

Effective Preventive Strategies for Pressure Injuries in Neonatal and Pediatric Intensive Care: Analysis of an Implemented Pathway

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Abstract

Introduction. This descriptive observational study aimed to assess the impact of a structured pressure injury (PI) prevention program on the incidence of PIs in critically ill neonatal and pediatric patients implemented in the Neonatal and Pediatric Intensive Care Unit of the IRCCS Istituto Giannina Gaslini. The program, coordinated by a nurse specialized in wound care, included the use of pediatric risk assessment tools (Braden, Braden Q, and Glamorgan scales), evidence-based protocols, frequent repositioning, support surfaces, and targeted staff training.

Methods. The primary objective was to assess the impact of these interventions on the incidence of PIs. Prospective data collection was carried out to document the implementation of the measures and the progression of PIs.

Results. A direct comparison between data collected prior to the systematic introduction of preventive strategies (incidence rate: 5.6%) and data collected after program implementation (average incidence rate: 1.6%) revealed an overall 71% reduction in PI cases.

Discussion. The program's success appears to be linked to a multifactorial approach: systematic risk assessment, continuous staff training, and the use of appropriate support devices and dressings. The role of the wound care nurse proved essential for clinical supervision and team engagement. However, fluctuations in incidence rates during staff turnover periods highlight the need for sustained education and a strong culture of prevention. The variable application of risk assessment tools also suggests that standardized use and interpretation should be promoted to improve consistency.

Conclusions. The adoption of a structured, multidisciplinary program—with the involvement of a wound care specialist nurse

and the use of pediatric-specific assessment tools—appears promising in reducing the incidence of pressure injuries in critically ill neonatal and pediatric patients. Further prospective studies are needed to confirm these results and to identify specific risk predictors.

Keywords: Pressure Injuries, Pediatric Intensive Care Unit, Prevention Program, Risk Assessment, Staff Training

Introduction

Pressure injuries (PIs) are among the most common and preventable complications in hospitalized patients,¹ with significant repercussions on quality of life, length of hospital stays, morbidity and overall healthcare costs. Although traditionally considered a problem primarily affecting adult and geriatric populations, recent scientific literature has increasingly drawn attention to the pediatric population, recognizing that newborns, infants and children – especially those hospitalized in critical settings such as intensive care – are also at risk.^{2,3}

In pediatric patients, PIs often exhibit distinct characteristics due to the fragility of their skin, the high incidence of complex pathological conditions, and the frequent, prolonged use of both invasive and non-invasive medical devices (probes, endotracheal tubes, CPAP masks, pulse oximeters, etc.). Particularly in premature infants or children with serious chronic or unstable pathologies, factors such as prolonged immobility, poor nutritional status, hemodynamic alterations, and invasive ventilatory assistance represent determining risk variables for the development of PIs.^{1,4}

The prevalence of PIs in Neonatal Intensive Care Units (NICU) and Pediatric Intensive Care Units (PICU) can vary widely, depending on organizational characteristics, clinical practices, and the implementation of preventive strategies.⁵ However, a proactive prevention approach – centered on early and systematic risk assessment, evidence-based protocols, and ongoing staff training – has been shown to significantly reduce the incidence of these adverse events.^{1,3}

Within this context, this study aims to assess the effectiveness of a structured PIs prevention program implemented at the Complex Operative Unit of Neonatal and Pediatric Intensive Care of the IRCCS Istituto Giannina Gaslini. The primary

objective was to evaluate the impact of specific interventions – such as the introduction of pediatric-specific risk assessment tools, nursing staff training programs, and the routine adoption of preventive care measures – on the incidence of PIs over a multi-year period.

Through this study, we aim to contribute to the dissemination of best practices and to promote a culture of prevention – an essential element in ensuring patient safety, equity, and quality of care in intensive settings dedicated to the most vulnerable patients.

Method and Materials

Study Design

This descriptive observational study was conducted to assess the impact of a structured pressure injury (PI) prevention program on the incidence of pressure injuries in a neonatal and pediatric intensive care setting.

Setting and Sample

The study was carried out in the Neonatal and Pediatric Intensive Care Unit of the IRCCS Istituto Giannina Gaslini. The unit comprises 16 beds (expandable to 21) and is staffed by a team of over 60 nurses, all highly specialized in the care of critically ill neonatal and pediatric patients. Data were collected over a seven-month period (from July 1 to January 31) for each of the following years: 2019–2020, 2020–2021, and 2021–2022. A further data collection phase occurred from July 1, 2023, to January 31, 2024, after the implementation of the Glamorgan Scale.

Nursing Staff Involved

As part of the project, a nurse specialized in wound care was appointed to coordinate the prevention and management of pressure injuries. In collaboration with the Directorate of Health Professions (DIPS), this nurse played a key role in designing, implementing, and monitoring a structured program aimed at

reinforcing preventive strategies. The specialist also ensured adherence to protocols, offered continuous on-site support, and promoted team engagement.

The prevention strategies implemented encompassed several actions: increasing staff awareness through dedicated training sessions on pressure injuries, risk assessment tools, and evidence-based care practices; reviewing and updating clinical procedures according to international EPUAP/NPIAP/PPPIA guidelines;⁶ increasing the frequency of repositioning; using pressure-relieving support surfaces appropriate to patient weight; applying prophylactic dressings; and conducting systematic skin assessments to detect early signs of injury. The specialist nurse maintained a continuous supervisory role, provided operational support, and ensured consistent team adherence to the prevention protocol.

Assessment Tools

To assess the risk of pressure injuries (PI), several age-specific tools were used during the study period (Table 1).

Table 1. Overview of the pressure injury risk assessment tools adopted in the study, detailing the target age range, main evaluated factors, and specific implementation notes. The tools supported age-appropriate and clinically tailored risk stratification in the neonatal and pediatric intensive care setting.

Assessment Tool	Target	Age Evaluated	Factors Notes
Braden ⁷	> 8 years	Sensory perception, moisture, activity, mobility, nutrition, friction/shear	Used in patients > 8 years
Braden Q ⁸	3–8 years	Mobility, activity, moisture, sensory perception, friction/shear, general condition, medical devices	Validated for pediatric use, adapted from Braden
Glamorgan ⁹	0–18 years	Medical devices, mobility, nutritional status, neurological condition, tissue perfusion, skin condition	Adopted since 2023 as the main tool for all pediatric ages

Initially, PI risk assessment was performed using different tools based on patient age: the Braden Scale for patients over 8 years of age, the Braden Q for children between 3 and 8 years, and a structured clinical assessment for those under

3 years.

While these tools initially allowed for age-appropriate and clinically tailored risk assessments, their heterogeneity posed challenges in terms of standardization, documentation, and data comparability within the unit.

To overcome these limitations and harmonize the assessment process, the Glamorgan Scale was systematically introduced in January 2023. This tool was selected for its validated application across a broad pediatric age range (0–18 years) and its inclusion of critical risk factors such as the use of medical devices. The adoption of a single, standardized tool aimed to ensure a more consistent, reproducible, and clinically relevant approach to PI risk stratification in critically ill pediatric patients.

Data Collection

A dedicated data collection tool was created to monitor the implementation of preventive strategies, including: 1) Daily number of repositioning interventions; 2) Use of pressure-relieving support surfaces; 3) Application of prophylactic dressings; 4) Utilization of risk assessment scales.

All interventions were individualized according to the patient's clinical and developmental condition. The collected data were analyzed to determine PI incidence, expressed as the number of new cases relative to the total number of patients admitted during each observation period. This allowed a longitudinal evaluation of the effectiveness of the implemented prevention measures.

Ethical Considerations

This study was conducted as a retrospective descriptive observational study using anonymized clinical data collected during routine care. No experimental interventions or deviations from standard clinical practice were introduced. According to the Italian Medicines Agency (AIFA)¹⁰ Circular dated June 7, 2012, and the opinion of the Italian National Bioethics Committee (2014),¹¹ ethical approval is not required for observational studies that do not involve direct patient interventions and use anonymized data collected as part of standard clinical activity. The study was carried out in compliance with the principles outlined in the Declaration of Helsinki and applicable data protection regulations (EU Regulation 2016/679 – GDPR).^{12,13}

Results

The data collected referred to the number of repositioning interventions performed, the use of pressure-relieving surfaces, the application of prophylactic dressings, and the adoption of a formal risk assessment scale (Glamorgan scale).

In the seven months preceding the structured implementation of preventive measures – namely staff training, systematic use of risk assessment scales, use of prophylactic dressings and pressure-relieving surfaces – 22 cases of PIs were recorded out of 388 patients admitted to the Operative Unit, corresponding to an incidence rate of 5.6%.

Following the progressive implementation of these interventions, the data collected from July 2019 to January 2024 show a significant and stable decline in incidence. (Table 2)

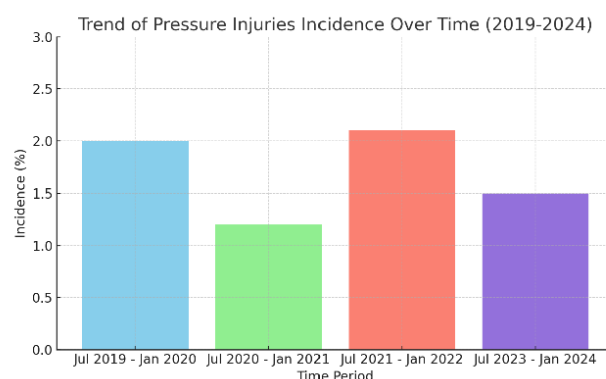
Table 2. Incidence of PIs in patients admitted to neonatal and pediatric intensive care units before and after the introduction of preventive measures (2019–2024).

Observational Period	Patients (n)	PIs (n)	Incidence (%)
July 2019 - January 2020	471	10	2.1
July 2020 - January 2021	386	4	1
July 2021 - January 2022	320	7	2.1
July 2023 - January 2024	473	6	1.2

To complete the data reported in the table, Graph 1 visually illustrates the trend in PIs incidence over time, clearly demonstrating the positive impact of the preventive strategies adopted by our Operating Unit. The bar chart highlights the reduction of the phenomenon starting from 2020, reinforcing the effectiveness of the measures adopted and underscoring the importance of a structured and continuous approach to prevention.

Discussion

The results of this study clearly illustrate the effectiveness of a multifactorial approach to the prevention of PIs in pediatric patients admitted to intensive care. The implementation of a structured program – based on systematic risk assessment, continuous staff training, and



Graph 1. Incidence of PIs among patients admitted to the neonatal and pediatric intensive care unit at IRCCS Istituto G. Gaslini from 2019 to 2024.

targeted preventive measures – led to a significant reduction in the PIs incidence, from 5.6% at baseline to 1.2% in the most recent observation period. This trend aligns with findings reported in the literature and supports the validity of the strategies adopted.¹⁴

Despite the overall positive trend, a temporary increase in PIs incidence was observed during the 2021-2022 biennium (2.1%) and in the first half of 2023. The rate subsequently declined to 1.2% in the second half of the same year, although it remained above the 2020 minimum of 1% and deviated from the expected trend.

This increase may be attributed to the turnover among nursing staff, which resulted in the temporary loss of experienced personnel – including the expert wound care nurse – causing a phase of reorganization and reduced stability within the team, which was engaged in training new staff.¹⁵ Concurrently, a certain underestimation of the risk was noted among the team, possibly due to a perception of the problem as "resolved" or secondary to more pressing clinical priorities in critically ill patients. In this context, although the Glamorgan Scale was introduced to improve risk assessment, it was at times perceived as a bureaucratic requirement rather than a clinically valuable tool for prevention.^{16,17}

This experience highlighted the need to maintain sustained attention on the issue, constantly renewing training efforts and fostering awareness among staff.^{16,17} The prevention of PIs cannot be considered a definitively achieved goal, but rather a dynamic and ongoing process that requires continuity, motivation, and a strong culture of risk awareness. It is essential that the tools adopted – such as assessment scales – are perceived not as formal obligations, but as

practical and effective resources in daily clinical assistance.¹⁸

A key factor in the success of the program was the active involvement of the specialist nurse in skin lesions, who served as a point of reference for the entire care team. Their role facilitated the adoption of new procedures, ensured consistent clinical monitoring, and provided hands-on support to staff.¹⁹ However, the long-term sustainability of this approach depends on the team's ability to internalize preventive principles and act in a coordinate and collaborative manner.²⁰

Further studies are warranted to explore the effectiveness of additional preventive strategies, such as the use of specific skin care products or the application of new technologies. Prospective studies would also be valuable to confirm the present findings and to identify predictors of PIs development in pediatric patients.

Limitations of the study

This study presents several methodological limitations that should be considered when interpreting the results. Firstly, it was conducted in a single hospital center, which limits the generalizability of the findings to other healthcare settings with different organizational and clinical characteristics.

Secondly, PIs the risk assessment was conducted over the years using different scales depending on patient age – namely the Braden Scale, Braden Q, clinical judgment-based assessment, and, more recently, the Glamorgan Scale. This heterogeneity may have introduced variability in the data, potentially affecting both the temporal comparability and the accuracy of risk classification.

Lastly, as a retrospective, descriptive observational study, it is not possible to fully exclude the influence of uncontrolled confounding factors, such as fluctuation in care workload, the clinical complexity of patient, and internal team dynamics.

Conclusions

The findings of this study support the effectiveness of a multifactorial strategy for preventing PIs in our intensive care unit. The comparison between data collected prior to the systematic implementation of preventive measures (5.6% incidence) and data following

the intervention (average incidence 1.6%) highlights an overall of 71% reduction in PIs cases, demonstrating the significant impact of the measures adopted.

These results suggest that systematic risk assessment, ongoing staff training, adherence to evidence-based practices aligned with international guidelines, and the involvement of a wound care specialist can produce tangible and measurable improvements in care quality.

To maintain and further enhance these results over time, it is essential to continue fostering a culture of prevention, emphasizing shared responsibility of healthcare professionals. The effectiveness of any prevention program ultimately depends on awareness, motivation, and the continuity of care practices.

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