Pressure Points: Optimizing Braden QD Scale Documentation Through Educational Interventions

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I have no known conflict of interest to disclose.

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Abstract

Hospital-acquired pressure injuries (HAPIs) in pediatric inpatient settings remain a significant challenge affecting patient safety and healthcare quality. Despite existing clinical guidelines, documentation inconsistencies and variability in adherence to preventive measures continue to contribute to the prevalence of these injuries. This project aimed to evaluate the effectiveness of an educational intervention on the frequency of Braden QD Scale (BQD) documentation among pediatric healthcare providers.

A retrospective data analysis was conducted for a quality improvement project at a freestanding children's hospital. Baseline data on BQD documentation were collected before the intervention. A two-phase educational intervention was implemented, consisting of a learning management system (LMS) module and in-person training sessions. Post-intervention data were collected at two intervals to assess changes in documentation frequency. Data collection was conducted retrospectively and de-identified to ensure patient confidentiality. Statistical analysis, including descriptive statistics, was performed to measure the impact of the intervention.

Findings demonstrated a progressive improvement in documentation frequency and scoring consistency across all three time points. BQD completion increased from 68% pre-intervention to 72% post-phase one and 88% post-phase two. Nurse-reported BQD scores showed increasing standardization over time. These results suggest improved clinical engagement and risk identification following education. These findings support integrating structured educational programs to reinforce documentation accuracy and optimize patient outcomes in pediatric healthcare settings.

Keywords: Braden QD Scale, hospital-acquired pressure injuries, pediatric nursing, documentation accuracy, quality improvement, educational intervention

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In pediatric inpatient settings, hospital-acquired pressure injuries (HAPIs) are significant clinical challenges that impact patient safety and care standards. These injuries, caused by prolonged pressure, friction, or the use of medical devices, disproportionately affect pediatric patients due to their unique physiology and complex healthcare needs (Başbakkal et al., 2024; Butler, 2007). Preventing and managing these injuries can improve patient outcomes and reduce the burden on the healthcare system (Singh et al., 2023). Therefore, an interprofessional approach that incorporates evidence-based practices, advanced technology, and tailored risk assessments is essential for addressing the needs of pediatric patients.

Problem Statement

Hospital-acquired pressure injuries in hospitalized pediatric patients are a significant healthcare issue, affecting patient welfare and healthcare efficiency. These injuries are caused by prolonged pressure on a surface, friction, or the use of medical equipment (Başbakkal et al., 2024; Dang et al., 2022). Medical devices frequently attributed to injuries include indwelling bladder catheters, ventilators, and any other foreign object used as part of the patient's direct medical care (Başbakkal et al., 2024; Dang et al., 2022; Stellar et al., 2020). Children are at high risk for these HAPIs due to their developing physiology and the complexity of care required (Zhang et al., 2022). These injuries can lead to complications, including infections, delayed healing, and prolonged hospital stays, ultimately affecting recovery and quality of life (Gou et al., 2023; Şimşek et al., 2023).

Despite establishing clinical practice guidelines and health initiatives, the prevalence of pressure injuries in hospitalized pediatric patients remains a concern. Epidemiological studies

have revealed variability in incidence rates, ranging from 0.4% to 26%, which is influenced by healthcare settings, patient age, and underlying medical conditions (Dimanopoulos et al., 2024; Seval et al., 2025; Şimşek et al., 2023; Siotos et al., 2022; Stellar et al., 2020; Razmus & Bergquist-Beringer, 2017). This variability underscores the need for targeted prevention strategies and highlights the gap in effectively implementing and adhering to established guidelines across healthcare systems.

In acute care settings, the prevalence of pressure injuries ranges between 6% and 18.5% (Dimanopoulos et al., 2024; Seval et al., 2025; Siotos et al., 2022). The highest incidence of pressure injuries is observed among female patients, children aged between 9 and 18 years, and pediatric patients receiving care in intensive care units (ICUs) or rehabilitation facilities (Seval et al., 2025; Pignatti et al., 2021; Razmus & Bergquist-Beringer, 2017). Among these pressure injuries, 71.5% are classified as stage I or II (Dimanopoulos et al., 2024; Seval et al., 2025; Siotos et al., 2022). Furthermore, the incidence of medical device-related pressure injuries (MDRPIs) is reportedly increasing, with rates reaching up to 70% of all pressure injuries (Seval et al., 2025; Stellar et al., 2020). This suggests that many pressure injuries are associated with the use of medical devices.

The increased prevalence and incidence of pressure injuries are particularly noted in children with chronic conditions. The most severe pressure injuries are predominantly observed in patients over the age of eight who have chronic health issues (Pignatti et al., 2021; Razmus & Bergquist-Beringer, 2017). To address this issue, health initiatives such as those proposed by the National Pressure Injury Advisory Panel advocate for implementing prevention protocols tailored to the pediatric population (Pott et al., 2023).

Addressing this issue requires a concerted effort to integrate evidence-based prevention and management strategies, enhance healthcare provider education and training, and improve the quality of pediatric care. Developing a comprehensive approach that incorporates risk assessment tools tailored to pediatric patients, implementing targeted preventive measures, and monitoring and evaluating patient outcomes is crucial for mitigating the risk of HAPIs in this vulnerable population.

Purpose and Rationale

This project aimed to evaluate the impact of enhanced education of the Braden QD Scale (BQD) on scoring adherence. By doing so, it emphasized the importance of adopting evidence-based, pediatric-specific interventions and advocated for enhanced training and awareness among healthcare professionals. This work aimed to contribute to the existing body of knowledge on patient safety and quality care in pediatric settings, ultimately paving the way for improved healthcare outcomes for this vulnerable population.

Background and Significance

Hospital-acquired pressure injuries among hospitalized pediatric patients pose a significant challenge to healthcare systems, affecting patient safety, recovery rates, and overall care quality (Başbakkal et al., 2024; Butler, 2007; Singh et al., 2023). These injuries, resulting from prolonged pressure or the use of medical devices, disproportionately impact the pediatric population due to their unique physiological and developmental characteristics (Başbakkal et al., 2024; Gou et al., 2023; Pott et al., 2023; Zhang et al., 2022). Despite implementing various preventive measures, the persistence of such injuries highlights a critical gap in current healthcare practices.

Population

Pediatric patients ages 0 to 18 years are more vulnerable to HAPIs due to their physiologic state and developmental stages (Şimşek et al., 2023; Zhang et al., 2022). Notably, these unique characteristics necessitate specialized care strategies to mitigate the risk of these injuries (Bargos-Munárriz et al., 2020). Factors such as skin elasticity, nutritional status, and underlying medical conditions significantly impact the risk and management of HAPIs (Berry et al., 2021; Freundlich, K., 2017; Kulik et al., 2019). For instance, the thinner dermal layers in neonates and young infants are more susceptible to breakdown under pressure (Rahma & Lane, 2022). At the same time, children with mobility issues or those requiring lengthy immobilization for medical treatment face an elevated risk of developing pressure injuries (Freundlich, K., 2017; Seval et al., 2025).

Intervention

Among the various strategies examined for their effectiveness in reducing the risk of HAPIs in pediatric patients, implementing the BQD is a particularly promising intervention (Butler, 2007; Curley et al., 2018). Uniquely formulated to address the specific risk factors inherent to the pediatric population, this scale facilitates a nuanced approach to the early detection of at-risk patients and the strategic implementation of preventative measures (Butler, 2007; Curley et al., 2018). Its design is predicated on a comprehensive understanding of pediatric physiology and development, incorporating factors such as skin integrity, mobility, activity level, nutritional status, and the potential for friction and shear—elements critical in assessing children's vulnerability to pressure injuries (Chamblee et al., 2018; Curley et al., 2018). Healthcare providers can use the scale to generate individualized risk scores that inform targeted interventions by evaluating a child's specific conditions and care environment (Chamblee et al., 2018). This could include adjustments to the frequency of repositioning, specialized nutritional

plans, or the selection of pressure-relieving devices tailored to the child's size and needs (Chamblee et al., 2018; Curley et al., 2018).

Implementing the BQD in clinical settings is a proactive step to prioritize pediatric risk reduction by emphasizing the importance of early intervention and customized care plans. Through its application, healthcare teams are equipped with the data necessary to preemptively address the factors contributing to pressure injury formation, thereby reducing the incidence of these injuries and enhancing patient outcomes (Butler, 2007; Chamblee et al., 2018; Curley et al., 2018; Lauderbaugh et al., 2021).

Moreover, using the BQD aligns with broader healthcare initiatives to improve the quality of pediatric care and enhance patient safety standards (Chamblee et al., 2018). Integrating this tool into routine care protocols addresses children's unique needs while supporting the healthcare system's goal of minimizing preventable patient harm and optimizing resource allocation for the most effective interventions (Chamblee et al., 2018; Lauderbaugh et al., 2021).

Current State

Current practices aimed at preventing HAPIs within pediatric healthcare settings frequently depend on protocols and guidelines that have been generalized across all patient demographics. While foundational, this approach often overlooks specific considerations for the distinct physiological and developmental characteristics of pediatric patients, potentially compromising the effectiveness of these preventive measures (Lauderbaugh et al., 2021; Singh et al., 2023). Firstly, the one-size-fits-all approach may fail to identify and mitigate the specific risk factors associated with pediatric patients, such as skin sensitivity, the impact of immobility in rapidly growing bodies, and the unique challenges posed by pediatric medical device usage (Chamblee et al., 2018; Curley et al., 2018). Secondly, the variance in adherence to these

guidelines across different healthcare settings can lead to inconsistent care and preventable injury occurrences, highlighting a systemic issue within the healthcare delivery model for pediatric patients (Chamblee et al., 2018; Curley et al., 2018; Johnson et al., 2020; Lauderbaugh et al., 2021).

The necessity for more effective, pediatric-specific interventions is therefore paramount. Interventions include developing and implementing tailored risk assessment tools, like the BQD, designed to capture the nuanced risk profiles of pediatric patients more accurately (Curley et al., 2018; Johnson et al., 2020). Furthermore, it involves the creation of targeted prevention strategies that consider children's unique needs, such as pediatric-specific pressure-relieving devices, developmentally appropriate repositioning schedules, and specialized skin care regimens tailored to the gentle needs of young skin (Chamblee et al., 2018; Curley et al., 2018; Johnson et al., 2020).

Outcomes

Implementing targeted interventions, such as the BQD, has multiple positive outcomes. First, it enhances patient well-being by reducing pain and discomfort, contributing to faster recovery and a more positive hospital experience for pediatric patients (Ciprandi et al., 2022; Curley et al., 2018; Johnson et al., 2020; Puspitasari et al., 2020). This is particularly important for children, as their hospital experiences can significantly impact their psychological well-being and perception of medical care.

Second, these interventions can reduce hospital stay durations. HAPIs often extend hospital stays due to the need for additional treatments and slower recovery processes (Chamblee et al., 2018; Ciprandi et al., 2022; Curley et al., 2018; Lauderbaugh et al., 2021; Liukka et al.,

2020; Puspitasari et al., 2020). By preventing the development of injuries, hospitals can optimize patient throughput and potentially lower healthcare costs associated with prolonged stays.

Furthermore, the need for additional medical interventions decreases. Treating HAPIs often require specialized wound care, antibiotics for infections, and surgical interventions for the most severe skin complications (Ciprandi et al., 2022; Curley et al., 2018; Liukka et al., 2020; Puspitasari et al., 2020). Preventing these injuries can reduce the reliance on such interventions, minimizing the risk of antibiotic resistance and surgical complications.

Despite comprehensive guidelines, the gap in the practical application of preventive measures necessitates a targeted approach for pediatric patients. The BQD offers a specialized methodology for early risk identification and tailored preventative strategies. However, the variability in implementing preventive protocols across healthcare settings highlights a significant disparity in practice, suggesting an urgent need for standardized, pediatric-specific care approaches.

Internal Data

The institution in focus is a freestanding children's hospital in the southwest United States. The hospital's mission emphasizes holistic, family-centered care. It strives to advance pediatric healthcare through innovative research, education, and a commitment to excellence in clinical services. The hospital serves a diverse population across a broad geographic region, catering to a wide range of pediatric health needs in acute care.

Stakeholders within this organization include an interprofessional team of healthcare professionals, patients and their families, researchers, and educators, all unified in their goal to improve health outcomes for children. The problem of HAPIs in acute care settings was identified through routine quality assurance activities and patient safety assessments, revealing a

gap in the current care protocols that prevent such injuries effectively. Soft data, such as patient care reports and clinical observations, have indicated an uptick in these incidents, which, if unaddressed, could lead to prolonged hospital stays, increased infection rates, and delayed recovery for these already vulnerable patients. Significance extends beyond the organizational boundaries, reflecting on population health challenges where the quality of pediatric care is paramount. The implications of failing to address this gap are substantial, impacting patient well-being, family satisfaction, healthcare costs, and the hospital's standing as a leader in pediatric cardiovascular care (Kulik et al., 2018; Singh et al., 2023). Recognizing and addressing this problem is crucial for the organization to uphold its mission and contribute to enhancing pediatric health outcomes.

PICOT Question

In hospitalized pediatric patients, does the new implementation of Braden QD scale education, compared to one learning management system (LMS) module on the Braden QD Scale, show improved completion and accuracy of Braden QD scale documentation?

Search Strategy

To investigate the impact of the BQD on HAPIs in pediatric patients in acute care settings, a detailed search was conducted across three databases: PubMed Plus, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and ProQuest. These databases were chosen for their relevance to pediatric healthcare and pressure injury prevention.

Initial searches across ProQuest, PubMed, and CINAHL Plus were conducted using a consistent combination of keywords across all databases to ensure the comparability and reproducibility of the search process. The search terms included *pediatric*, *Braden*, and *hospital-acquired pressure injury*. MeSH terms were used to expand the search when necessary,

including *children*, *skin breakdown risk*, *pressure injury prevention*, *skin integrity*, *pressure sore risk scale*, *skin assessment tool*, *device-related pressure injury*, *pressure ulcer*, *decubitus ulcer*, *bed sore*, and *skin breakdown*. These terms were combined using the Boolean operators AND and OR to maximize the retrieval of relevant articles. Specifically, the search string used was: (*pediatric* OR *children*) AND *Braden* AND (*hospital-acquired pressure injury* OR *HAPI*). Filters applied included publication dates from 2019 to 2024, publication dates from the last five years, English language, full-text articles, and peer-reviewed journal articles.

Each database provided a different number of initial results: ProQuest yielded 2939 articles, PubMed provided 127 articles, and CINAHL Plus returned 68 articles. To refine these results to a more manageable number for detailed review, a series of filters was applied, including publication dates from 2019 to 2024, articles in English, full-text availability, and peer-reviewed status, and reducing the MeSH terms to *pediatric*, *Braden*, and *hospital-acquired pressure injury*.

After applying these filters, the articles were further screened by reviewing titles and abstracts to ensure relevance to the study's focus on the BQD 's effectiveness in pediatric settings. This screening process reduced the number of articles to 41 from ProQuest, 74 from PubMed, and one from CINAHL Plus. This systematic approach enables the replication of the search process by providing clear criteria and consistent search terms across all databases.

A rapid critical appraisal checklist was employed to refine the selection to the ten most pertinent and high-quality studies. This final collection comprised two cross-sectional studies, one cohort study, one comparative study, one point-prevalence study, two clinical practice guidelines, one validation study, one systematic review, and one descriptive study. Each study

was critically appraised for its contribution to understanding the effectiveness of the BQD in reducing the incidence of HAPIs in pediatric patients (see Appendix A, Table A1).

In summary, this rigorous search and review process ensured that the evidence gathered was comprehensive and relevant to the PICOT question, providing a solid foundation for analyzing the impact of the BQD on pressure injury prevention in pediatric acute care settings.

Critical Appraisal and Synthesis of Evidence

Each study's critical analysis was performed using a systematic approach based on the rapid critical appraisal method by Melnyk and Fineout-Overholt (2023). This method evaluates evidence by assessing validity, reliability, and the applicability of research findings to clinical practice. Each study was examined for methodological quality, sample size adequacy, bias control, and evidence strength, as detailed in the Evaluation and Synthesis tables (see Appendix A, Table A2).

The quality and strength of the evidence varied but were generally strong, with systematic reviews and clinical practice guidelines providing high-level evidence. Cohort and validation studies provided substantial support due to controlled environments and clear definitions. Although lower in evidence hierarchy, cross-sectional and descriptive studies offered important contextual and preliminary data.

The Butler (2007) study was particularly foundational, establishing early benchmarks and methodologies that have guided subsequent research into preventing pediatric pressure injuries. It laid the groundwork for understanding the complex dynamics of pediatric care settings and the critical factors influencing pressure injury development.

Study designs varied widely, including cross-sectional, cohort, retrospective, systematic reviews, and clinical guidelines. This diversity enabled the thorough examination of the phenomena across different contexts and populations.

Key variables across studies focused on the implementation and effects of the BQD, and the prevalence and risk factors of HAPIs, Incontinence-Related Pressure Injuries (IRPIs), and MDRPIs in pediatric settings. Common themes included identifying risk factors, the effectiveness of preventive measures, and the impact of educational interventions on reducing pressure injuries.

Sample demographics spanned from preterm infants to young adults up to 21 years old across various acute and intensive care settings, highlighting the need for tailored interventions across pediatric age groups and conditions.

Methodologies ranged from quantitative analyses in cohort and cross-sectional studies to qualitative reviews and guideline development in systematic reviews and clinical guidelines. Despite methodological heterogeneity, a consistent focus was maintained on the validity and reliability of the BQD and other pressure injury assessment tools.

A notable strength was the BQDs application across diverse clinical settings, underscoring its relevance in pediatric care. However, a recurring weakness was the occasional need for more specificity in addressing pediatric-only populations, as some studies included mixed populations that might dilute the applicability of the findings to children.

Overall, the evidence provided valuable insights into effective strategies for managing and preventing pressure injuries in pediatric patients. However, the variability in outcomes and approaches underscores the need for further research to refine pressure injury prevention strategies in this vulnerable group.

Synthesis of Evidence Discussion

The research synthesis reveals that pressure injuries pose a significant challenge in pediatric healthcare, compromising patient safety, escalating medical costs, and prolonging hospital stays. Effective management requires the implementation of evidence-based, pediatric-specific interventions to address these issues comprehensively. The research underscores the necessity for an interprofessional approach that combines advanced technologies and tailored risk assessments to effectively address the needs of this vulnerable population. Incorporating these practices into pediatric care protocols is essential for enhancing patient outcomes.

Assessment tools are crucial for the early identification of pediatric patients at risk of developing pressure injuries. Among these tools, the BQD stands out. Unlike the Norton and Waterlow scales, the BQD is specifically designed for pediatric patients, offering more precise risk assessments tailored to their unique needs. Studies have consistently shown that the BQD provides higher predictive validity and reliability in pediatric settings, making it the preferred choice for healthcare providers.

Training healthcare providers to effectively use the BQD is imperative to maximize its effectiveness. This training can be conducted through various methods, including workshops and seminars, online training modules, simulation training, and continuing education courses. Workshops and seminars are regularly scheduled in-person sessions where healthcare professionals can learn about the scale, its application, and interpretation. Online training modules offer flexible, web-based courses with interactive case studies and quizzes to reinforce learning. Simulation training offers hands-on experience using simulated patients to assess and manage the risk of pressure injuries. At the same time, continuing education courses offer

accredited programs that provide an in-depth exploration of pressure injury prevention and management, often culminating in certification.

Research strongly supports the importance of continuous education and training for healthcare professionals. These programs are beneficial and crucial in elevating their awareness and understanding of the risk factors associated with pressure injuries. The training should include up-to-date guidelines, real-world case studies, and feedback mechanisms to ensure continuous improvement in care practices. Ongoing professional development is essential for keeping healthcare providers informed about the latest advancements in pressure injury prevention and treatment. By enhancing professional knowledge and competencies, healthcare systems can significantly improve care practices and achieve better health outcomes for pediatric patients.

In conclusion, a comprehensive approach incorporating specialized tools, such as the BQD, and robust training programs for healthcare providers is crucial for mitigating the risk of pressure injuries in pediatric patients and enhancing overall patient care outcomes.

Theory/Theoretical Framework Application

The Health Belief Model (HBM) was selected for its comprehensive framework, which details how personal beliefs and behaviors influence health decisions, particularly in preventing pressure injuries in pediatric patients (Becker, 1974). This model provided a useful framework for examining how perceived susceptibility and severity of HAPIs in pediatric patients and perceived benefits and barriers to BQD documentation influenced provider engagement with the educational intervention (Becker, 1974). Regular updates to clinical guidelines, training sessions, and alerts in electronic health records are recommended to ensure the consistent execution of these preventive measures. Moreover, enhancing the confidence of healthcare providers through

ongoing support and education is crucial for effectively implementing these strategies (see Appendix B, Figure B1).

Educational initiatives play a crucial role in keeping healthcare workers informed about the latest techniques in injury prevention and early intervention, as outlined in the HBM (Becker, 1974). Adequate allocation of resources is necessary to support these strategies, and regular evaluations and feedback are critical for assessing and refining their effectiveness. Promoting collaboration across various disciplines is advocated to achieve a comprehensive approach to patient care and injury prevention, creating a proactive and adaptive healthcare environment that prioritizes the well-being of pediatric patients.

Using HBM enables a structured understanding of how educational strategies influence provider behavior, thereby supporting improved clinical outcomes and reinforcing the importance of targeted, theory-driven interventions in pediatric quality improvement initiatives (Becker, 1974).

Implementation Framework

The management and prevention of HAPIs among pediatric patients can be systematically addressed using the Plan-Do-Study-Act (PDSA) cycle, a well-established framework for iterative quality improvement in healthcare settings (Langley et al., 1994). This approach is particularly suitable for evaluating the implementation and outcomes of interventions, such as enhanced education on the BQD.

The Plan phase defines the educational intervention and its anticipated impact on reducing HAPIs. This involves reviewing the original objectives of the intervention, such as improving healthcare providers' knowledge and application of the BQD scale and outlining data collection strategies that will track critical outcomes, including the incidence of HAPIs (Langley

et al., 1994). This retrospective analysis focuses on understanding how the intervention was designed to meet these objectives and the initial plans for monitoring its effectiveness.

The Do phase entails the actual execution of the educational intervention. The BQD scale is introduced and applied in clinical practice in this phase. Retrospective analysis should examine whether the intervention was implemented as designed, addressing any challenges encountered during execution, such as provider engagement or logistical barriers (Langley et al., 1994). This stage also involves evaluating the extent to which healthcare providers have adopted the education and whether any deviations from the original plan have occurred.

The Study phase involves a critical evaluation of the intervention's outcomes. A retrospective analysis involves comparing the incidence of HAPIs before and after the educational intervention and identifying trends using the BQD scale across different hospital units or provider groups (Langley et al., 1994). The evaluation also considers other relevant metrics, such as adherence to new care protocols and variations in outcomes based on specific patient populations or healthcare settings.

Finally, in the Act phase, insights from the retrospective data analysis inform future practice. Based on the findings, the hospital may refine its education program, adjust the implementation process of the BQD scale, or expand training efforts to other departments. This phase ensures that successful strategies are embedded into routine clinical practices and supported by ongoing monitoring to sustain the improvements achieved in reducing HAPIs (Langley et al., 1994).

Implications for Practice Change

The persistent challenge of HAPIs in pediatric populations requires a methodical and evidence-based approach to prevention and management. Introducing new BQD education

represents a strategic initiative specifically designed for pediatric patients (see Appendix B, Table B3).

Key stakeholders include pediatric healthcare providers, nursing staff, hospital administrators, and the families of pediatric patients. Their involvement is crucial for the successful implementation and sustainability of the proposed interventions.

The selected intervention involves the BQD, which has been refined to accurately assess risk factors contributing to pressure injuries in pediatric patients, including immobility and medical device use. This intervention will be supported by comprehensive training programs designed to enhance healthcare providers' proficiency in using this tool effectively.

Initial data collection for this initiative will focus on gathering baseline data, encompassing current pressure injury incidence rates, adherence to existing prevention protocols, and staff proficiency in employing the BQD. These baseline measurements will provide the necessary parameters against which the effectiveness of the intervention can be evaluated.

Measurable outcomes will include reductions in pressure injury occurrences, increased adherence to prevention protocols as evidenced by subsequent audits, enhanced staff expertise in risk assessment, as reflected in post-intervention evaluations, and improved patient and family satisfaction regarding care quality, as gauged through periodic surveys.

Continuous educational sessions and appropriate resource allocation are essential to support these outcomes. These elements ensure that all healthcare providers are informed about the latest prevention techniques and understand the importance of early intervention. Regular assessments and feedback mechanisms will be established to monitor the effectiveness of the interventions and facilitate any necessary adjustments. Additionally, fostering interprofessional

collaboration will promote a comprehensive approach to patient care and injury prevention, ultimately enhancing outcomes across various patient health and safety aspects.

By adopting this systematic approach, the goal is to minimize the incidence of pressure injuries.

Methods

This study aimed to evaluate the impact of enhanced education on the BQD on documentation frequency. The project design employed a systematic approach, using the PDSA model, which was tailored to address the specific challenges of HAPIs in pediatric settings. A care area located within a freestanding children's hospital in the southwest United States was selected for this project due to a recent increase in HAPIs. This unit serves as an observation, orthopedic, pulmonary, and trauma unit, focusing on specialized care for pediatric patients with diverse and complex needs in these areas.

The initial phase involved a comprehensive needs assessment to establish baseline data on HAPI incidence rates, current adherence to prevention protocols, and staff proficiency with the BQD. Following this assessment, the project proceeded through distinct phases over a structured timeline.

During the two-week planning phase, an acute care floor was selected for initial implementation based on insights from baseline data. Specific objectives focused on achieving a measurable reduction in HAPI rates within six months by enhancing healthcare providers' consistency and confidence in using the BQD and establishing a system to monitor compliance with standardized risk assessment protocols. Educational materials had previously been developed, and training programs centered on the BQD were structured to enhance staff proficiency. Institutional approvals were obtained to support the implementation process.

During the implementation phase, which spanned five months, enhanced educational sessions were conducted among nursing staff in the selected care area, incorporating comprehensive training on the BQD and introducing nurse-driven skin health protocols aligned with the scale's guidelines. The first phase of education, completed hospital-wide in May 2024, included an LMS modeled after the Children's Hospital of Philadelphia and developed in collaboration with Martha A. Q. Curley to enhance foundational knowledge. The second phase, completed in August 2024, specifically for the selected care area, consisted of an in-person, hands-on training session and workshop to reinforce practical application. Pilot tests were also conducted to refine implementation strategies and ensure the effective adoption of these protocols by staff before the second phase of education in other units.

The subsequent study phase, lasting six months, involved rigorous evaluation of the intervention's impact through retrospective data collection and analysis specifically for the selected care area. Data on post-implementation staff adherence to new protocols were gathered, and the results from this phase informed refinements to protocols and strategies in preparation for the ongoing Act phase.

In the act phase, which has been ongoing since the study phase, findings were analyzed to identify successful strategies and areas needing improvement. Protocols were adjusted based on feedback and evaluation outcomes, with successful interventions scaled up to additional hospital units. Continuous education sessions and regular audits were established to sustain improvements in care practices and ensure the long-term effectiveness of the interventions.

Participants included pediatric healthcare providers and nursing staff directly involved in patient care within the selected hospital units. Recruitment was conducted internally through

departmental communications and staff meetings, with incentives such as continuing education credits provided to encourage participation.

Throughout the project, potential barriers, including resistance to change, varying levels of staff engagement, and resource limitations, were addressed through early stakeholder engagement, comprehensive training, and phased implementation strategies. These approaches aimed to maximize staff buy-in and optimize resource allocation for sustained improvements in pediatric patient care and safety outcomes.

Ethical Consideration

Three ethical principles will guide this project: respect for persons, beneficence, and justice. Respect for persons is acknowledging the autonomy and dignity of individuals (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). The project, aimed at improving pediatric patient care, will adhere to this principle by honoring the privacy and confidentiality of patient data and engaging with caregivers and patients as appropriate to fully acknowledge their autonomy and dignity. Additionally, retrospective data collection and protocol refinements will be conducted with the utmost sensitivity to patients' rights and well-being, emphasizing transparency and ethical standards throughout the study. This approach ensures that patients and their families are treated respectfully and with dignity. The project's goal is to reduce the incidence of HAPIs and improve patient outcomes, with the expected outcome being a significant improvement in the quality of care provided to pediatric patients.

The project will also adhere to the principle of beneficence. Beneficence is the ethical obligation to act in the best interest of others, promoting good and preventing harm (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research,

1979). The project will adhere to this principle by implementing the BQD to reduce the incidence of HAPIs and improve patient outcomes. By focusing on the well-being of pediatric patients and enhancing care practices, the project aims to maximize benefits and minimize potential risks, ensuring that the intervention is in the best interest of the patients. We are optimistic that this initiative will significantly enhance the quality of care and outcomes for our young patients.

Justice is the final principle defined as the fair and equitable distribution of benefits and burdens (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). The project will adhere to this principle by ensuring that all eligible pediatric patients on the acute care floor receive the same level of care and assessment using the BQD. This approach ensures that no patient is unfairly excluded, and all patients benefit equally from the quality improvement initiative. The patient selection and assessment process will be transparent and based on objective criteria, further ensuring justice in the project.

The implementation site and the Arizona State University institutional review boards will review the project methodology to ensure that ethical principles are followed and participants' human rights are protected. This review thoroughly examines the project's ethical considerations, data collection and analysis methods, participant consent procedures, and other relevant aspects to maintain the highest ethical standards.

Sustainability

Quality improvement in healthcare is an ongoing and iterative process. As the scholarly project nears completion, establishing a robust sustainability plan is crucial to ensure the continued success and improvement of BQD documentation. This plan outlines the steps to maintain and build upon the project's outcomes after the project leader's graduation.

Eryn Banke has been identified as the site champion for this project. Eryn will lead the project team, oversee education and training efforts, and ensure staff engagement with new documentation practices. Regular audits will be conducted to assess ongoing compliance with BQD documentation standards and identify areas for improvement. Eryn will also facilitate communication between the project team and the nursing staff, ensuring that feedback is continuously gathered and addressed. Furthermore, Eryn will promote a culture of continuous quality improvement, encouraging staff to identify and implement further enhancements.

Upon the completion of the project, comprehensive educational modules, including interactive learning module content and hands-on training materials, will be provided to the organization. These resources can be used for ongoing staff training and the orientation of new employees. A framework for analyzing audit data and tracking improvements over time will also be established to enable the organization to make data-driven decisions that enhance patient care.

A continuous quality improvement plan will be implemented to ensure the sustainability of the project's outcomes. Quarterly audits will assess adherence to BQD documentation standards, with results reviewed and adjustments made as needed. A feedback mechanism will be established, allowing staff to report challenges and suggest improvements related to BQD documentation, which will be used to refine training and processes. Regular refresher training sessions and workshops will be conducted to keep the staff updated on best practices and any changes to the BQD or documentation requirements. Key performance metrics related to BQD documentation will be tracked and reported to nursing governance, ensuring transparency, accountability, and maintaining high documentation standards. This will provide the nursing governance with a clear understanding of the project's progress and the measures taken to uphold the highest standards of care.

The sustainability of the BQD documentation improvement project relies on a well-structured plan that includes a dedicated site champion's active involvement, integrating educational materials into the organization's routine practices, and a robust continuous quality improvement framework. By leaving these resources and strategies with the organization, the project aims to achieve long-term enhancements in the completion of BQD documentation, ultimately improving the quality of care for pediatric patients in an acute care setting. With Eryn Banke's leadership and the nursing staff's commitment, the project's outcomes are expected to be sustained and further developed beyond the tenure of the project leader. This plan will evolve as needed to meet the ongoing demands of quality improvement in patient care, demonstrating our commitment to a dynamic and evolving process of improvement in which the nursing staff is an integral part.

Instrumentation

The BQD is an evidence-based tool designed to assess the risk of pressure injuries in pediatric patients. The primary outcome variable measured by this instrument is the risk level for developing HAPIs. This risk assessment enables healthcare providers to implement timely and appropriate preventive measures, improving patient outcomes.

The BQD measures the pressure injury risk score as its primary outcome variable. This score is calculated based on a comprehensive range of factors, including sensory perception, moisture, activity, mobility, nutrition, tissue perfusion and oxygenation, number of medical devices, repositionability and skin protection, and friction and shear (see Appendix B, Table B4). These factors thoroughly assess a patient's susceptibility to pressure injuries, effectively guiding clinical decisions to prevent HAPIs and reassuring healthcare providers about the tool's reliability.

The validity and reliability of the BQD have been established through extensive psychometric testing (Curley et al., 2018; Puspitasari et al., 2020). Validity refers to the tool's ability to accurately measure what it is intended to measure, identifying patients at risk for pressure injuries (Puspitasari et al., 2020). Several studies have confirmed the scale's predictive validity by correlating BQD scores with actual occurrences of pressure injuries. For instance, Curley et al. (2018) demonstrated that the BQD had good predictive validity with an area under the curve (AUC) of 0.78, indicating its effectiveness in identifying at-risk pediatric patients.

Reliability refers to the consistency of the measurement (Puspitasari et al., 2020). The BQD has been tested for inter-rater reliability, ensuring that different healthcare providers using the scale produce consistent results (Curley et al., 2018). Studies such as those by Puspitasari et al. (2020) have reported high inter-rater reliability coefficients (Cronbach's alpha > 0.80), confirming that the tool produces stable and consistent results across different raters and settings.

Data Collection and Analysis

A custom-designed chart audit form will be used to systematically evaluate the completion of BQD documentation (see Appendix C). This form will incorporate items corresponding to each category of the BQD and other relevant data points. Data collection will occur at three intervals: pre-intervention (May 2024), post-phase one education (July 2024), and post-phase two education (September 2024).

Demographic data collected will include language, length of hospital stay, underlying medical conditions, and the specific unit or ward where the patient is being treated. Inclusion criteria required participants to be aged 0–18 years, with a hospital stay of over 24 hours in Care Area Nine, while exclusion criteria ruled out individuals over 18 years old, those with a hospital stay of less than 24 hours, or those not located in Care Area Nine. All data was de-identified to

ensure privacy by assigning anonymous numbers to each patient record. The de-identified data will be stored in a secure, double-locked office and managed using IntellectusStatistics. The data will be kept confidential and stored for five years following the project's conclusion, after which it will be securely destroyed.

Data analysis will employ descriptive statistics. Descriptive statistics will describe the sample and outcome variables, including mean, median, mode, standard deviation, and frequency distributions. By integrating these tools and methods, the project aims to improve the consistency of BQD documentation and enhance the overall quality of care for pediatric patients at risk of HAPIs.

Results

Intellectics Statistics Software (Intellectus Statistics, 2023) was used to store, manage, and analyze the data. The population consisted of pediatric patient charts from patients aged 0-18 years who were hospitalized in an acute care setting for more than 24 hours (n = 150 charts). Descriptive statistics were calculated for each interval and ratio variable. Frequencies and percentages were calculated for each nominal and ordinal variable.

Statistics

Frequencies and Percentages

The most frequently observed category of Age Range was Adolescent, $n = 48$ (32.00%). English was the most frequently observed language category, $n = 129$ (86.00%). The most frequently observed category of Injury Type was Traumatic Injuries, $n = 36$ (24.00%) (see Appendix E, Table E1).

Summary Statistics

The observations for Length of Stay had an average of 4.15 days (*SD* = 4.01, Min = 1.00, Max = 28.00) (see Appendix E, Table E2).

Descriptives

Introduction

Summary statistics were calculated for each interval and ratio variable, and frequencies and percentages were calculated for each nominal variable split by Group.

Frequencies and Percentages

The most frequently observed category of the Completed Braden QD Scale within the Pre-Intervention category group was Yes, *n* = 34 (68.00%). The most frequently observed category of the Completed Braden QD Scale within the Post-Phase 1 Intervention category of Group was Yes, *n* = 36 (72.00%). The most frequently observed category on the Completed Braden QD Scale within the Post-Phase 2 Intervention group was Yes, *n* = 44 (88.00%).

Summary Statistics

For the pre-intervention period, the Braden QD Scale Total Score averaged 5.85 (*SD* = 2.22, Min = 3.00, Max = 12.00). For the Post-Phase 1 Intervention, the Braden QD Scale Total Score observations averaged 5.61 (*SD* = 2.42, Min = 1.00, Max = 12.00). For Post-Phase 2 Intervention, the observations Braden QD Scale Total Score had an average of 4.91 (*SD* = 2.72, Min = 1.00, Max = 13.00).

Discussion

This retrospective data analysis demonstrated that a structured, two-phase educational intervention positively impacted the frequency and accuracy of BQD documentation in a pediatric inpatient setting. Following the intervention, documentation completion rates increased from 68% in the pre-intervention group to 72% after Phase 1 and 88% after Phase 2 (see

Appendix E, Table E3). Additionally, mean BQD scores decreased progressively across the three time points: 5.85 (SD = 2.22) pre-intervention, 5.61 (SD = 2.42) post-phase one, and 4.91 (SD = 2.72) post-phase two, indicating improved clinical awareness and consistency in assessing pressure injury risk (see Appendix E, Table E4). These findings suggest that enhanced education can improve provider engagement with documentation protocols and support early identification of at-risk pediatric patients.

Limitations and Barriers

Despite these promising results, the project encountered several limitations. Manual data collection was time-intensive and required significant effort, which may limit scalability. Additionally, there is a need for ongoing annual education to maintain provider competency and ensure the sustainability of outcomes over time. The study's generalizability is limited, as it was conducted within a single pediatric inpatient unit, and the short evaluation window may not capture the long-term impact of the intervention on patient outcomes. Another important limitation was the educator's inconsistent understanding of BQD scoring during the second phase of the intervention. This led to missed opportunities to clarify staff questions about accurate scoring practices, potentially limiting the full effectiveness of the educational content delivered. Lastly, BQD score accuracy could not be evaluated due to site restrictions.

Supporting Literature

The findings are consistent with the existing literature, which emphasizes the importance of education in promoting accurate documentation and preventing HAPIs. Previous studies have demonstrated that the BQD is a valid and reliable tool for assessing pressure injury risk in pediatric populations and that educational initiatives can enhance the clinical application of such tools (Curley et al., 2018; Chamblee et al., 2018; Puspitasari et al., 2020). The alignment of these

findings with published research reinforces the significance of educational strategies in quality improvement efforts.

Recommendations

Several recommendations can be made to build on these results. First, routine refresher education should be incorporated into annual competencies or onboarding processes to ensure continued provider proficiency. Additionally, healthcare systems may consider automating BQD scoring using artificial intelligence or integration into electronic health record (EHR) systems to reduce the documentation burden and support real-time decision-making. Future research should investigate the intervention's impact in various clinical settings and over extended periods to assess its sustainability and broader applicability.

In conclusion, this study supports the effectiveness of structured educational interventions in improving BQD documentation practices among pediatric care providers. By enhancing documentation accuracy and consistency, such initiatives improve early risk identification and prevention of hospital-acquired pressure injuries. Continued emphasis on provider education, system integration, and evaluation of long-term outcomes is essential to further advance patient safety and care quality in pediatric settings.

References

Bargos-Munárriz, M., Bermúdez-Pérez, M., Martínez-Alonso, A. M., García-Molina, P., & Orts-Cortés, M. I. (2020). Prevention of pressure injuries in critically ill children: A preliminary evaluation. *Journal of Tissue Viability*, *29*(4), 310–318. https://doi-org.ezproxy1.lib.asu.edu/10.1016/j.jtv.2020.08.005

Başbakkal, Z., Yilmaz, H. B., Gümüş, M., Belli, M., & Erçelik, Z. E. (2024). Medical device-related pressure injuries in paediatric patients: An incidence study in a children's hospital. *Journal of Clinical Nursing*, *33*(7), 2633–2639. https://doi-org.ezproxy1.lib.asu.edu/10.1111/jocn.16973

Becker, M.H. (1974). The health belief model and personal health behavior. *Health Education Monographs*, *2*, 324–508. http://dx.doi.org/10.1177/109019817400200407

Berry, K. G., Seiple, S. M., Stellar, J. J., Nagle, M. L., Curry, K., Immel, A., James, R., Srinivasan, V., Mascarenhas, M. R., Garrett, A., & Irving, S. Y. (2021). A scoping review to inform a multi-disciplinary approach for nutrition therapy in critically ill children with pressure injuries. *Translational Pediatrics*, *10*(10), 2799–2813. https://doi.org/10.21037/tp-21-3

Bradshaw, M. J., Vitale, T. R., Bensenson, I., & Oermann, M. (2021). Skills for formal review of literature and evidence appraisal. In M. J. Bradshaw & T. R. Vitale (Eds.), *The DNP project workbook: A step-by-step process for success* (pp. 129-160). Springer Publishing.

Butler C. T. (2007). Pediatric skin care: Guidelines for assessment, prevention, and treatment. *Dermatology Nursing*, *19*(5), 471–485.

Chamblee, T. B., Pasek, T. A., Caillouette, C. N., Stellar, J. J., Quigley, S. M., & Curley, M. A. Q. (2018). CE: How to predict pediatric pressure injury risk with the Braden QD Scale.

The American Journal of Nursing, *118*(11), 34–43. https://doi.org/10.1097/01.NAJ.0000547638.92908.de

Ciprandi, G., Crucianelli, S., Zama, M., Antonielli, G., Armani, R., Aureli, S., Barra, G., Beetham, C. J. C., Bernardini, G., Cancani, F., Carai, A., Cajozzo, M., Carlesi, L., Cialdella, A., Ciaralli, I., Ciliento, G., Corsetti, T., De Chirico, B., Di Corato, P., Dotta, A., … Santamaria, N. (2022). The clinical effectiveness of an integrated multidisciplinary evidence-based program to prevent intraoperative pressure injuries in high-risk children undergoing long-duration surgical procedures: A quality improvement study. *International Wound Journal*, *19*(7), 1887–1900. https://doi.org/10.1111/iwj.13967

Curley, M. A. Q., Hasbani, N. R., Quigley, S. M., Stellar, J. J., Pasek, T. A., Shelley, S. S., Kulik, L. A., Chamblee, T. B., Dilloway, M. A., Caillouette, C. N., McCabe, M. A., & Wypij, D. (2018). Predicting pressure injury risk in pediatric patients: The Braden QD Scale. *The Journal of Pediatrics*, *192*, 189–195. https://doi.org/10.1016/j.jpeds.2017.09.045

Dang, W., Liu, Y., Zhou, Q., Duan, Y., Gan, H., Wang, L., Zhu, Q., Xie, C., & Hu, A. (2022). Risk factors of medical device-related pressure injury in intensive care units. *Journal of Clinical Nursing*, *31*(9-10), 1174–1183. https://doi.org/10.1111/jocn.15974

Deming, W.E. (1993). *The new economics* (p. 135). Massachusetts Institute of Technology Press.

Dimanopoulos, T., Chaboyer, W., Campbell, J., Ullman, A. J., Battley, C., Ware, R. S., Patel, M., & Griffin, B. R. (2024). Incidence of hospital-acquired pressure injuries and predictors of severity in a paediatric hospital. *Journal of Advanced Nursing*, *80*(10), 4161–4170. https://doi-org.ezproxy1.lib.asu.edu/10.1111/jan.16140

Freundlich, K. (2017). Pressure injuries in medically complex children: A review. *Children*, *4*(4), 25. https://doi.org/10.3390/children4040025

Ford, D. M., Budworth, L., Lawton, R., Teale, E. A., & O'Connor, D. B. (2023). In-hospital stress and patient outcomes: A systematic review and meta-analysis. *PloS One*, *18*(3). https://doi.org/10.1371/journal.pone.0282789

Gou, L., Zhang, Z., & A, Y. (2023). Risk factors for medical device-related pressure injury in ICU patients: A systematic review and meta-analysis. *PloS One*, *18*(6). https://doi.org/10.1371/journal.pone.0287326

Intellectus Statistics [Online computer software]. (2023). Intellectus Statistics. https://statistics.intellectus360.com

Johnson, A. K., Kruger, J. F., Ferrari, S., Weisse, M. B., Hamilton, M., Loh, L., Chapman, A. M., Taylor, K., Bargmann-Losche, J., & Donnelly, L. F. (2020). Key drivers in reducing hospital-acquired pressure injury at a quaternary children's hospital. *Pediatric Quality & Safety*, *5*(2), e289. https://doi.org/10.1097/pq9.0000000000000289

Kulik, L. A., Hasbani, N. R., Stellar, J. J., Quigley, S. M., Shelley, S. S., Wypij, D., & Curley, M. A. Q. (2019). Hospital-acquired pressure injuries in children with congenital heart disease: Prevalence and associated factors. *Pediatric Critical Care Medicine*, *20*(11), 1048–1056. https://doi.org/10.1097/PCC.0000000000002077

Langley, G., Nolan, K, & Nolan, T. (1994). The foundation of improvement. *Quality Progress*, *27* (pp. 81–86).

Lauderbaugh, D. L., Billman, G., Popien, T. L., Hauseur, S., Lee, E., & O'Haver, J. (2021). A comparison of the Braden Q and the Braden QD Scale to assess pediatric risk for pressure

injuries during noninvasive ventilation. *Respiratory Care*, *66*(8), 1234–1239. https://doi.org/10.4187/RESPCARE.08536

Liukka, M., Steven, A., Moreno, M. F. V., Sara-Aho, A. M., Khakurel, J., Pearson, P., Turunen, H., & Tella, S. (2020). Action after adverse events in healthcare: An integrative literature review. *International Journal of Environmental Research and Public Health*, *17*(13), 4717. https://doi.org/10.3390/ijerph17134717

Seval, M., Güney, E. U., Ayyıldız, T. K., & Alkan, N. Ş. K. (2025). Risk factors and prevalence of medical device-related pressure injuries in pediatric intensive care. *Journal of Pediatric Nursing*, *S0882-5963*(25) 1-9. Advance online publication. https://doi-org.ezproxy1.lib.asu.edu/10.1016/j.pedn.2025.03.014

National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. (1979). *The Belmont report: Ethical principles and guidelines for the protection of human subjects of research*. U.S. Department of Health and Human Services. https://www.hhs.gov/ohrp/sites/default/files/the-belmont-report-508c_FINAL.pdf

Padula, W. V., & Delarmente, B. A. (2019). The national cost of hospital-acquired pressure injuries in the United States. *International Wound Journal*, *16*(3), 634–640. https://doi.org/10.1111/iwj.13071

Pignatti, M., D'Arpa, S., Roche, N., Giorgini, F. A., Lusetti, I. L., Lorca-Garcia, C., De Santis, G., & Berenguer, B. (2021). Surgical treatment of pressure injuries in children: A multicentre experience. *Wound Repair and Regeneration*, *29*(6), 961–972. https://doi.org/10.1111/wrr.12964

Pott, F. S., Meier, M. J., Stocco, J. G. D., Petz, F. F. C., Roehrs, H., & Ziegelmann, P. K. (2023). Pressure injury prevention measures: overview of systematic reviews. *Revista da Escola de Enfermagem da U S P*, *57*. https://doi.org/10.1590/1980-220X-REEUSP-2023-0039en

Puspitasari, J. D., Nurhaeni, N., & Waluyanti, F. T. (2020). Testing of Braden QD Scale for predicting pressure ulcer risk in the pediatric intensive care unit. *Pediatric Reports*, *12*(1), 8694. https://doi.org/10.4081/pr.2020.8694

Rahma, A., & Lane, M. E. (2022). Skin barrier function in infants: Update and outlook. *Pharmaceutics*, *14*(2), 433. https://doi.org/10.3390/pharmaceutics14020433

Razmus, I., & Bergquist-Beringer, S. (2017). Pressure injury prevalence and the rate of hospital-acquired pressure injury among pediatric patients in acute care. *Journal of Wound, Ostomy, and Continence Nursing*, *44*(2), 110–117. https://doi.org/10.1097/WON.0000000000000306

Şimşek, E., Demir, A. S., Semerci, R., & Karadağ, A. (2023). The incidence and prevalence of medical device-related pressure injuries in pediatric patients: Systematic review and meta-analysis. *Journal of Pediatric Nursing*, *72*, 130–138. https://doi.org/10.1016/j.pedn.2023.06.019

Singh, C., Shoqirat, N., Thorpe, L., & Villaneuva, S. (2023). Sustainable pressure injury prevention. *BioMedical Journal*, *12*(2), e002248. https://doi.org/10.1136/bmjoq-2022-002248

Siotos, C., Bonett, A. M., Damoulakis, G., Becerra, A. Z., Kokosis, G., Hood, K., Dorafshar, A. H., & Shenaq, D. S. (2022). Burden of pressure injuries: Findings from the global burden of disease study. *Eplasty*, *22*, 19. https://pubmed.ncbi.nlm.nih.gov/35873067/

Stellar, J. J., Hasbani, N. R., Kulik, L. A., Shelley, S. S., Quigley, S., Wypij, D., & Curley, M. A. Q. (2020). Medical device-related pressure injuries in infants and children. *Journal of Wound, Ostomy, and Continence Nursing*, *47*(5), 459–469. https://doi.org/10.1097/WON.0000000000000683

Widiati, E., Nurhaeni, N., & Gayatri, D. (2017). Medical-device related pressure injuries to children in the intensive care unit. *Comprehensive Child and Adolescent Nursing*, *40*(1), 69–77. https://doi.org/10.1080/24694193.2017.1386973

Zhang, H., Ma, Y., Wang, Q., Zhang, X., & Han, L. (2022). Incidence and prevalence of pressure injuries in children patients: A systematic review and meta-analysis. *Journal of Tissue Viability*, *31*(1), 142–151. https://doi-org.ezproxy1.lib.asu.edu/10.1016/j.jtv.2021.07.003

Appendix A

Evaluation and Synthesis Tables

Table A1

Evaluation Table for Quantitative Studies

Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence; Application to practice Generalization
Puspitasari et al. (2020), Testing of Braden QD Scale for predicting pressure ulcer risk in the Pediatric Intensive Care Unit **Country**: Indonesia **Funding**: DRPM Universitas Indonesia **Bias**: Not explicitly mentioned. potential biases: selection bias, observer bias.	**Theoretical:** Health belief model	**Design:** Correlational study **Method:** Consecutive sampling **Purpose:** To test the validity and reliability of the BQD for assessing pressure injury risk in pediatric patients in the PICU.	**n=** 51 **Demographics:** < 18 y/o Bedridden > 24hr **Setting:** PICU **Exclusion:** UNK **Attrition:** N/A	**IV1:** BQD **IV2:** Braden Q Scale **DV1:** Risk for pressure injury **Definitions:** Braden QD score > 13, and Braden Q score > 16 = pressure injury risk	**Tools:** BQD Braden Q Scale Observation checklist **Validity/ Reliability:** Braden QD Validity/ Reliability 0.532 and 0.833 $\alpha > 0.6$ Braden Q Validity/ Reliability 0.528 and 0.804 $\alpha > 0.6$	**Statistical Tests Used:** Pearson correlation coefficients Cronbach's alpha Sensitivity, and specificity tests	**DV1:** 88.2% of pediatric patients were at risk for pressure injury based on the BQD. Sensitivity value of the BQD was 100%, and specificity value was 40%. The BQD is a valid and reliable instrument for predicting pressure injury risk in the PICU.	**Level of Evidence**: level 1 primary study **Strengths**: Provides evidence of validity/ reliability of the BQD **Weakness**: Limited generalizability due to single-center study & small sample size **Feasibility**: Feasible for clinical practice to assess risk/implement preventive measures. **Application**: Nurses to assess

Key: **α** Cronbach's alpha, **AUC** area under the ROC Curve, **BQD** Braden QD Scale, **CI** confidence interval, **DV** Dependent Variable, **ETT** endotracheal tube, **HAPI** Hospital-Acquired Pressure Injuries, **ICU** Intensive Care Unit, **IV** Independent Variable, **LOS** length of stay, **MDRPI** medical device-related pressure injuries, **N** number of studies, **n** number of participants, **N/A** not applicable, **NIV** noninvasive positive-pressure ventilation, **O**R odds ratio, **PICU** Pediatric Intensive Care Unit, **unk** unknown, **y/o** years of age

								pressure injury risk in pediatric patients.
Curley et al. (2018), Predicting pressure injury risk in pediatric patients: The Braden QD Scale **Country**: USA **Funding**: American Association of Critical-Care Nurses and the Wound, Ostomy, Continence® Society. **Bias**: Not explicitly mentioned. Potential biases: selection bias, observer bias	**Theoretical:** Health belief model **Conceptual:** Braden and Bergstrom's conceptual framework of pressure injury risk	**Design:** Multicenter, prospective cohort study **Method:** Receiver operating characteristic curves **Purpose:** To describe the development and initial testing of the BQD to predict both immobility-related and medical device–related pressure injury risk in pediatric patients.	**n=** 625 **Demographics:** < 21 y/o **Setting:** Eight pediatric academic medical centers across the US **Exclusion:** pre-existing pressure injury DNR order **Attrition:** N/A	**IV1:** Use of the BQD **DV1:** HAPIs **Definitions:** Pressure injury risk assessed based on the Braden QD Scale scores Bedrest-infants not being held, toddlers not cruising, or children not walking per usual.	**Tools:** BQD **Validity/ Reliability:** good predictive validity AUC of 0.78 (95% CI 0.73-0.84)	**Statistical Tests Used:** Regression methods Receiver operating characteristic curves	**DV1:** The BQD performed well in predicting immobility-related and medical device–related pressure injuries in pediatric patients. At a cutoff score of 13, the scale provided a sensitivity of 0.86 and specificity of 0.59.	**Level of Evidence**: level 1 **Strengths**: Provides a single instrument to assess both immobility-related and MDRPI risk in a diverse pediatric population. **Weakness**: May require further validation in different settings or populations. **Feasibility**: Can be easily integrated into clinical practice for early and reliable assessment of pressure injury risk. **Application**: acute care settings for pediatric patients ranging from preterm to 21 years.
Butler, C. T. (2007), Pediatric skin care: Guidelines for assessment,	**Theoretical:** critical determinants of pressure ulcer development	**Design:** clinical practice guideline	**N=** N/A **Demographics:** dermatology nurses who work	**IV1:** Use of the BQD	**Tools:** Eczema Area and Severity Index	**Statistical Tests Used:** N/A	**DV1:** N/A **DV2:** N/A	**Level of Evidence**: level 1 **Strengths**: Comprehensive

Key: **α** Cronbach's alpha, **AUC** area under the ROC Curve, **BQD** Braden QD Scale, **CI** confidence interval, **DV** Dependent Variable, **ETT** endotracheal tube, **HAPI** Hospital-Acquired Pressure Injuries, **ICU** Intensive Care Unit, **IV** Independent Variable, **LOS** length of stay, **MDRPI** medical device-related pressure injuries, **N** number of studies, **n** number of participants, **N/A** not applicable, **NIV** noninvasive positive-pressure ventilation, **OR** odds ratio, **PICU** Pediatric Intensive Care Unit, **unk** unknown, **y/o** years of age

prevention, and treatment **Country**: USA **Funding**: unk **Bias**: Not explicitly mentioned.	**Conceptual:** Braden and Bergstrom	**Purpose:** provide comprehensive guidelines for healthcare professionals on the assessment, prevention, and treatment of skin conditions in pediatric patients	with pediatric patients **Setting:** various healthcare settings **Exclusion:** N/A **Attrition:** N/A	**DV1:** Improvement or worsening of skin conditions **DV2:** Effectiveness of preventive measures in reducing skin issues **DV3:** Efficacy of treatment modalities in addressing skin problems **Definitions:** BQD, pressure injuries	Pressure Ulcer Scale for Healing Bates-Jensen Wound Assessment Tool Braden Scale **Validity/ Reliability:** supported by their widespread use in clinical practice and research		**DV3:** N/A	Guidelines, Evidence-Based **Weakness**: unk **Feasibility**: Can be easily integrated into clinical practice for early and reliable assessment of pressure injury risk. **Application**: Nurses to assess pressure injury risk in pediatric patients.
Chamblee et al., (2018), CE: How to predict pediatric pressure injury risk with the Braden QD Scale	**Theoretical:** Health belief model **Conceptual:** Braden and Bergstrom's conceptual framework of	**Design:** Descriptive **Purpose:** Demonstrate how the BQD can be used to predict the risk of pressure injuries in pediatric patients	**N=** N/A **Demographics:** Pediatric nurses **Setting:** Various healthcare settings where pressure	**IV1:** Use of the BQD **DV1:** Incidence of pressure ulcers	**Tools:** BQD Pressure Ulcer Staging Assessment of Skin Integrity **Validity/ Reliability:**	**Statistical Tests Used:** N/A	**DV1:** Pressure ulcers do occur in this population and certain factors, such as age, length of intubation, and length of stay in the intensive care	**Level of Evidence**: level IV **Strengths**: Comprehensive Coverage, Practical Guidelines, Emphasis on Prevention

Key: **α** Cronbach's alpha, **AUC** area under the ROC Curve, **BQD** Braden QD Scale, **CI** confidence interval, **DV** Dependent Variable, **ETT** endotracheal tube, **HAPI** Hospital-Acquired Pressure Injuries, **ICU** Intensive Care Unit, **IV** Independent Variable, **LOS** length of stay, **MDRPI** medical device-related pressure injuries, **N** number of studies, **n** number of participants, **N/A** not applicable, **NIV** noninvasive positive-pressure ventilation, **OR** odds ratio, **PICU** Pediatric Intensive Care Unit, **unk** unknown, **y/o** years of age

Country: unk **Funding**: unk **Bias**: Not explicitly mentioned. Potential biases: Limited tool variation	pressure injury risk		injuries may be a risk **Exclusion:** N/A **Attrition:** N/A	**DV2:** Stage of pressure ulcers **DV3:** Location of pressure ulcers **DV4:** Healing time **Definitions:** N/A	Supported by their widespread use in clinical practice and research		unit, are associated with an increased risk of skin breakdown in critically ill children. **DV2:** Defined stages I-IV **DV3:** Occipital pressure ulcers from 16.9% to 4.8% **DV4:** N/A	**Weakness**: Limited Research References, Absence of Case Studies, Lack of Specificity, Lack of Information on Cultural and Socioeconomic Factors **Feasibility**: Can be easily integrated into clinical practice for early and reliable assessment of pressure injury risk. **Application**: acute care settings for pediatric patients ranging from preterm to 21 years.
Dang et al. (2022), Risk factors of medical device-related pressure injury in intensive care units **Country**: China **Funding**: Guangdong	**Theoretical:** critical determinants of pressure ulcer development **Conceptual:** Braden and Bergstrom	**Design:** Cross-sectional **Purpose:** identify and analyze the risk factors associated with medical device-related pressure injuries in patients admitted to intensive care units	**N= 694** **Demographics:** Pediatric ICU patients **Setting:** 30 hospitals located in 14 cities in Guangdong Province, China ICU	**IV1:** Use of the Braden Scale **DV1:** presence of MDRPI **Definitions:** MDRPI: a pressure injury caused using medical devices with	**Tools:** Braden Scale **Validity/ Reliability:** α 0.752	**Statistical Tests Used:** independent t test chi-square test Fisher's exact test logistic regression mode	**DV1:** prevalence rate of MDRPI ICUs was 13.1%. The most common stages stage 1 54.1% stage 2 15.3% BiPAP masks were the highest at 25%. oximetry probes were the most common medical device associated	**Level of Evidence**: level IV **Strengths**: sample size, Provides evidence of validity/ reliability of the BQD **Weakness**: Retrospective design, limited generalizability,

Key: **α** Cronbach's alpha, **AUC** area under the ROC Curve, **BQD** Braden QD Scale, **CI** confidence interval, **DV** Dependent Variable, **ETT** endotracheal tube, **HAPI** Hospital-Acquired Pressure Injuries, **ICU** Intensive Care Unit, **IV** Independent Variable, **LOS** length of stay, **MDRPI** medical device-related pressure injuries, **N** number of studies, **n** number of participants, **N/A** not applicable, **NIV** noninvasive positive-pressure ventilation, **OR** odds ratio, **PICU** Pediatric Intensive Care Unit, **unk** unknown, **y/o** years of age

Nursing Association **Bias**: Not explicitly mentioned. Potential biases: selection bias			**Exclusion:** unk **Attrition:** N/A	the shape of the injured part being consistent with that of medical devices. Braden scores: lower scores indicating higher risk.			with MDRPI, followed by endotracheal tubes and nasogastric tubes	potential confounding variables **Feasibility**: Harder due to confounding variables **Application**: Prevention Strategies, Device Selection, Quality Improvement Initiatives
Kulik et al. (2019), Hospital-acquired pressure injuries in children with congenital heart disease: Prevalence and associated factors **Country**: USA **Funding**: Wound, Ostomy and Continence Nurses Society	**Theoretical:** Health belief model **Conceptual:** Braden and Bergstrom's conceptual framework of pressure injury risk	**Design:** Multicenter prospective cohort study **Purpose:** explore the prevalence, location, and clinical factors associated with HAPI among pediatric patients with congenital heart disease	**N= 279** **Demographics:** < 21 y/o Cardiac pt. **Setting:** **e**ight acute care academic pediatric hospitals ICU **Exclusion:** Presence of Pressure Injury at Admission DNR order **Attrition:** N/A	**IV1:** Use of the Braden Scale **DV1:** Prevalence HAPI **DV2:** Most Common Medical Devices Causing Injury **DV3:** Risk Factors for HAPI Development	**Tools:** BQD **Validity/ Reliability:** P value: < 0.10-0.05	**Statistical Tests Used:** Univariate Logistic Regression Stepwise Multivariate Logistic Regression Descriptive Statistics	**DV1:** Prevalence HAPI 9.7% **DV2:** 74% MDRPI oxygen saturation probes (28/38 injuries). Other devices: oral ETT, NIV facemasks, and peripheral IVs. **DV3:** Risk Factors non-Hispanic white OR 3.54, 95%, Operating OR 2.91, 95%, Oxygen saturation levels	**Level of Evidence**: Level II **Strengths**: Prospective Design, Multicenter Approach, Large Sample Size, Comprehensive Data Collection **Weakness**: Secondary Analysis, Lack of Randomization, Limited Information on Intervention Implementation

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Program for Patient Safety and Quality, Boston Children's Hospital, American Association of Critical-Care Nurses **Bias**: Not explicitly mentioned. Potential biases: selection bias				**DV4:** HAPI location **DV5:** Timing of HAPI development **Definitions:** Congenital Heart Disease: A range of structural problems in the heart that are present from birth.			less than 85% OR 2.65, 95%, Worse Braden QD scores OR 1., 95% **DV4:** HAPI location buttock, sacrum, and coccyx, accounting for 50% **DV5:** 67% identified by the third study observation day	**Feasibility**: feasible in terms of resources data collection methods, statistical analysis, time frame **Application**: Prevention Strategies, Risk Assessment, Medical Device Management, Quality Improvement
Widiati et al. (2017), Medical-device related pressure injuries to children in the intensive care unit **Country**: Indonesia **Funding**: Directorate of Research and Community Engagement, Universitas Indonesia **Bias**: Not explicitly mentioned.	**Theoretical:** critical determinants of pressure ulcer development **Conceptual:** Braden and Bergstrom	**Design:** randomized controlled trial method with a cross-over design **Purpose:** determine the effectiveness of injury-prevention guidance about children who need to have medical devices attached to their bodies as part of their treatment	**N= 50** **Demographics:** 1 day -18 y/o **Setting:** pediatric ICU **Exclusion: N/A** **Attrition: N/A**	**IV1:** standard hospital routine care IV2: medical treatment based on Kiss and Heiler's guidelines **DV1:** Incidence of Pressure Injuries **DV2:** Pressure Injury Categories	**Tools:** Braden Q scores Neonatal Skin Risk Assessment Scale Kiss and Heiler's Guidelines Photographic Assessment **Validity/ Reliability:** Supported by their widespread use in clinical practice and research	**Statistical Tests Used:** Not stated	**DV1:** ETT (13%), OGT (12%), NGT (11%), and SpO2 probe (6%) **DV2:** pressure injuries observed were categorized as Grade 1 pressure injuries **DV3:** no significant difference between the control group and the intervention group	**Level of Evidence**: Level II **Strengths**: Focused Population, Use of Validated Tools, Ethical Considerations, Objective Outcome Measures **Weakness**: Small Sample Size, Short Duration, Limited Detail on Intervention, Lack of Blinding, Statistical Analysis **Feasibility**: feasible in terms of

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Potential biases: selection bias, observer bias				**DV3:** Intervention Effectiveness **Definitions:** Pressure Injury Staging: pressure injuries are staged based on the depth and characteristics of the wound				design and methodology **Application**: Prevention Strategies, Risk Assessment, Medical Device Management, Quality Improvement
Şimşek et al., (2023), The incidence and prevalence of medical device-related pressure injuries in pediatric patients: Systematic review and meta-analysis **Country**: Turkey **Funding**: No funding **Bias**: Not explicitly mentioned. Potential biases: selection bias, Heterogeneity bias	**Theoretical:** Health belief model **Conceptual:** Population, Intervention, Comparison, Outcome, and Study Types	**Design:** systematic review and meta- analysis design, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines **Purpose:** To determine the pooled incidence and prevalence rate of MDRPIs using the BQD, medical devices that frequently cause MDRPIs, and anatomical locations that are vulnerable to them	**N=** 25,742 **Demographics:** Birth – 21 y/o United States of America and the United Kingdom **Setting:** hospital environments **Exclusion:** scales other than Braden QD, Not reporting incidence or prevalence rate, Consensus report, gray literature, case study, guideline, all type of review and meta-analysis	**IV1:** Use of Medical Devices **IV2:** Anatomical Locations **IV3:** Patient Characteristics **IV4:** Duration of Hospital Stay **DV1:** Prevalence of HAPI **DV2:** Location **DV3:** Medical	**Tools:** Joanna Briggs Institute Meta-Analysis of Statistics Assessment and Review Instruments Cochrane Risk of Bias tool Literature databases Confidence Intervals **Validity/ Reliability:** p-value 0.10 α 0.10 CI: 95%	**Statistical Tests Used:** Cochran's Q statistics p-value Cochran Q test Fixed effects model I^2 statistic Random-effects model Egger's test	**DV1:** Moderate to High Incidence and Prevalence **DV2:** the face, ankle/foot, and head are the most commonly affected areas **DV3:** External monitoring devices, respiratory devices, and supportive/securing devices are frequently associated with MDRPIs	**Level of Evidence**: Level II **Strengths**: Comprehensive Data Synthesis, Use of Validated Scales, Highlighting Key Risk Factors **Weakness**: Heterogeneity, Potential Underreporting **Feasibility**: feasible in healthcare settings with adequate resources **Application**: Risk Assessment, Policy Development, Education and

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			Attrition: N/A	Devices Causing MDRPIs				Training, Preventive Measures
Lauderbaugh et al. (2021), A comparison of the Braden Q and the Braden QD Scale to assess pediatric risk for pressure injuries during noninvasive ventilation **Country**: USA **Funding**: N/A **Bias**: measurement and sampling error, non-differential bias	**Theoretical:** critical determinants of pressure ulcer development **Conceptual:** Braden and Bergstrom	**Design:** retrospective study **Purpose:** evaluate whether the Braden QD scoring tool is better able to identify pediatric patients receiving NIV who are at risk for the development of pressure injury as compared to the previously used Braden Q scale	**N= 45** **Demographics:** 1 month-23 y/o **Setting:** large tertiary children's hospital **Exclusion:** Subjects without NIV mask-related pressure injuries **Attrition: N/A**	**IV1:** Braden Q **DV1:** Braden QD **Definitions:** BQD: A pediatric pressure injury risk assessment tool	**Tools:** Braden Q Scale BQD **Validity/ Reliability:** α 0.05	**Statistical Tests Used:** McNemar test OR	**DV1:** The Braden QD "at-risk" score of ≥ 16 had a significant correlation with pressure injury at admission, 48 hours prior to injury, 24 hours before injury, at the time of injury, and at resolution. The Braden Q score of ≤ 16 identified 100% of subjects as being at no risk of pressure injury at admission, at the identification of the pressure injury, and at 24 hours prior to injury.	**Level of Evidence**: Level II **Strengths**: Real-World Application, Comparison of Scales, Focus on Medical Device-Related Injuries **Weakness**: Limited Generalizability, Lack of Detailed Analysis **Feasibility**: The study demonstrates the feasibility of using the BQD in a clinical setting **Application**: BQD could be more effective in identifying pediatric patients at risk for pressure injuries related to

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								noninvasive ventilation masks.
Marufu et al. (2021), Pressure injury and risk in the inpatient paediatric and neonatal populations: A single centre point-prevalence study **Country**: United Kingdom **Funding**: None **Bias**: Not explicitly mentioned. Potential biases: selection bias, Confounding Bias	**Theoretical:** tissues tolerating exposure to pressure **Conceptual:** Braden and Bergstrom	**Design:** cross-sectional **Purpose:** quantify prevalence of pressure injury, assess skin integrity risk level, and quantify preventive interventions in both neonatal and child inpatient populations at a large children's hospital in the UK	**N=** 88 **Demographics:** 0–18 y/o **Setting:** large children's hospital with tertiary neonatal services located across two site **Exclusion:** N/A **Attrition:** 4	**IV1:** Use of the Braden Scale **DV1:** Pressure Injury Prevalence **DV2:** Pressure Injury Grade **DV3:** Location of Pressure Injuries	**Tools:** European Pressure Ulcer Advisory Pane BQD Medstrom pre-prevalence survey **Validity/ Reliability:** CI 95%	**Statistical Tests Used:** Descriptive Statistics Kruskal-Wallis Test Odds ratios Logistic Regression Analysis Inferential Measures	**DV1:** overall prevalence of pressure injuries was 3.4% **DV2:** Grade 1 1.1% Grade 2 2.3% **DV3:** Having a medical device was associated with an increased risk of developing pressure injuries (OR 0.03, 95% CI 0.01–0.05, p = 0.02)	**Level of Evidence**: Level IV **Strengths**: Comprehensive Assessment, Use of a Validated Risk Assessment Tool, Inclusion of a Wide Age Range **Weakness**: Single-Center Design, Small Sample Size **Feasibility**: feasible for implementation in other pediatric and neonatal hospital settings **Application**: Risk Assessment and Prevention, Policy and Protocol Development, Quality Improvement Initiatives

Key: **α** Cronbach's alpha, **AUC** area under the ROC Curve, **BQD** Braden QD Scale, **CI** confidence interval, **DV** Dependent Variable, **ETT** endotracheal tube, **HAPI** Hospital-Acquired Pressure Injuries, **ICU** Intensive Care Unit, **IV** Independent Variable, **LOS** length of stay, **MDRPI** medical device-related pressure injuries, **N** number of studies, **n** number of participants, **N/A** not applicable, **NIV** noninvasive positive-pressure ventilation, **O**R odds ratio, **PICU** Pediatric Intensive Care Unit, **unk** unknown, **y/o** years of age

Key: **α** Cronbach's alpha, **AUC** area under the ROC Curve, **BQD** Braden QD Scale, **CI** confidence interval, **DV** Dependent Variable, **ETT** endotracheal tube, **HAPI** Hospital-Acquired Pressure Injuries, **ICU** Intensive Care Unit, **IV** Independent Variable, **LOS** length of stay, **MDRPI** medical device-related pressure injuries, **N** number of studies, **n** number of participants, **N/A** not applicable, **NIV** noninvasive positive-pressure ventilation, **OR** odds ratio, **PICU** Pediatric Intensive Care Unit, **unk** unknown, **y/o** years of age

Table A2

Synthesis Table

Study (Author, year)	Butler, 2007	Chamblee et al., 2022	Curley et al., 2018	Dang et al., 2022	Kulik et al., 2019	Lauderbaugh et al., 2021	Marufu et al., 2021	Puspitasari et al., 2020	Şimşek et al., 2023	Widiati et al., 2017
Design LOE	Review/IV	Review/IV	Cohort Study/III	Cross-sectional/IV	Cohort Study/III	Retrospective/ IV	Cross-sectional/IV	Cross-sectional/IV	Systematic Review/II	Cross-sectional/IV
Sample										
n subjects			625	694	279	45	88	51	25,742	50
Age Range			Preterm-21y/o	=/> 18 y/o	Preterm-21y/o	1 month-23y/o	0 -18 y/o	< 18 y/o	0 - 21 y/o	1 day - 18 y/o
Median LoS			28 days	10 days	4 weeks		11 days			3 days
Setting										
ICU			X	X	X	X	X	X	X	X
Acute care			X		X		X		X	
Interventions/Themes										
Braden QD Scale	X	X	X		X	X	X			X
Staged injures				X	X	X	X			
Noted location				X	X	X	X		X	
Noted device	X	X		X		X	X		X	X
Prevention	X	X			X	X	X			
Risk Factors			X	X	X		X		X	
Guidelines	X									
Prevalence										
HAPI			7.8%		9.7%		2.3%		7.8%	
IRPI			2%		26%					
MDRPI			6.7%	13.1%	7.5%		2.3%		7%	
Incidence				15.3%	29		2			
Classification			NPUAP		NPUAP		EPUAP			

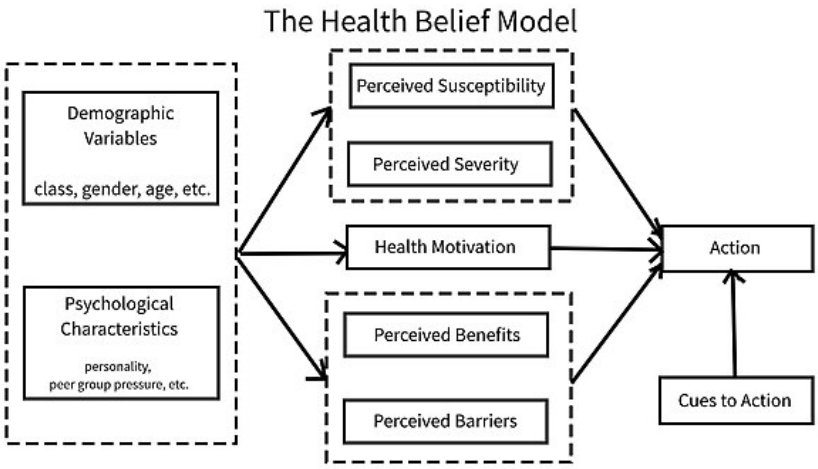
Key: **EPUAP** European Pressure Ulcer Advisory Panel, **HAPI** Hospital-acquired pressure injury, **ICU** Intensive Care Unit, **LOE** Level of Evidence, **IRPI** Incontinence-Related Pressure Injury, **LoS** Length of study, **MDPI** Medical device–related pressure injury, **n** number of participants, **NPUAP** National Pressure Ulcer Advisory Panel, **PICU** Pediatric intensive care unit, **y/o** years old.

Appendix B

Models and Frameworks

Figure B1

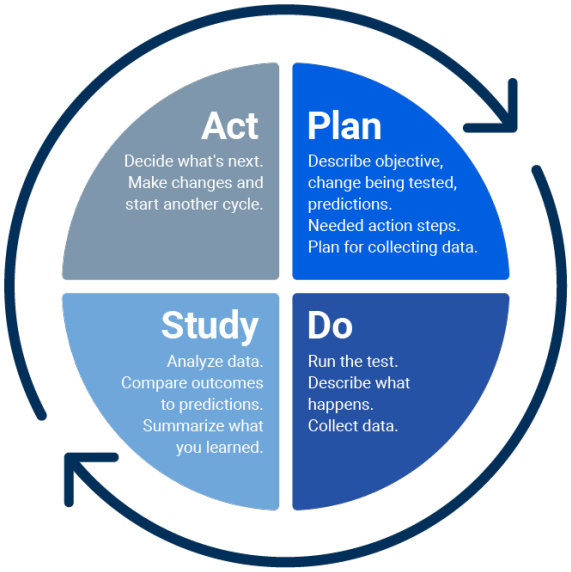
Health Belief Model



(Becker, 1974)

Figure B2

PDSA Cycle



(Langley et al., 1994)

Figure B3

HAPI prevention – Logic Model

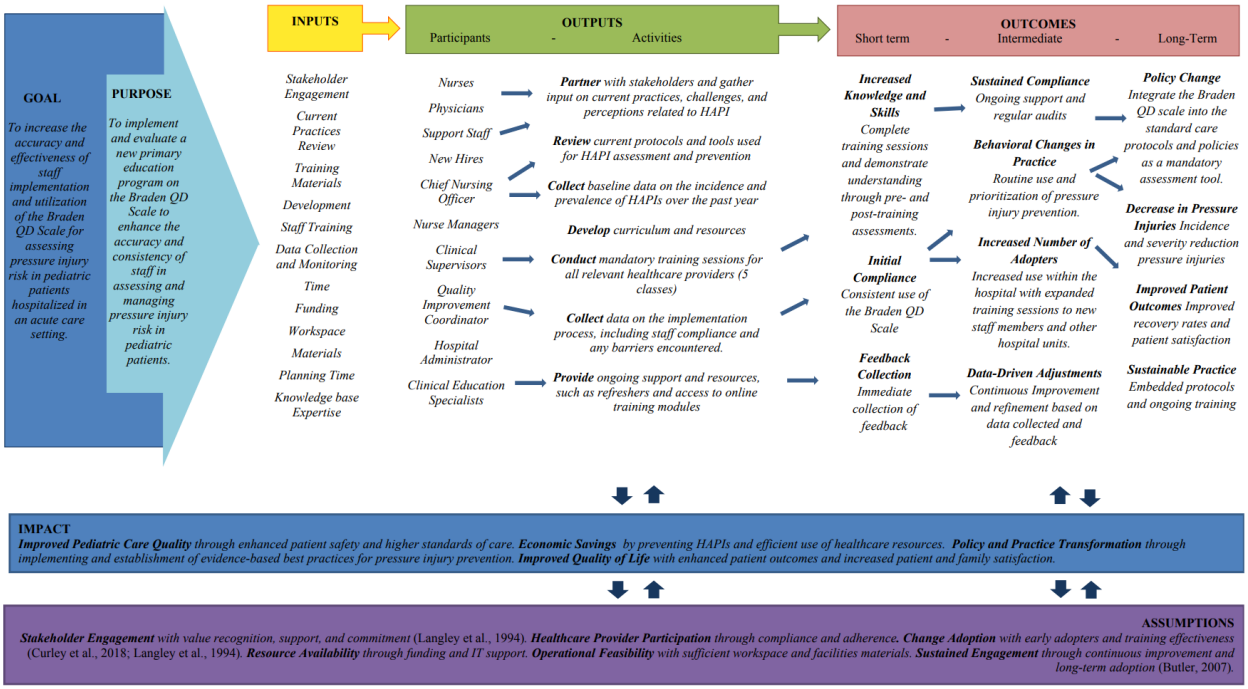


Figure B4

Braden QD Scale

Braden QD Scale				
Intensity and Duration of Pressure				**Score**
Mobility The ability to independently change & control body position	**0. No Limitation** Makes major and frequent changes in body or extremity position independently.	**1. Limited** Makes slight and infrequent changes in body or extremity position **OR** unable to reposition self independently (includes infants too young to roll over).	**2. Completely Immobile** Does not make even slight changes in body or extremity position independently.	
Sensory Perception The ability to respond meaningfully, in a **developmentally** appropriate way, to pressure-related discomfort	**0. No Impairment** Responsive **and** has no sensory deficits which limit ability to feel or communicate discomfort.	**1. Limited** Cannot always communicate pressure-related discomfort **OR** has some sensory deficits that limit ability to feel pressure-related discomfort.	**2. Completely Limited** Unresponsive due to diminished level of consciousness or sedation **OR** sensory deficits limit ability to feel pressure-related discomfort over most of body surface.	
Tolerance of the Skin and Supporting Structure				
Friction & Shear ***Friction:*** occurs when skin moves against support surfaces ***Shear:*** occurs when skin & adjacent bony surface slide across one another	**0. No Problem** Has sufficient strength to completely lift self up during a move. Maintains good body position in bed/chair at all times. Able to completely lift patient during a position change.	**1. Potential Problem** Requires **some** assistance in moving. Occasionally slides down in bed/chair, requiring repositioning. During repositioning, skin often slides against surface.	**2. Problem** Requires **full** assistance in moving. Frequently slides down and requires repositioning. Complete lifting without skin sliding against surface is impossible **OR** spasticity, contractures, itching or agitation leads to almost constant friction.	
Nutrition *Usual* diet for age – assess pattern over the most recent 3 consecutive days	**0. Adequate** Diet for age providing **adequate** calories **&** protein to support metabolism and growth.	**1. Limited** Diet for age providing **inadequate** calories **OR inadequate** protein to support metabolism and growth **OR** receiving supplemental nutrition any part of the day.	**2. Poor** Diet for age providing **inadequate** calories **and** protein to support metabolism and growth.	
Tissue Perfusion & Oxygenation	**0. Adequate** Normotensive for age, **&** oxygen saturation ≥ 95%, **&** normal hemoglobin, **&** capillary refill ≤ 2 seconds.	**1. Potential Problem** Normotensive for age **with** oxygen saturation <95%, **OR** hemoglobin <10 g/dl, **OR** capillary refill > 2 seconds.	**2. Compromised** Hypotensive for age **OR** hemodynamically unstable with position changes.	
Medical Devices				
Number of Medical Devices	**Score 1 point for each medical device* up to 8 (Score 8 points maximum)** ****Any diagnostic or therapeutic device that is currently attached to or traverses the patient's skin or mucous membrane.***			
Repositionability/ Skin Protection	**0. No Medical Devices**	**1. Potential Problem** All medical devices can be repositioned **OR** the skin under each device is protected.	**2. Problem** Any one or more medical device(s) cannot be repositioned **OR** the skin under each device is not protected.	
			Total **(≥ 13 considered at risk)**	

(Curley et al., 2018)

Appendix C

Chart Audit Form

Date: _____ Page 1 of 7

Pressure Points: Optimizing Braden QD Scale Documentation Through Educational Interventions

Chart Audit Form

Subject ID	**Age** (Years/Months)	**Gender** (Female/Male)	**Ethnicity/ Race**	**Language**	**Insurance Status**	**Braden QD Scale Total** (Nurse Score)	**Braden QD Scale Total** (Evaluator Score)	**Braden QD Scale Mobility** (Nurse Score)	**Braden QD Scale Mobility** (Evaluator Score)

IRB Approval # _____ Date_____
Data Entry_____ Data Validation_____ Data Analysis _____

Date: _____ Page 2 of 7

Pressure Points: Optimizing Braden QD Scale Documentation Through Educational Interventions

Chart Audit Form

HAC Prevention: Pressure Injury	Ambulation	Motor Response	**Braden QD Scale Sensory Perception** (Nurse Score)	**Braden QD Scale Sensory Perception** (Evaluator Score)	Level of Consciousness	Arousal Level	Speech	Motor Response	Sbs Sedation Scale

IRB Approval # _____ Date_____
Data Entry_____ Data Validation_____ Data Analysis _____

Date: _____ Page 3 of 7

Pressure Points: Optimizing Braden QD Scale Documentation Through Educational Interventions

Chart Audit Form

Aldrete Sedation Assessment	PCA/Epi Sedation Scale	Pain scale	Mood/Behavior	Active Medication List	**Braden QD Scale Friction & Shear** (Nurse Score)(spasticity, contractures, itching or agitation)	**Braden QD Scale Friction & Shear** (Evaluator Score)	Pediatric Delirium Screening	Seizure Episode	**Braden QD Scale Nutrition** (Nurse Score)

IRB Approval # _____ Date_____
Data Entry_____ Data Validation_____ Data Analysis _____

Date: _____ Page 4 of 7

Pressure Points: Optimizing Braden QD Scale Documentation Through Educational Interventions

Chart Audit Form

Braden QD Scale Nutrition (Evaluator Score)	Diet for Past 3 Days	Meal Consumption	IV Fluids	TPN/Lipids	Nutritional Risk Assessments	Nutritional Supplements	Feeding Techniques	Body Mass Index	**Braden QD Scale Tissue Perfusion & Oxygenation** (Nurse Score)

IRB Approval # _____ Date_____
Data Entry_____ Data Validation_____ Data Analysis _____

Date: _____ Page 5 of 7

Pressure Points: Optimizing Braden QD Scale Documentation Through Educational Interventions

Chart Audit Form

Braden QD Scale Tissue Perfusion & Oxygenation (Evaluator Score)	Heart Rate	Respiratory Rate	Respiratory Rate and Effort	Blood Pressure	Temperature	Pulse Oximetry	Supplemental Oxygen	Capillary Refill	Peripheral Pulses

IRB Approval # _____ Date_____
Data Entry_____ Data Validation_____ Data Analysis _____

Date: _____ Page 6 of 7

Pressure Points: Optimizing Braden QD Scale Documentation Through Educational Interventions

Chart Audit Form

Hemoglobin	**Braden QD Scale Number of Medical Devices** (Nurse Score)	**Braden QD Scale Number of Medical Devices** (Evaluator Score)	Access/Monitoring Devices	Restraints	Shunts	Chest Tubes	Feeding Tubes	Tracheostomies	Drains

IRB Approval # _____ Date_____
Data Entry_____ Data Validation_____ Data Analysis _____

Date: _____ Page 7 of 7

Pressure Points: Optimizing Braden QD Scale Documentation Through Educational Interventions

Chart Audit Form

Immobilizers	Catheters	Medication Patches	G-Tube	Respiratory Devices	Orthopedic Devices	Compression Devices	EEG	**Braden QD Scale Repositionability/ Skin Protection** (Nurse Score)	**Braden QD Scale Repositionability/ Skin Protection** (Evaluator Score)

IRB Approval # _____ Date_____
Data Entry_____ Data Validation_____ Data Analysis _____

Appendix D

Braden QD Evaluation Project: Budget Proposal

Potential Funding: This project could be sought from healthcare research grants, hospital internal funds, or educational institutions focused on improving patient care quality and outcomes.

Revenue/Savings: By implementing this project, the hospital can expect to reduce the incidence of HAPIs, leading to potential savings in treatment costs, reduced hospital stays, and improved patient outcomes. Enhanced documentation can also contribute to better compliance with healthcare regulations and improve overall patient care quality, potentially increasing the hospital's reputation and attracting more funding opportunities.

Phase	Activities	Cost	subtotal	Total
Preparation	Chart review for the month of April 2024 qualifying pediatric patients from the 9th floor ($30/hr x 24 hours)	$720		
	Chart review for the month of July 2024 qualifying pediatric patients from the 9th floor ($30/hr x 24 hours)	$720		
	Chart review for the month of September 2024 qualifying pediatric patients from the 9th floor ($30/hr x 24 hours)	$720		
	Meetings with project champion- Megan Morgan ($52/hr x 1hr each meeting)	$520		
	Meetings with project champion- Eryn Banke ($58/hr x 1=hr each meeting)	$580		
	Meetings with project mentor-	$630		

	Dani Sebbens ($63/hr x 1hr each meeting)			
	Designing data collection tool (fixed rate)	$400		
	Air conditioning/electricity ($250/month)	$750		
	Internet Connection: Wi-Fi ($120/month)	$360		
	ZOOM business membership ($19.99/month)	$60	**$5,460**	
Evaluation	Intellectus statistical software for data review	$0- already accessible by student		
	Review and analysis of results (statistician fixed rate)	$400	**$400**	**$5,860**

Budget Justification:

Preparation:

Effective preparation is essential for the success of this project:

Direct Costs:

- Chart Review: Conducting comprehensive chart reviews in April, July, and September 2024 to assess current Braden QD Scale documentation practices. This involves analyzing data from pediatric patient records on the 9th floor, totaling 72 work hours at $30/hr.
- Meetings with Project Champions: Project champions Megan Morgan, Eryn Banke, and project mentor Dani Sebbens meet regularly to gather insights and support protocol improvements. These meetings are budgeted at $52/hr, $58/hr, and $63/hr, respectively.

- Designing Data Collection Tool: Developing a tailored data collection tool to systematically evaluate the completeness of Braden QD Scale documentation.
- Infrastructure Costs: This includes air conditioning/electricity expenses and internet services at the project site, essential for data collection and project coordination.
- ZOOM Membership: Using a ZOOM business membership for seamless communication and collaboration among project stakeholders.

Indirect Costs:

- Infrastructure Costs: Air conditioning/electricity expenses and internet services at the project site.

Evaluation:

Continuous evaluation ensures sustained improvements:

Direct Costs:

- Annual Chart Review: Conduct annual reviews to monitor adherence to the optimized Braden QD Scale documentation protocol.
- Provider Training: Providing annual remedial training sessions to educate providers on the updated documentation standards, ensuring consistent evidence-based care delivery.
- Statistical Analysis: Using Intellectus statistical software for robust data review and analysis of project outcomes, facilitating evidence-based decision-making and continuous quality enhancement.

Continuous Improvement:

Tracking results and statistics will drive continuous improvement efforts:

Direct Costs:

- Statistical Review and Analysis: Allocating resources for a statistician to analyze project outcomes, supporting informed decisions and ongoing enhancements in Braden QD Scale documentation practices.

Appendix E

Statistical Analysis

Table E1

Frequency Table for Nominal and Ordinal Variables

Variable	*n*	*%*
Age Range		
Adolescent	48	32.00
School-age	47	31.33
Preschooler	8	5.33
Toddler	8	5.33
Infant	30	20.00
Neonate	9	6.00
Language		
English	129	86.00
Spanish	21	14.00
Injury Type		
Traumatic Injuries	36	24.00
Surgical & Post-surgical Complications	2	1.33
Pediatric-Specific Injuries	6	4.00
Respiratory Injuries	21	14.00
Neurological Injuries	9	6.00
Gastrointestinal Injuries	11	7.33
Infectious Diseases & Sepsis-related Injuries	26	17.33
Musculoskeletal Injuries	30	20.00
Cardiovascular Injuries	2	1.33
Metabolic and Endocrine Disorders	6	4.00
Skin & Soft Tissue Injuries	1	0.67

Note. Due to rounding errors, percentages may not equal 100%.

Table E2

Summary Statistics Table for Interval and Ratio Variables

Variable	*M*	*SD*	*n*	Min	Max
Length of Stay	4.15	4.01	150	1.00	28.00

Note. '-' indicates the statistic is undefined due to constant data or an insufficient sample size.

Table E3

Frequency Table for Nominal Variables

Variable	Group		
	Pre-Intervention	Post-Phase 1 Intervention	Post-Phase 2 Intervention
Completed Braden QD Scale			
Yes	34 (68.00%)	36 (72.00%)	44 (88.00%)
No	16 (32.00%)	14 (28.00%)	6 (12.00%)
Total	50 (100.00%)	50 (100.00%)	50 (100.00%)

Note. Due to rounding errors, percentages may not sum to 100%.

Table E4

Summary Statistics Table for Interval and Ratio Variables by Group

Variable	*M*	*SD*	*n*	Min	Max
Braden QD Scale Total Score					
Pre-Intervention	5.85	2.22	34	3.00	12.00
Post-Phase 1 Intervention	5.61	2.42	36	1.00	12.00
Post-Phase 2 Intervention	4.91	2.72	44	1.00	13.00

Note. '-' indicates the statistic is undefined due to constant data or an insufficient sample size.