 2 hours Care plans may change
5-6	Repeat PEWS in 30 minutes Check in 2 hours Care plan is going to change
≥7	Repeat PEWS in 20 minutes Follow-up in 1 hour Consider transfer to PICU

PEWS: Pediatric Early Warning Score, PICU: pediatric intensive care unit.

Table 2. Comparison of the baseline and implementation periods. Results expressed as median (IQR)

	Baseline (n = 46)	Implementation (n = 58)	*p*-value
Age (months)*	15.5 (5–40)	16.5 (6–98)	0.60
Female #	28 (60.9%)	29 (50%)	0.32
Weight (kg)*	10 (6–15)	9.5 (7–20)	0.55
Comorbidities #	28 (60.9%)	32 (55.2%)	0.69
Previous days of hospitalization*	2 (1–6)	1.5 (1–5)	0.70
Days of PICU stay*	7.5 (4–12)	8 (4–14)	0.66
PIM3*	1.53 (0.6–3.95)	0.72 (0.46–3.98)	0.24
Intervention within the first hour in the PICU#	33 (71.4%)	43 (74.1%)	0.82
Death#	4 (8.7%)	5 (8.6%)	>0.99

n: number of patients, PICU: pediatric intensive care unit, PIM3: Pediatric Index of Mortality III.
**Median and interquartile range.*
#Number and percentage.

DISCUSSION

This study demonstrates that implementing the Pediatric Early Warning Score (PEWS) is feasible in a public pediatric hospital in Argentina. The proposed target of 50% adherence was met and exceeded, with 58.6% of unscheduled transfers to the pediatric intensive care unit (PICU) recorded and 100% adherence toward the end of the period. This progressive increase constitutes the central finding, as it reflects not only the healthcare team's acceptance of the intervention but also the possibility of integrating standardized tools into care settings with high staff turnover and limited resources. In this sense, the PEWS functions as a patient safety strategy by providing a common clinical language that facilitates communication and decision-making, consistent with what has been reported in the literature.[6,7,11-17]

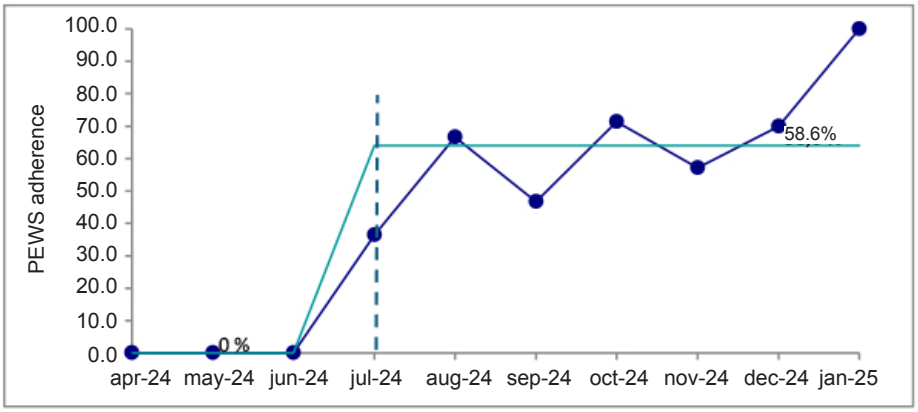
The absence of statistically significant differences in secondary clinical outcomes should be interpreted with caution and not as an indication that the tool is ineffective. The study was designed as an implementation intervention, optimized to measure adherence to a care practice rather than clinical effectiveness, and therefore lacks statistical power to detect changes in mortality or other hard endpoints. This limitation is inherent in single-center quality improvement studies.[7,10] The findings are consistent with previous studies. Duncan et al. validated the predictive capacity of the PEWS for urgent care but did not demonstrate a reduction in mortality on its own.[5] At the same time, regional studies such as that by Elencwajg et al. also found no impact on this outcome, although they highlighted its utility as a predictor of deterioration.[3] Similarly, McElroy et al. observed that, although mortality did not change, the implementation of a full PEWS score improved the frequency of vital sign recording and early identification.[15,18]

The median PEWS score among transferred patients was 6 (IQR 3-7), a value that, according to the institutional algorithm, warranted an escalated response. This suggests that, when applied, the tool adequately identified high-risk patients, consistent with its previously described diagnostic performance.[4] However, the subanalysis of deceased patients highlights a critical issue: only one had a recorded PEWS. Although not statistically significant, this finding raises the hypothesis that the lack of application may have contributed to delays in detecting deterioration, underscoring that the system's effectiveness depends on its sustained use rather than its mere availability.[12,19,20]

Our findings are consistent with the multicenter studies by Agulnik et al. in Latin America, which emphasize that successful implementation depends on support strategies (such as huddles, debriefings, and training) rather than on the tool alone.[6,17] The high prevalence of comorbidities, primarily respiratory and neurological, reflects the complexity of the patient population and reinforces the value of having objective clinical monitoring systems.[4,5] It also aligns with regional reports describing unscheduled transfers as frequent and potentially preventable events.[1,2] The main limitation is its design.

This is an observational before-and-after study without a concurrent control group, which precludes establishing causality and does not

Figure 2. Adherence to the Pediatric Early Warning Score. Performance graph



Y-axis: % adherence to the PEWS.
X-axis: duration of the study.
Dotted vertical line: separation between pre- and post-intervention periods.
Dotted blue horizontal line: monthly adherence and PEWS score recording.
Green horizontal line: post-intervention period mean.

PEWS: *Pediatric Early Warning Score.*

rule out unmeasured confounders (such as the Hawthorne effect). The sample size limits the analysis of subgroups and rare events. As this is a single-center study, caution is warranted regarding generalizability; however, the fact that it was conducted at a public pediatric hospital in Argentina lends it contextual applicability.[13]

As strengths, this is one of the first documented experiences of PEWS implementation in an Argentine public hospital and provides relevant local evidence.[1,11] The intervention relied on validated implementation strategies (structured training, clinical mentors, and systematic feedback), which strengthen the change process.[9] Nearly complete adherence by the end of the period suggests institutional internalization and lays the groundwork for evaluating clinical impact and sustainability in subsequent phases.[19,20]

CONCLUSION

The implementation of the PEWS scale was feasible. It exceeded the proposed goal, demonstrating that standardized early detection tools can be integrated into the daily practice of an Argentine pediatric hospital. Although no significant clinical improvements were observed in this initial phase, the high level of adherence achieved is an essential prerequisite for evaluating effectiveness. Future multicenter studies, with controlled designs and greater statistical power, will be necessary to determine its impact on morbidity, mortality, resource utilization, and long-term sustainability.

The implementation of PEWS represents more than a final result; it is the beginning of a shift toward a care culture focused on anticipating clinical deterioration. ■

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