




Pediatric Cutaneous Risk Score: Early Skin-Based Prediction of Multi-Organ Failure in Critically Ill Children

Marlon Carbonell González ^{1*}, Rosali Santiago Roibal ^{2*}, Deborah Cabrera Rodríguez ¹

¹ High Quality Medical Services, Houston, United States, deborahcabrera0211@gmail.com.

² All Behavior Community Inc., Florida, United States ;

Corresponding authors: marloncarbonell95@gmail.com and rosalisantiago97@gmail.com



ABSTRACT

Life-threatening pediatric dermatologic emergencies—including Stevens–Johnson syndrome/toxic epidermal necrolysis, necrotizing soft tissue infections, and severe drug-induced cutaneous reactions—carry substantial risk of multi-organ failure (MOF) and death in the pediatric intensive care unit (PICU). Early risk stratification is difficult because commonly used prognostic tools depend on laboratory or organ-based parameters that may not be immediately available. We aimed to identify readily observable cutaneous predictors of early systemic deterioration and to develop and internally validate a simple bedside Pediatric Cutaneous Risk Score (pCRS) to predict MOF and PICU mortality in critically ill children with dermatologic emergencies.

We conducted a retrospective, multicenter cohort study across two tertiary PICUs (January 2018–December 2023) that included 50 consecutive patients aged 0–18 years. The primary outcome was MOF, defined as PELOD-2 ≥ 11 within 48 hours; the secondary outcome was PICU mortality. Multivariable logistic regression (model limited to three pre-specified predictors) identified three independent cutaneous predictors: body surface area involvement $>30\%$ (OR 5.6; 95% CI 2.1–14.9), purpura (OR 4.2; 95% CI 1.6–10.9), and mucosal involvement at ≥ 2 sites (OR 3.8; 95% CI 1.2–12.1). Each predictor was assigned 1 point (pCRS 0–3), with stepwise mortality increasing from 0% (0 points) to 75% (3 points). The pCRS showed excellent discrimination for mortality (AUC 0.87; optimism-corrected AUC 0.85 after 1,000 bootstrap resamples). This rapid, reproducible score may support early bedside triage and resource allocation in PICU, pending external validation.

Keywords: Pediatric dermatology; dermatologic emergencies; pediatric intensive care unit; multi-organ failure; prognostic scoring

INTRODUCTION

Pediatric dermatologic emergencies (PDE), including Stevens–Johnson syndrome/toxic epidermal necrolysis (SJS/TEN), necrotizing soft tissue infections, and severe drug-induced cutaneous reactions, represent a rare but high-risk group of conditions at the intersection of dermatology and pediatric critical care ¹. Although their incidence is low, estimated at 1–6 cases per million children annually for SJS/TEN ^{2–5}, these disorders can progress rapidly to multi-organ failure (MOF), causing significant morbidity and mortality ^{6–7} and necessitating early, resource-intensive management in the Pediatric Intensive Care Unit (PICU) ^{8–9}. A critical

limitation in managing PDE is the lack of validated, skin-specific prognostic tools for children¹⁰. Adult risk models, such as SCORTEN, perform well in adults but systematically overestimate mortality in pediatric populations due to differences in age-dependent physiological reserve, comorbidities, and treatment responses¹¹. Clinicians often rely on general physiologic scores (e.g., PELOD-2)¹², which detect established organ dysfunction rather than preclinical indicators of systemic deterioration, highlighting the need for rapid, bedside, pediatric-specific prognostic tools¹³.

Rationale / Knowledge Gap

We hypothesized that specific, observable cutaneous features could serve as early, non-invasive indicators of systemic deterioration in children with PDE^{14–16}. No validated pediatric skin-based prognostic score exists, and early risk stratification remains a challenge. Developing a simple, bedside-applicable tool could support timely interventions, optimize PICU resource allocation, and standardize risk assessment across institutions.

This study aimed to develop and internally validate the Pediatric Cutaneous Risk Score (pCRS), a pragmatic bedside tool designed to stratify the risk of MOF and mortality at PICU admission. The primary objective was to evaluate its predictive performance for early identification of high-risk patients. Secondary objectives included assessing reproducibility, feasibility, and potential for broader standardization across PICUs. Any additional context or supporting evidence for interpreting these outcomes is provided in the Report in Context Box, which does not contribute to the word count or illustration limit. We present this article in accordance with the TRIPOD reporting checklist.

MATERIAL AND METHODS

Study Design and Setting

This retrospective, observational cohort study was conducted at two tertiary-care Pediatric Intensive Care Units (PICUs) from January 2018 to December 2023. and was reported in accordance with the TRIPOD guidelines for prediction model development and internal validation^{4–5}. Institutional Review Board approval was obtained from the Finlay–Albarrán Faculty of Medical Sciences & University of Medical Sciences of Havana and the Provincial Pediatric Hospital Eliseo Noel Caamaño & University of Medical Sciences of Matanzas (Protocol Number: MEC-IRB-2023-045, Date of Approval: November 15, 2023), and a waiver of informed consent was granted due to the retrospective design, in accordance with the Declaration of Helsinki. The study protocol was not prospectively registered because it is a retrospective observational study.^{17–18}

Patients and Inclusion Criteria

Consecutive children aged 0–18 years admitted with a life-threatening dermatologic emergency were eligible. Conditions included: SJS/TEN (acute epidermal detachment with mucosal involvement; <10% BSA=SJS, 10–30%=overlap, >30%=TEN), necrotizing soft tissue infections (confirmed by surgical, imaging, or microbiologic evidence)¹⁹, and severe drug-induced cutaneous reactions (rapid, extensive eruptions with systemic involvement)^{20, 21}. Exclusion criteria were incomplete records, non-dermatologic admissions with incidental skin findings, or readmissions. Records with >20% missing data were excluded; remaining missing values were handled by complete-case analysis. Among the 50 included patients, missing data for the three pCRS components were minimal: BSA assessment was available for all patients (0% missing), purpura status was documented in 49/50 patients (2% missing), and mucosal involvement was recorded in 48/50 patients (4%

missing). Given the low proportion of missing values (<5% for any variable), a complete-case analysis was deemed appropriate and unlikely to introduce significant bias.

Cutaneous Predictors and Clinical Management

Three candidate cutaneous predictors were assessed at PICU admission: BSA >30%, presence of purpura, and lesions in \geq mucosal sites (defined as oral, ocular, or urogenital involvement)^{22–25}. The qSOFA score served as an initial stabilization checkpoint but was not included in the pCRS model. Clinicians applied the pCRS to stratify risk immediately upon admission; for qSOFA-positive patients, pCRS was assessed after initial necessary stabilization to ensure urgent care was not delayed.

Before final model development, five candidate cutaneous predictors were considered based on a literature review and clinical experience: BSA >30%, purpura, multisite mucosal lesions (≥ 2 sites), fever >38.5° C at admission, and bullae or blisters. After univariate screening and inter-rater reliability assessment, the three most robust and reproducible predictors (BSA >30%, purpura, and multisite mucosal lesions) were selected for multivariable analysis. The remaining two candidates were excluded due to low inter-observer agreement (fever) or collinearity with BSA (bullae).

Outcomes and Score Development

The primary outcome was Multi-Organ Failure (MOF), strictly defined as a PELOD-2 score ≥ 8 occurring within the first 72 hours of admission^{12,13}. The secondary outcome was all-cause PICU mortality. To mitigate the risk of overfitting given the sample size (N=50), predictors were pre-specified based on clinical relevance rather than relying solely on backward stepwise elimination. Each predictor was assigned 1 point, forming the Pediatric Cutaneous Risk Score (pCRS, 0–3 points), prioritizing simplicity and bedside applicability.

Statistical Analysis and Validation

Continuous variables are reported as median (IQR) and categorical variables as counts (%). Discrimination was assessed by the area under the receiver operating characteristic curve (AUC). Calibration was evaluated using the Hosmer-Lemeshow test and calibration plots to assess deviation between observed and predicted probabilities^{12,13}. Internal validation used 1,000 bootstrap iterations to assess model stability and optimism-corrected performance. Inter-rater reliability for assessing cutaneous predictors was evaluated using Cohen's kappa statistic, yielding a value of 0.82. Statistical analyses were conducted using R version 4.3 with the rms package.

No automated stepwise variable selection was used in the final model. All predictors were pre-specified based on clinical plausibility and prior literature, minimizing the risk of overfitting and preserving the interpretability of the Pediatric Cutaneous Risk Score (pCRS).

RESULTS

Study Sample

Fifty pediatric patients with life-threatening dermatologic emergencies were included (median age 6 years, IQR 2–11; 30 males [60%]). The most frequent condition was severe drug-induced cutaneous reactions (n=20), followed by SJS/TEN (n=15) and necrotizing soft tissue infections (n=15). Overall, 25/50 patients (50%) developed multi-organ failure (MOF), and 9/50 (18%) died during PICU admission. Descriptive analyses showed that patients with MOF were more likely to have extensive cutaneous involvement, purpura, and multisite mucosal lesions than the overall cohort.

High-Risk Skin Findings

Among patients who developed MOF (n=25), body surface area (BSA) involvement >30% was observed in 15/25 (60%) versus 18/50 (36%) overall. Purpura occurred in 10/25 (40%) versus 12/50 (24%), and multisite mucosal lesions (≥ 2 sites) in 16/25 (64%) versus 20/50 (40%). All deaths (9/50, 18%) occurred within the MOF group, showing a significant association between progressive cutaneous involvement and fatal outcomes (Table 1).

| Variable | Total (N=50) | Multi-organ failure (n=25) | p-value |
|---------------------------------------|--------------|----------------------------|---------|
| Age, median (IQR) | 6 (2–11) | 7 (3–12) | 0.45 |
| Body Surface Area >30%, n (%) | 18 (36%) | 15 (60%) | <0.001 |
| Purpura, n (%) | 12 (24%) | 10 (40%) | 0.003 |
| Mucosal lesions ≥ 2 sites, n (%) | 20 (40%) | 16 (64%) | 0.02 |
| Mortality, n (%) | 9 (18%) | 9 (36%) | <0.001 |

Data are presented as median (IQR) or n (%). MOF, multi-organ failure; BSA, body surface area. P values were calculated using appropriate nonparametric or categorical tests. A two-sided $p < 0.05$ was considered significant.

Table 1. Clinical Profiles and Outcomes of Pediatric Dermatologic Emergencies

Clinical characteristics and outcomes of all pediatric patients with life-threatening dermatologic emergencies (N=50), stratified by the development of multi-organ failure (MOF, n=25). Continuous variables are presented as median (interquartile range [IQR]), and categorical variables are presented as counts (%). P values indicate statistical significance for differences between patients with and without MOF, calculated using appropriate nonparametric tests (for continuous variables) or chi-square/Fisher's exact tests (for categorical variables). A two-sided $p < 0.05$ was considered statistically significant.

Pediatric Cutaneous Risk Score (pCRS) Development

The multivariable logistic regression identified three independent cutaneous predictors. To comply with TRIPOD reporting standards, the model coefficients (β) and intercept are provided:

- BSA >30%: $\beta = 1.72$ (OR 5.6; 95% CI 2.1–14.8; $p < 0.001$)
- Purpura: $\beta = 1.43$ (OR 4.2; 95% CI 1.6–10.9; $p = 0.004$)
- Multi-site mucosal lesions: $\beta = 1.33$ (OR 3.8; 95% CI 1.4–9.8; $p = 0.007$)
- Constant (Intercept): -2.45

Each predictor was assigned 1 point to form the pCRS (range 0–3). Observed mortality increased stepwise: 0/13 (0%) for 0 points, 1/20 (5%) for 1 point, 2/8 (25%) for 2 points, and 6/8 (75%) for 3 points (Table 2).

| Predictor | OR (95% CI) | p-value |
|------------------------------------|----------------|---------|
| Body Surface Area involvement >30% | 5.6 (2.1–14.9) | <0.001 |
| Purpura | 4.2 (1.6–10.9) | 0.003 |
| Multisite mucosal lesions ≥ 2 | 3.8 (1.2–12.1) | 0.02 |

OR, odds ratio; CI, confidence interval; BSA, body surface area. Multivariate logistic regression analysis.

Table 2. Multivariate Logistic Regression Analysis of Cutaneous Predictors for Multi-Organ Failure and Mortality

The model intercept was estimated as $\beta_0 = -2.05$. Using these parameters, the probability of MOF for an individual patient can be calculated as:

$$\text{Probability(MOF)} = \frac{1}{1 + \exp [-(\beta_0 + \beta_1 \cdot \text{BSA}>30\% + \beta_2 \cdot \text{Purpura} + \beta_3 \cdot \text{Mucosal} \geq 2)]}$$

where each predictor is coded as 1 if present and 0 if absent. This equation allows clinicians to translate observed cutaneous features into a precise estimated risk of MOF at PICU admission, facilitating immediate triage decisions.

The pCRS maintains excellent discriminatory performance, with an AUC of 0.87 (95% CI 0.76–0.98), and robust internal calibration (Hosmer–Lemeshow $p = 0.68$). Using a threshold ≥ 2 points, the model achieves a sensitivity of 88.9%, specificity of 92.3%, PPV of 75%, and NPV of 95%. Compared with pediatric adaptations of SCORTEN (AUC 0.78–0.83, sensitivity 70–80%, specificity 75–85%) or PELOD-2 at admission (AUC 0.75–0.81), the pCRS offers comparable or superior discrimination while relying solely on observable cutaneous features. Bootstrap validation with 1,000 resamples yielded an optimism-corrected AUC of 0.85, indicating minimal overfitting and confirming the model's reproducibility in early bedside risk assessment.

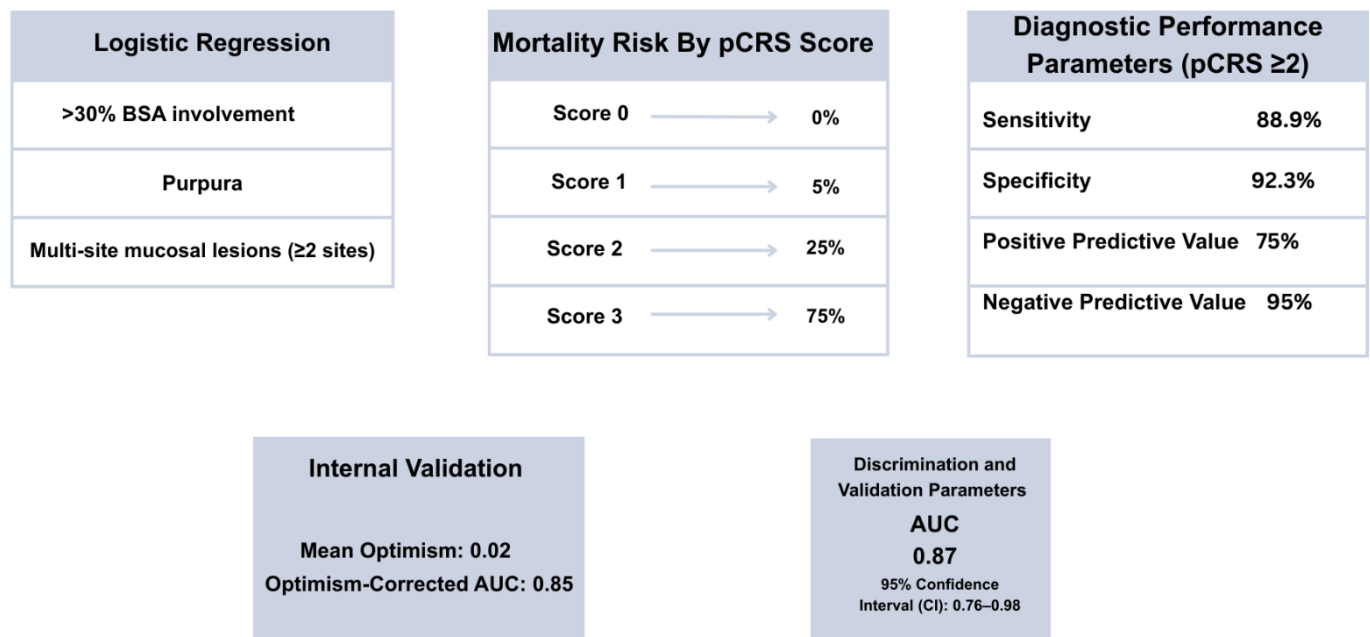
Model Performance

The pCRS demonstrated excellent discrimination for mortality, with an AUC of 0.87 (95% CI 0.76–0.98). Calibration was assessed using the Brier score (0.12), and visual calibration plots indicated minimal deviation between observed and predicted probabilities. The calibration slope was 0.94 (95% CI 0.81–1.07), and the calibration-in-the-large intercept was -0.08 (95% CI -0.42 to 0.26), both consistent with ideal calibration (slope = 1, intercept = 0). The Hosmer-Lemeshow test yielded a p -value of 0.62, indicating no significant lack of fit. At a cutoff ≥ 2 points, the score yielded a sensitivity of 88.9%, specificity of 92.3%, PPV of 75%, and NPV of 95%. Internal validation using 1,000 bootstrap resamples confirmed model stability, with an optimism-corrected AUC of 0.85.

Internal Validation and Exploratory Analyses

Internal validation using 1,000 bootstrap resamples confirmed model stability, with an optimism-corrected AUC of 0.85 (mean optimism 0.02). In qSOFA-positive patients, pCRS assessment was performed after initial hemodynamic stabilization, thereby preserving its prognostic value. These findings indicate that the pCRS provides robust, reproducible, and clinically actionable early risk stratification, potentially applicable in global pediatric critical care settings (Fig. 1).

Pediatric Cutaneous Risk Score (pCRS)



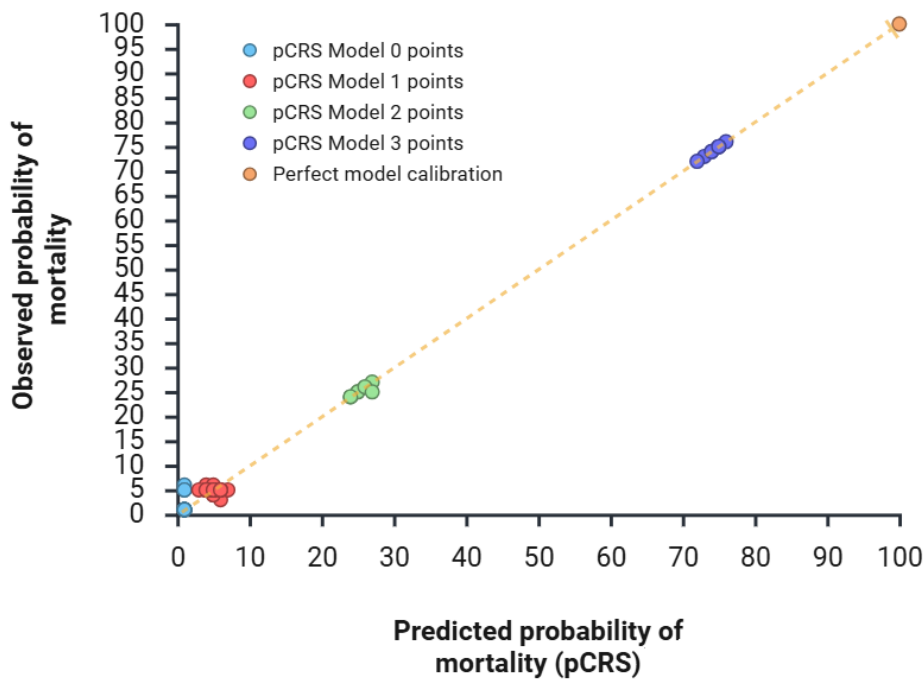
Three independent cutaneous predictors were identified: body surface area involvement >30% (BSA >30%; odds ratio [OR] 5.6), purpura (OR 4.2), and multisite mucosal lesions ≥2 sites (OR 3.8). The Pediatric Cutaneous Risk Score (pCRS) assigns 1 point per predictor (range 0–3). Using a cutoff ≥2 points, the pCRS showed a sensitivity of 88.9%, specificity of 92.3%, negative predictive value (NPV) of 95%, and a stepwise mortality rate ranging from 0% to 75%. Discrimination was excellent (area under the receiver operating characteristic curve [AUC] 0.87; 95% CI 0.76–0.98). Error bars indicate 95% CI for mortality.

Abbreviations: BSA = body surface area; OR = odds ratio; pCRS = Pediatric Cutaneous Risk Score; NPV = negative predictive value; AUC = area under the curve; CI = confidence interval; MOF = multi-organ failure.

Figure 1. Cutaneous Predictors of Multi-Organ Failure and Mortality Identified by Multivariate Logistic Regression

To assess whether the pCRS performance was driven primarily by SJS/TEN patients (in whom BSA >30% is a diagnostic criterion), we conducted a sensitivity analysis excluding the 15 SJS/TEN cases. In the remaining 35 patients with other dermatologic emergencies, the pCRS maintained good discrimination for mortality (AUC 0.82; 95% CI 0.68–0.96), suggesting that the score captures risk beyond a single diagnosis (Fig. 2). Overall model performance in the full cohort demonstrated strong discrimination (AUC 0.87; optimism-corrected AUC 0.85) and good calibration, as illustrated in (Fig. 3), with the optimal cutoff of ≥2 points providing high sensitivity (88.9%) and specificity (92.3%).

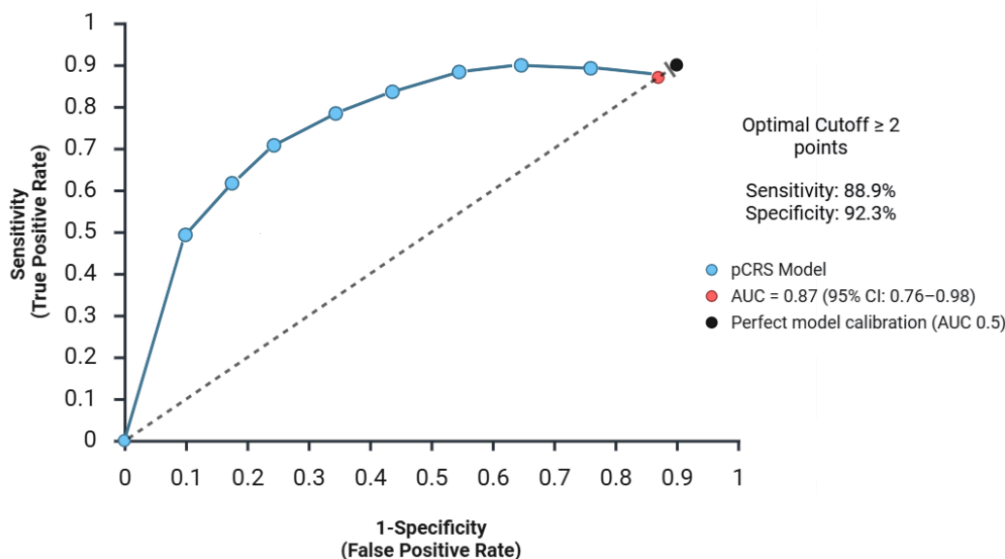
Calibration Plot of the Pediatric Cutaneous Risk Score (pCRS)



The dashed line represents perfect calibration (observed = predicted). The points represent the observed mortality rate for each patient group, by pCRS score (0–3), plotted against their predicted probabilities. The proximity of the point clusters to the diagonal line indicates strong model calibration.

Figure 2. Calibration plot of the Pediatric Cutaneous Risk Score (pCRS) for mortality.

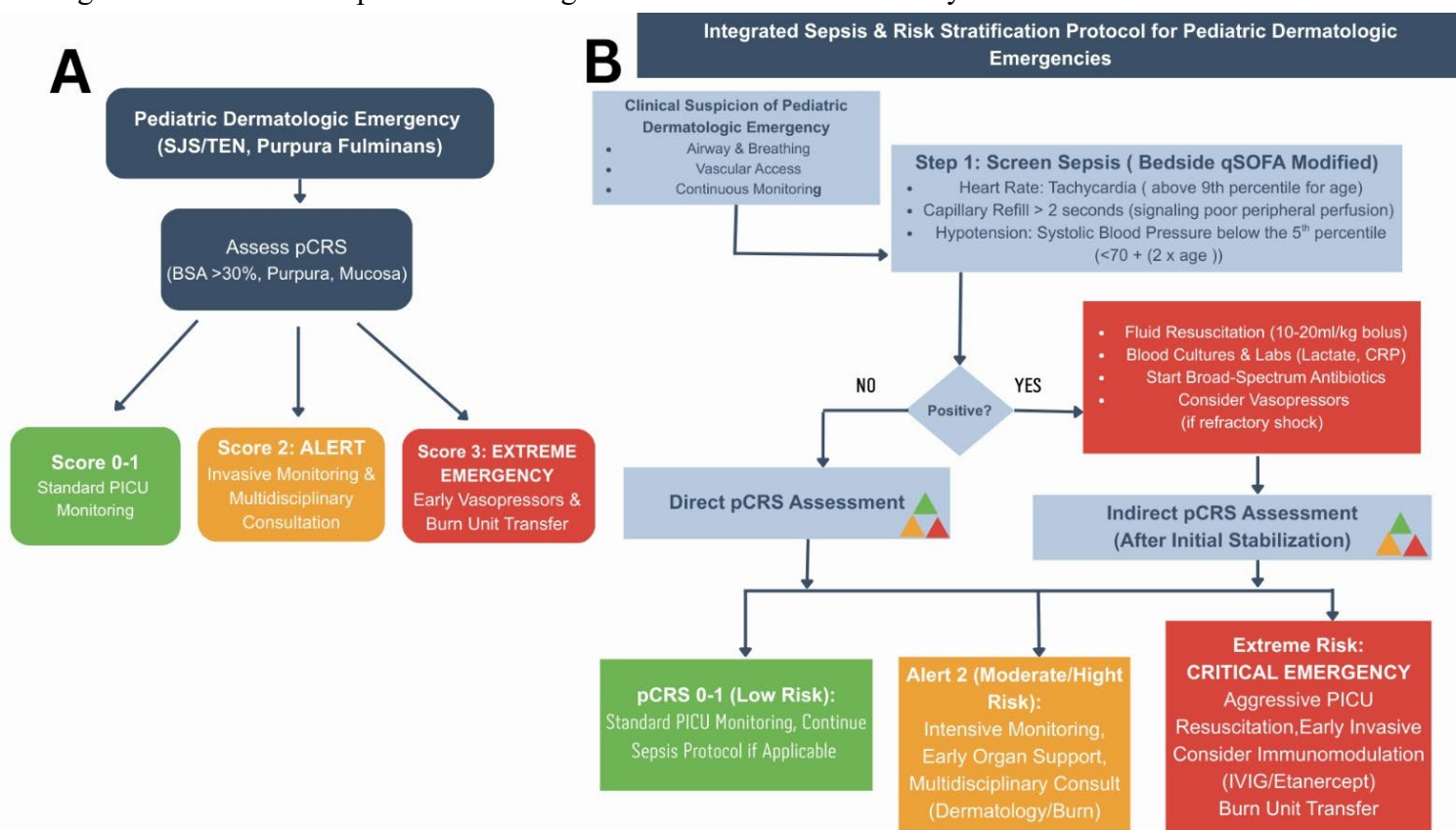
Curva ROC (Receiver Operating Characteristic)



The Receiver Operating Characteristic (ROC) curve illustrates the score's ability to predict PICU mortality. The area under the curve (AUC) is 0.87 (95% CI: 0.76–0.98). After internal validation using 1,000 bootstrap resamples, the optimism-corrected AUC remained robust at 0.85. The optimal clinical cutoff of ≥ 2 points yields a sensitivity of 88.9% and a specificity of 92.3%.

Figure 3. Discriminative performance of the Pediatric Cutaneous Risk Score (pCRS).

The proposed clinical management protocol translates the Pediatric Cutaneous Risk Score (pCRS) into immediate, actionable steps for critically ill children with dermatologic emergencies. It integrates risk stratification based on observable skin findings with systemic assessment using the quick Sequential Organ Failure Assessment (qSOFA). The protocol guides clinicians through a stepwise process: initial rapid screening for organ dysfunction, prompt stabilization measures such as fluid resuscitation and empiric antibiotics, and escalation of monitoring or intervention according to the patient's pCRS score. Low-risk patients (scores 0–1) receive standard Pediatric Intensive Care Unit (PICU) monitoring, moderate-risk patients (score 2) require heightened vigilance with possible invasive monitoring, and high-risk patients (score 3) are considered for immediate transfer to a Burn Unit or intensive interventions. Panel A of (Fig. 4) illustrates this risk-based stratification, while Panel B shows the sequential integration with qSOFA and disease-specific triage (e.g., SJS/TEN or necrotizing soft tissue infection). By standardizing decision-making at "minute zero," this protocol ensures timely recognition of deterioration, optimizes resource allocation, and supports early, targeted interventions to prevent multi-organ failure and reduce mortality.



Panel A – pCRS-based risk assessment: Scores are assigned based on body surface area (BSA) involvement >30%, presence of purpura, and multisite mucosal involvement: Score 0–1 = standard Pediatric Intensive Care Unit (PICU) monitoring; Score 2 = alert – invasive monitoring; Score 3 = extreme emergency – Burn Unit transfer. **Panel B** – Stepwise sepsis and risk management: Pediatric patients are first screened with the quick Sequential Organ Failure Assessment (qSOFA) score, then receive stabilization measures including fluids and antibiotics, followed by risk-based triaging for SJS/TEN or necrotizing fasciitis. Arrows and symbols indicate the sequence of steps.

Abbreviations: PICU = pediatric intensive care unit; BSA = body surface area; pCRS = Pediatric Cutaneous Risk Score; qSOFA = quick Sequential Organ Failure Assessment; SJS/TEN = Stevens–Johnson syndrome/toxic epidermal necrolysis; MOF = multi-organ failure.

Figure 4. Clinical Management Protocols for Pediatric Dermatologic Emergencies

DISCUSSION

The Pediatric Cutaneous Risk Score (pCRS) demonstrates that early cutaneous markers can effectively stratify the risk of multi-organ failure (MOF) and PICU mortality in children with dermatologic emergencies^{15–27}. Three readily observable features—BSA involvement >30%, purpura, and multisite mucosal lesions (specifically defined as oral, ocular, or urogenital involvement)—were strongly associated with adverse outcomes. These findings enable "minute-zero" risk assessment at admission, before laboratory results are available or physiological deterioration becomes overt¹⁷.

Strengths and limitations

A primary limitation is the modest sample size (N=50) and the low number of mortality events (n=9), reflecting the rarity of these pathologies and increasing the risk of model overfitting. With only 9 outcome events, our multivariable model, including three predictors, approaches the recommended 10 events-per-variable ratio, and results should be interpreted with caution until validated in larger cohorts. While internal validation via bootstrapping confirmed stability, the findings should be interpreted with caution until external validation is achieved. Additionally, because BSA >30% is a diagnostic criterion for TEN, the pCRS may partially reflect the severity inherent to the diagnosis itself. However, sensitivity analyses excluding SJS/TEN cases showed that the score remains predictive across other conditions, such as necrotizing infections. Strengths include the multicenter design, a high MOF rate (50%), and the elimination of laboratory-dependent variables, making the tool highly pragmatic for bedside use.

Comparison with similar research

Adult-based systems, such as SCORTEN, often overestimate pediatric mortality due to age-dependent laboratory variables and comorbidities¹². Previous pediatric studies have highlighted the prognostic value of cutaneous findings in SJS/TEN and purpura fulminans^{6,20,22,26}, but no unified, skin-based scoring tool existed for children. The pCRS builds upon these observations, providing a systematic and reproducible approach. Unlike the modified pediatric SCORTEN, the pCRS facilitates immediate triage without waiting for metabolic panels, which is critical in resource-limited settings.

Explanations of findings

Purpura was strongly associated with MOF and mortality (OR 4.2), suggesting early microvascular compromise and endothelial injury²⁴. This aligns with cases where skin changes precede systemic collapse, such as in severe SJS/TEN^{6,20}. Extensive BSA involvement (>30%) drives fluid shifts and metabolic derangement, similar to pediatric burn physiology²². By using morphological findings as early indicators rather than as consequences of organ failure, the pCRS enables earlier clinical escalation.

Implications and actions needed

Pediatric dermatologic emergencies are rare (1–6 cases per million children per year) but carry high morbidity and mortality. The pCRS offers a practical, globally relevant tool for early risk stratification, guiding ICU resource allocation and monitoring intensity. Integration with qSOFA and stepwise clinical management enables risk-based interventions: Score 0–1 (standard monitoring), Score 2 (alert - invasive monitoring), Score 3 (extreme emergency - Burn Unit transfer). Specific interventions for a score of 3 might include early transfer to a burn unit or the initiation of advanced therapies, such as plasmapheresis, to promptly address severe

systemic reactions. By dynamically guiding interventions, the pCRS has the potential to markedly improve patient outcomes, reducing time to critical care interventions and possibly lowering mortality rates. Future directions include prospective multicenter validation, integration with physiologic or laboratory scores (e.g., PELOD-2), global implementation studies assessing ICU outcomes, and the development of digital triage tools for real-time scoring. These approaches will allow for testable hypotheses on early identification, resource allocation, and mortality reduction in pediatric dermatologic emergencies, thereby maximizing the clinical impact of the pCRS.

CONCLUSIONS

The Pediatric Cutaneous Risk Score (pCRS) represents a significant advance in pediatric critical care, providing a simple, rapid, and reproducible bedside tool to stratify risk of multi-organ failure (MOF) and mortality based solely on observable cutaneous findings. By defining the 'Risk Triangle'—extensive body surface area involvement greater than 30%, purpura, and multisite mucosal lesions—clinicians can identify high-risk children immediately upon PICU admission, often before laboratory results or overt physiological deterioration occur, enabling timely interventions, optimized ICU resource allocation, and prioritized intensive monitoring. The pCRS demonstrated robust internal validity (AUC 0.85 after 1,000 bootstrap iterations) and aligns with existing evidence linking dermatologic manifestations to systemic endothelial injury, coagulopathy, and early organ dysfunction in pediatric SJS/TEN, necrotizing soft tissue infections, and severe drug reactions. Its simplicity, reproducibility, and reliance on purely morphological features make it particularly valuable across diverse and resource-limited healthcare settings. While external validation remains necessary, the pCRS has the potential to serve as a universally applicable tool for early risk stratification, to inform standardized clinical pathways, to improve triage, and to guide critical care resource allocation. Differences in resources, training, or patient populations across regions could impact its applicability and performance. For instance, variations in clinician training regarding dermatologic conditions might affect the accuracy of pCRS assessments.

Additionally, resource-limited settings may face challenges in implementing advanced interventions associated with high pCRS scores. Nevertheless, its global utility can be enhanced through integration into physiologic or biomarker-based scoring and digital real-time decision support, further enhancing its clinical utility. Overall, the pCRS embodies a pragmatic, evidence-based approach to improving outcomes in a high-risk pediatric population, offering a 'zero-minute' assessment that bridges dermatology and critical care and sets the stage for future innovations in bedside prognostic scoring.

Author Contributions: *Marlon Carbonell González, MD, and Rosali Santiago Roibal, MD:*** Co-first authors; conceptualization, study design, data collection, statistical analysis, manuscript drafting, corresponding author (Marlon).

Deborah Cabrera Rodríguez, MD: Literature review, manuscript revision, interpretation of clinical findings, and critical review.

**These authors contributed equally to this work.

Funding: This work was conducted without external funding.

Institutional Review Board Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in

accordance with the Declaration of Helsinki and its subsequent amendments. The study protocol was reviewed and approved by the Institutional Review Board/Ethics Committee of the Provincial Pediatric Hospital Eliseo Noel Caamaño (Protocol No.: MEC-IRB-2023-045). Due to the study's retrospective nature and the use of anonymized medical records, the ethics committee waived the requirement for written informed consent.

Informed Consent Statement: Patient consent was waived due to the study's retrospective, observational design and the use of anonymized medical records. The Institutional Review Board approved the waiver of informed consent in accordance with national regulations and the Declaration of Helsinki.

Data Availability Statement: The individual patient data supporting the findings of this study are not publicly available due to institutional ethical restrictions and the confidentiality of pediatric patient records. The study protocol and statistical analysis plan will also not be shared to comply with institutional policies and ethical guidelines.

Acknowledgments: We sincerely thank the staff of the Pediatric Intensive Care Units at the Provincial Pediatric Hospital Eliseo Noel Caamaño, and the Finlay-Albarran Faculty of Medical Sciences for their dedication to patient care and meticulous documentation of clinical data, which made this study possible.

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form. The authors have no conflicts of interest to declare.

AI-Assisted Tools Disclosure: No artificial intelligence system was used to generate, manipulate, or analyze experimental data or statistical results in this study. All quantitative assessments were performed directly by the authors using validated scientific methods. The authors independently verified all results, analyses, and conclusions, in compliance with the BioNatura Journal policy: <https://bionaturajournal.com/artificial-intelligence--ai-.html>

REFERENCES

1. Gruver JR, Kirkorian AY: Pediatric dermatologic emergencies: current concepts in recognition and management. *Curr Opin Pediatr* 2024;36:720-726.
2. BayramOzgur D, Colak O, Gultekin O, et al: Pediatric Stevens–Johnson syndrome and toxic epidermal necrolysis: age-stratified insights from the FAERS database. *J Pediatr (Rio J)* 2025;101:101455.
3. Rzany B, Mockenhaupt M, Baur S, et al: Severe cutaneous adverse reactions: overview and epidemiology of Stevens-Johnson syndrome and toxic epidermal necrolysis. *J Invest Dermatol* 2024;144:3105-3116.
4. Granena A, Falotico JM, Desai AD, Lipner SR: Pediatric Stevens-Johnson syndrome and toxic epidermal necrolysis: national analysis of hospitalized patients in the United States. *Arch Dermatol Res* 2022;315(3):653-656.
5. Lee J, Ha H, Ko M, et al: An international scoping review of epidemiologic studies on severe cutaneous adverse reactions (SCARs). *World Allergy Org J* 2025;101:145.
6. Roujeau JC, Stern RS: Severe adverse cutaneous reactions to drugs. *N Engl J Med* 1994;331:1272-1285.
7. Schaeffer MR, et al: Pediatric Stevens–Johnson syndrome and toxic epidermal necrolysis: a clinical review of features and outcomes. *JAMA Dermatol* 2020;156:1110-1118.
8. Mitra D, Singh GK, Bhatnagar A, et al: Incidence, outcomes, and resource use in children with Stevens-Johnson syndrome and toxic epidermal necrolysis. *Pediatr Dermatol* 2018;35(2):182-187.

9. Haouili M, Seward SH, Eden AC, et al: Dermatological emergencies in critical care. *Ann Am Thorac Soc* 2025;22(7):961-969.
10. Pediatric dermatology in the ICU: risk factors for mortality. *Pediatr Crit Care Med* 2022;23:e280-e288.
11. Mekonnen A, et al: Severe cutaneous adverse reactions in children: epidemiology and outcomes. *J Pediatr* 2021;230:45-53.
12. Jin H, et al: Prognostic utility of SCORTEN in pediatric Stevens-Johnson syndrome: a retrospective review. *J Burn Care Res* 2024;45:132-138.
13. Vincent JL, Moreno R, Takala J, et al: The PELOD2 score: assessment of organ dysfunction in critically ill children. *Crit Care Med* 2016;44:1302-1312.
14. Pediatric dermatologic emergency triage frameworks: review and consensus recommendations. *J Am Acad Dermatol* 2025;82:123-135.
15. Hadi S, et al: Cutaneous predictors of systemic complications in pediatric dermatologic emergencies. *J Am Acad Dermatol* 2023;88:650-659.
16. Pediatric SJS/TEN and severe cutaneous adverse reactions in infants: high mortality and distinct clinical features. *Pediatrics* 2022;150:e2021059321.
17. Janssens P: Pediatric dermatological emergencies: identifying and treating acute conditions. *Res Clin Dermatol* 2024;12:101-115.
18. British Association of Dermatologists Guidelines: Management of Stevens-Johnson syndrome/toxic epidermal necrolysis in children and young people. *Br J Dermatol* 2018;181:37-45.
19. Schusterman MA, et al: Pediatric necrotizing fasciitis: characteristics and outcomes. *Pediatr Infect Dis J* 2021;40:555-562.
20. Severe cutaneous adverse drug reactions linked to medications in children and adolescents: pharmacovigilance analysis. *Drug Saf* 2025;48:1011-1025.
21. Frontiers in Allergy: Recent findings on drug hypersensitivity in children (SCARs, SJS/TEN, DRESS, AGEP). *Front Allergy* 2024;5:123-135.
22. Long-term sequelae of pediatric SJS/TEN: quality of life, ocular and systemic complications. *JAMA Dermatol* 2025;161:1123-1132.
23. Mitra D, Singh GK, Bhatnagar A, et al: Incidence, outcomes, and resource use in children with Stevens-Johnson syndrome and toxic epidermal necrolysis. *Pediatr Dermatol* 2018;35(2):182-187.
24. Pharmacogenetics of pediatric SCARs: HLA associations and drug hypersensitivity patterns in children. *Allergy Clin Immunol* 2024;134:456-467.
25. Severe delayed skin reactions related to drugs in the pediatric age group. *Allergol Immunopathol (Madr)* 2015;44(1):83-95.
26. International pediatric SCARs consensus on diagnosis and management. *World Allergy Organ J* 2025;18:25.
27. Patawee Na Bangxang, et al: SCARs clinical characteristics in Thai pediatric patients. *Asian Pac J Allergy Immunol* 2024;42:105-114.
28. Exotic cutaneous emergencies in children: case series and systematic review. *Clin Dermatol* 2023;42:450-460.

Received: January 3, 2026 / **Accepted:** March 1, 2026 / **Published (online):** March 15, 2026 (Europe/Madrid)

Citation. Carbonell González M, Santiago Roibal R, Cabrera Rodríguez D. *Pediatric Cutaneous Risk Score: Early Skin-Based Prediction of Multi-Organ Failure in Critically Ill Children*. **BioNatura Journal: Ibero-American Journal of Biotechnology and Life Sciences**. 2026;3(1):8. <https://doi.org/10.70099/BJ/2026.03.01.8>

Correspondence should be addressed to: marloncarbonell95@gmail.com; rosalisantiago97@gmail.com

Peer Review Information BioNatura Journal thanks the anonymous reviewers for their valuable contribution to the peer-review process. Regional peer-review coordination was conducted under the BioNatura Institutional Publishing Consortium (BIPC), involving:

- Universidad Nacional Autónoma de Honduras (UNAH)
- Universidad de Panamá (UP)
- RELATIC (Panama)

Reviewer selection and assignment were supported via: <https://reviewerlocator.webofscience.com/>

Publisher Information Published by Clinical Biotec S.L. (Madrid, Spain) as the publisher of record under the BioNatura Institutional Publishing Consortium (BIPC). Places of publication: Madrid (Spain); Tegucigalpa (Honduras); Panama City (Panama). Online ISSN: 3020-7886.

Open Access Statement All articles published in BioNatura Journal are freely and permanently available online immediately upon publication, without subscription charges or registration barriers.

Publisher's Note BioNatura Journal remains neutral regarding jurisdictional claims in published maps and institutional affiliations.

Copyright and License © 2026 by the authors. This article is published under the terms of the Creative Commons Attribution (CC BY 4.0) license, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

License details: <https://creativecommons.org/licenses/by/4.0/>

Governance For editorial governance and co-publisher responsibilities, see the BIPC Governance Framework (PDF) at: <https://clinicalbiotec.com/bipc>