



Implementation of a Nurse Driven Pathway to Reduce Incidence of Hospital Acquired Pressure Injuries in the Pediatric Intensive Care Setting



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ABSTRACT

Purpose: A large, freestanding pediatric hospital in the southern United States saw a 117% increase in reported hospital acquired pressure injuries (HAPI) between 2013 and 2015, with the intensive care units being the units of highest occurrence.

Design and Methods

A quality improvement project was designed and implemented to assist with pressure injury prevention. Literature review confirmed that pediatric HAPIs are a challenge and that usage of bundles and user-friendly guidelines/pathways can help eliminate barriers to prevention. The aim of this quality improvement project had two aims. First, to reduce HAPI incidence in the PICU by 10%. Second, to increase consistent usage of pressure injury prevention strategies as evidenced by a 10% increase in pressure injury bundle compliance. The third aim was to identify if there are differences in percentage of interventions implemented between two different groups of patients. Donabedian's model of Structure, Process, and Outcomes guided the development and implementation of this quality improvement project. Interventions focused on risk assessment subscale scores have the opportunity to mitigate specific risk factors and improve pressure injury prevention.

Results: Through implementation of the nurse driven pathway there was a 57% decrease in reported HAPIs in the PICU as well as a 66% increase in pressure ulcer prevention bundle compliance.

Conclusions: Implementation of the nurse driven pressure injury prevention pathway was successful. There was a significant increase in bundle compliance for pressure ulcer prevention and a decrease in reported HAPIs.

Practice Implications: The pathway developed and implemented for this quality improvement project could be adapted to other populations and care settings to provide guidance across the continuum.

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Introduction

Development of a pressure injury in the inpatient setting is a costly epidemic in healthcare costing between \$9.1 and \$11.6 billion per year in the United States (Agency for Healthcare Research & Quality (AHRQ), 2014). Literature supports prevention of pressure injuries being more cost effective and beneficial to the patient since pressure injuries can increase length of stay, increase risk for infection, and complicate treatment (Institute for Healthcare Improvement, n.d.). Development of a pressure injury comes as a result of pressure and/or shear to the skin (The National Pressure Ulcer Advisory Panel (NPUAP), 2016). There are many factors that put patients at increased risk of Hospital Acquired Pressure Injuries (HAPI). To identify patients at risk, clinicians can utilize pressure injury risk assessment tools. In 1996, the Braden Q Scale for Predicting Pediatric Pressure Ulcer Risk was modified from the Braden Scale for Predicting Pressure Sore Risk

and developed for the pediatric population. The Braden Q risk assessment tool has proven valid and reliable for patients 21 days to 8 years of age with a sensitivity of 0.88 and specificity of 0.58 at a score of 16 (Curley, Razmus, Roberts, & Wypij, 2003). The Braden Q tool consists of seven subscales—mobility, activity, sensory perception, moisture, friction-shear, nutrition, and tissue perfusion/oxygenation. Each of these subscales is scored from 1 (very limited/comprised/poor) to 4 (no problems/limitations/impairment) to arrive at a total score which ranges from 7 to 28. A score of 16 or less is considered at high risk for pressure injury development (Curley et al., 2003).

Utilization of risk assessment tools such as the Braden Q can assist care providers with identification of pediatric patients at risk for developing a HAPI. However, even after patients are identified, nurses are often unsure and do not feel empowered to prevent pressure injuries. Instead of relying on their clinical knowledge and judgment, nurses frequently rely on their interdisciplinary team members for interventions and treatment options (Samuriwo, 2012). Moreover, secondary to an increased number of higher acuity patients, higher patient to nurse ratios, and competing priorities in patient care, skin care and pressure

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injury prevention is often not implemented (Carnevale, 2003). Clinical practice guidelines that are user-friendly with standardized interventions that can be individualized based on patient condition can assist nurses in pressure injury prevention and help eliminate barriers such as knowledge deficits (Drake, Redfern, Sherburne, Nugent, & Simpson, 2012; Kiss & Heiler, 2014).

Local Problem

HAPIs have long been thought of as a problem that only adults and adult institutions face, however, HAPIs are a very real problem in the pediatric patient population for reasons that differ from adults (Schindler et al., 2011). In 2010 a research study by Kottner and colleagues showed that the pressure injury prevalence rate was approximately 7% in the general hospitalized pediatric patient population and closer to 26% in pediatric intensive care (Kottner, Wilborn, & Dassen, 2010).

A large, freestanding pediatric hospital in the southern United States saw a 117% increase in reported HAPIs between 2013 and 2015, with the intensive care units being the units of highest occurrence. During 2013, there were 80 reported HAPIs including Stage I–IV, unstageable, and Deep Tissue Injuries. In 2014 this increased to 110, and in 2015 there were 174 reported HAPIs. Moreover, in 2015, 20% of the Serious Safety Events at this organization were secondary to pressure injuries due to the level of harm caused to the patient (stage III, stage IV, and unstageable). In addition, the hospital and the Pediatric Intensive Care Unit (PICU) frequently performed below the benchmark on HAPIs reported to the National Database of Nursing Quality Indicators (NDNQI) when compared to peer organizations.

Aims

A quality improvement project was designed and implemented to assist with pressure injury prevention as part of the author's Doctorate of Nursing Practice Scholarly Project requirement. The first aim was to reduce HAPI incidence in the PICU by 10%. Second was to increase consistent usage of pressure injury prevention strategies as evidenced by a 10% increase in pressure injury bundle compliance. The third aim was to identify if there are differences in percentage of interventions implemented between two different groups of patients.

PICOT question format was utilized to frame the research questions. The population, intervention, comparison, outcome, and time element of the three research questions were defined and addressed.

1. Will the implementation of a nurse driven pathway based on Braden Q subscale scores (I), compared to current practice (C), lead to a decrease in hospital acquired pressure injury incidence in (O) in hospitalized pediatric patients in the PICU (P) within six weeks of implementation (T)?
2. Will the implementation of a nurse driven pathway based on Braden Q subscale scores (I), compared to current practice (C), lead to an increase in pressure injury bundle compliance (O) in hospitalized pediatric patients in the PICU (P) within six weeks of implementation (T)?
3. Will patients identified as high risk for HAPI development (Braden Q \leq 16) (P), have a lower percentage (O) of implemented pathway interventions (I) when compared to patients identified as at moderate risk for HAPI development (Braden Q 17–21) (C) during the six weeks after implementation (T)?

Methods

Setting and Ethics

The quality improvement project took place in a 26-bed PICU, at a large, tertiary care, free-standing children's hospital in the southern United States. The project received administrative review and was

deemed not human subjects research by the university-affiliate institutional review board and was approved by the University of Alabama institutional review board. Risks to participants was minimal. There were no conflicts of interest identified by the author. Project activities were part of quality improvement activities; identifiable information about patients was not collected. The project was carried out over a 12-week period from August 31, 2016 to November 20, 2016.

Planning and Implementation

Donabedian's model of Structure, Process, and Outcomes guided the development and implementation of this quality improvement project. Donabedian's model of Structure, Process, and Outcomes suggests that clinical outcomes are impacted by the structure (i.e. physical and organizational elements) and process (i.e. the provision of care and process characteristics) (Naranjo & Kaimal, 2011). For this quality improvement project Structure was the care environment at the hospital, Process was the nurse driven pathway, and the Outcomes evaluated include HAPI incidence, bundle compliance, and usage of the nurse driven pathway. Evaluation of bundle compliance, implementation of interventions in the nurse driven pathway, and HAPI incidence and description were collected via the electronic health record.

Intervention

Development and implementation of bundles has proven effective in many fields of healthcare delivery to assist clinicians with translating research into practice, (Institute for Healthcare Improvement, 2016). A bundle is a collection of evidence-based interventions that should be implemented on each applicable patient on every occasion. The purpose of a bundle is to help improve the process and cement the components into a single unit of care (Berenholtz et al., 2004; Downie, Perrin, & Kiernan, 2013; Pronovost, 2008). Many bundles focus around care to be provided based off a cumulative pressure injury risk assessment score.

As part of the organization's involvement in the Solutions for Patient Safety collaborative, a pressure injury prevention bundle was implemented in 2014 (see Table 1). The bundle consisted of several evidence-based interventions to assist with pressure injury prevention and was implemented on patients deemed high risk, defined as those scoring \leq 16 based on the Braden Q risk assessment scale. There was no bundle or pathway to guide interventions for patients identified as moderate (Braden Q score of 17–21) or low (Braden Q score of 22–26) risk. Compliance with the pressure injury prevention bundle was monitored monthly by the organization. During 2015 and early 2016, bundle compliance was consistently below the organizational goal of 90%. Despite implementation of risk assessment scales and a prevention bundle, pressure injury development continued to be a challenge in the PICU.

Recent literature suggests focusing interventions based on risk assessment subscale scores may prove more effective in pressure injury prevention (Gadd, 2014). By developing a pathway to assist nurses to implement interventions based on subscale scores may enhance pressure injury prevention and improve the plan-to-intervention time (Gadd, 2012). Utilizing the 2014 Clinical Guidelines from the National Pressure Ulcer Advisory Panel, a nurse driven pathway was developed that expanded upon the previously implemented pressure injury prevention bundle. Interventions were chosen based on the level of evidence, strength of recommendation, and feasibility for implementation as outlined in the guidelines. The pathway included interventions to mitigate each of the risk factors outlined in the Braden Q risk assessment scale. For all patients with a Braden Q subscale score of 3 or under, nurses implemented the interventions as indicated by the pathway (see Fig. 1 and Table 1).

Nurses in the PICU received education regarding the pathway and interventions for three weeks prior to implementation of the pathway. Education was provided via staff meetings, online training module, and electronic just-in-time teaching handout. Copies of the pathway

Table 1
Current practice of SPS Bundle compared to interventions outlined on Nurse Driven Pressure Injury Pathway.

Solutions for Patient Safety Pressure Injury Prevention Bundle Components (Solutions for Patient Safety (SPS), 2014)	Nurse Driven Pressure Injury Prevention Pathway Interventions (The National Pressure Ulcer Advisory Panel (NPUAP), European Pressure Ulcer Advisory Panel (EPUAP), Pan Pacific Pressure Injury Alliance, 2014)
Skin assessment	Skin Assessment
<ul style="list-style-type: none"> At least every 24 h but consensus best practice recommend every shift change (Q4H in perfusion compromised patients), Operating Room (OR) at end of cases lasting 4 h or more and/or on arrival PACU/ICU's 	<ul style="list-style-type: none"> Assess skin every shift
Device rotation	Device rotation:
<ul style="list-style-type: none"> Assess skin in contact with medical devices each shift or more frequently with other care, Rotate pulse-ox probe at least every 8 h or more often if able 	<ul style="list-style-type: none"> Patients with medical devices in place require assessment of skin around and under the device at minimum of q shift. Rotation of medical device placement should occur per policy.
Patient positioning	Mobility:
<ul style="list-style-type: none"> Turn all immobile patients at least every 2 h or timed with care in NICU (e.g. standardized turning schedule, clock at bedside) Maintain HOB <30° (unless medically contraindicated) 	<ul style="list-style-type: none"> Reposition pt. q2 hr with turning schedule Do not position on areas of non-blanchable redness Float heels Discuss specialty bed per algorithm with LIP Utilize pillows, jellies, and aids for pressure relief/rep. Keep HOB <30 degrees if possible Place sacral border on pt
Appropriate bed surface	Activity
<ul style="list-style-type: none"> Use of Positioning Devices (Evaluate need for specialty bed based on Skin Risk Assessment, Use gel pads, pillows and/or pressure reduction device such as Z-Flo™ to cushion bony prominences) 	<ul style="list-style-type: none"> Advocate for increased activity as patient condition allows.
Moisture management	Sensory Perception
<ul style="list-style-type: none"> Barrier cream applied to create a moisture barrier for all diapered patients; Keep skin clean and dry 	<ul style="list-style-type: none"> Limit time in a single position to 2 h Ensure pt. is not lying on tubes, wires, small objects.
	Moisture
	<ul style="list-style-type: none"> Use barrier cream on all diapered patients Limit layers of linen in incontinent patients
	Friction & Shear
	<ul style="list-style-type: none"> Consider usage of foam dressing (Mepilex or Mepilex Lite) to bony prominences frequently subjected to friction and shear. Use draw sheet on patients who require to be pulled up in bed. Place sacral border on patient.
	Nutrition
	<ul style="list-style-type: none"> Complete nutritional screen on admission Discuss need for nutrition consult with LIP.
	Tissue perfusion & oxygenation
	<ul style="list-style-type: none"> If hemo-dynamically unstable, patient may only tolerate small tilts and reposition of limbs and head.

were located at every bed-space in the PICU with extra copies at the team leader desk and with nursing leadership. The PICU nurses who served as pressure injury prevention champions for the unit also served as subject matter experts and super users of the pathway. These staff members were available for nurses to ask questions during real time implementation of the pathway.

Measurements

Data regarding pressure injury bundle compliance and pressure injury incidence rates were collected for six weeks prior to implementation of the pressure injury prevention pathway and again six weeks post implementation. Assessment of bundle compliance, was assessed by electronic health record report to identify patients at high risk for pressure injury development. For these patients, pressure ulcer risk assessment (Braden Q) scores and subscores as well as demographic data and compliance with the pressure injury prevention bundle (post

implementation) was collected weekly. When a pressure injury was reported via electronic reporting system, patient demographics, pressure ulcer risk assessment (Braden Q) scores and subscores as well as descriptive information about any HAPI that occurred. A complete list of all variables can be found in Table 2. All data were collected and stored in a password protected, encrypted spreadsheet on an encrypted network drive.

Statistical Analysis

Demographic data were analyzed using descriptive statistics. Categorical variables were summarized using frequencies and percentages. Two sample *t*-tests were conducted to compare percentage of implemented pathway interventions between participants scoring at high-risk for HAPI development (Braden Q ≤ 16) and those scoring as moderate risk (Braden Q 17–21).

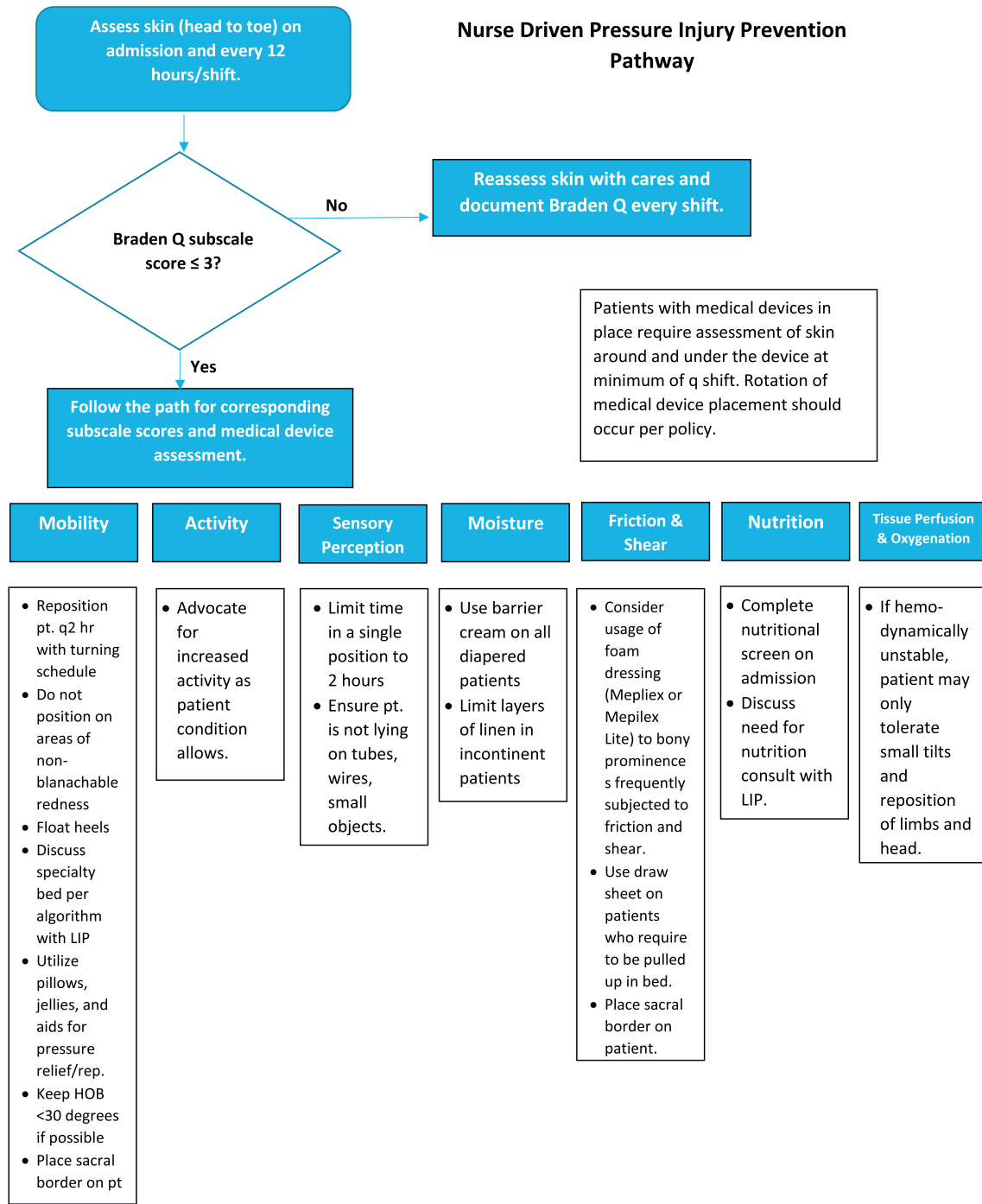


Fig. 1. Nurse Driven Pressure Injury Prevention Pathway.

Results

Patient Demographics

Throughout the course of the project, 53 patient records were reviewed for bundle audits or for information about pressure injury development. Patients ranged in age from 27 days to 20 years, with an average age of 8.27 years. Sixty-six percent of patients in the PICU were males with 33% being females. Most patients were Caucasian (50.94%), followed by black (35.85%), Hispanic (9.43%), and other (3.77%). Respiratory and trauma diagnoses were the main admission diagnosis for patients, comprising 55% of the population, with several other diagnoses seen as well (Table 3).

Bundle Compliance

Audits of bundle compliance were completed pre- and post-intervention. The audits of bundle compliance included the elements of the Solutions for Patient Safety Pressure Injury Prevention listed in Table 1. A total of 33 audits were completed pre-intervention and 67 were completed post-intervention. Many patients had a length of stay in the PICU that expanded over multiple weeks of the study so bundle compliance was collected for those patients each time. Prior to implementation of the nurse driven pressure injury prevention pathway (August 31, 2016 to October 9, 2016) bundle compliance was 45% while post intervention (October 10, 2016–November 20, 2016) compliance was 75%.

Table 2
List of Variables.

Variables
Age
Gender
Race
Admission diagnosis
Stage of pressure injury (1, 2, 3, 4, sDTI, US, mucosal)
Pressure injury location
Medical device related pressure ulcer (yes/no)
Type of device
Braden Q risk assessment scale total score
Braden Q risk assessment scale subscale scores (mobility, activity, sensory perception, moisture, nutrition, tissue/perfusion)
Compliance with pressure ulcer prevention bundle (yes/no)
Interventions from nurse driven pathway implemented

Pressure Injury Incidence

Pressure injury incidence was determined by pressure injuries reported during the pre- and post-intervention period. During the pre-intervention period, 6 pressure injuries were reported: Stage 1 (1), Stage 2 (1), Stage 3 (1), Unstageable (1), and Deep Tissue Injury (2). This provided an incidence rate of 1.05 per 100 patient days. Post-intervention, 3 pressure injuries were reported—1 Stage 1, 1 Stage 2, and 1 Unstageable—for an incidence rate of 0.48 per 100 patient days.

Usage of Pathway

A paired, two sample *t*-test was conducted to compare the implementation of interventions on the nurse driven pressure injury prevention pathway on patients identified as high risk (Braden Q ≤ 16) to those identified as moderate risk (Braden Q 17–21). There was not a significant difference in the usage for high risk patients (mean = 12.23; SD = 14) and moderate risk patients (mean = 12.02; SD = 3.9); $t = 0.25$; $p = 0.80$. The paired two sample *t*-test was conducted for each subscale arm of the pathway in addition to the complete usage identified above. Only moisture (wetness related to incontinence and/or perspiration) showed a significant difference in implementation of pathway elements for high risk patients (M = 1.66; SD = 0.46) when compared to moderate risk patients (M = 1.13; SD = 0.93); $t = 2.96$; $p = 0.008$.

Table 3
Demographic Characteristics.

Demographic	n	%
Gender		
Male	35	66%
Female	18	34%
Race		
Caucasian	27	51%
Black	19	36%
Hispanic	5	9%
Other	2	4%
Diagnosis		
Respiratory distress/failure	18	34%
Trauma	11	21%
Seizure	7	13%
Post-surgical	6	11%
Abdominal pain	2	4%
Asthma	2	4%
Cancer	2	4%
Sepsis	2	4%
Ingestion	1	2%
Meningitis	1	2%
Renal failure	1	2%

Discussion

Reduction of pressure injuries by 10% was the primary aim of this quality improvement project. The PICOT question, “Will the implementation of a nurse driven pathway based on Braden Q subscale scores (I), compared to current practice (C), lead to a decrease in hospital acquired pressure injury incidence in (O) in hospitalized pediatric patients in the PICU (P) within six weeks of implementation (T)?” was answered at the completion of this project. By developing and implementing a nurse driven pathway, interventions were identified and implemented for mitigation of patient risk factors for pressure injury development. The PICU saw a 57% decrease in reported pressure injuries after implementation of the nurse driven pathway. Focus on reducing the incidence of pressure injuries, improves patient outcomes, lowers costs, and does not increase length of stay related to wound treatment (Agency for Healthcare Research and Quality (AHRQ), 2014).

In addition to pressure injury reduction, this quality improvement project sought to examine if implementation of the nurse driven pathway would assist nurses with compliance to the previously implemented bundle. The nurse driven pathway included interventions, that if implemented, would meet all the components of the pressure injury prevention bundle. Bundle compliance improved from 45% pre-intervention to 75% post intervention. This 66% increase in compliance was a significant improvement in the six week timeframe of this project. In addition, the aim of a 10% increase in bundle compliance was met. While this improvement was substantial, it does still fall short of the organizational goal of 90% compliance. Utilization of Donabedian's model of Structure, Process, and Outcomes, would suggest future work should be focused on identification and elimination of barriers in the hospital environment (structure) that prohibit nurses from meeting this compliance goal and could further improve patient outcomes by decreasing HAPI occurrences.

This project also examined the difference in pathway intervention implementation between high risk patients (Braden Q ≤ 16) and patients at moderate risk for pressure injury development (Braden Q 17–21). Most often, the more acutely ill the patient, the higher the risk for pressure injury development. This increased risk comes from a decrease in mobility and activity while increasing the medical interventions (i.e. devices, medications) utilized to provide lifesaving treatment. Due to competing priorities in patient care, often skin care and pressure injury prevention often falls by the wayside (Carnevale, 2003). Surprisingly, no significant difference was found in the implementation of the pathway between the high risk and moderate risk group ($t = 0.25$; $p = 0.80$). With further examination of each Braden Q subscale category, only the subscale of moisture showed a significant difference between the implementation of the interventions to mitigate this risk factor between high risk and moderate risk patients ($t = 2.96$; $p = 0.008$). This could include use of bowel management systems and/or urinary catheters in the more acutely ill, higher risk patients. Additionally patients identified as moderate risk, may not have been incontinent of stool or urine, thus lessening the need for intervention. Given that data related to continence and continence management was not collected during this quality improvement project, it is unclear the exact reason for the difference between the two groups.

Implications for Practice

With changes to reimbursement, the focus on patient outcomes, and prevention of patient harm, preventing pressure injuries has become a focus across the country in all patient populations. Identification of patients at risk utilizing standardized assessments and tools is a key step in pressure ulcer prevention, however, organizations must assist nurses to go beyond identification of patients at risk to assist them in preventing pressure injuries. By providing clear, easy to use, nurse driven clinical pathways, organizations can improve outcomes and give nurses the ability to implement pressure injury prevention strategies

without relying on their interdisciplinary partners for guidance or orders. Moreover, implementing pathways that work to mitigate risk factors for pressure injury development instead of focusing on the overall risk score can prevent pressure injuries in a greater number of patients; including those that are not identified as high risk.

Spreading the pressure injury prevention pathway to other care areas and other organizations has the potential to further reduce pressure injuries in the pediatric patient population. Education to direct care nurses would need to occur to ensure understanding of the pathway and how to appropriately implement interventions. Also, to further assist with feasibility and integration of the pathway into routine nursing practice, placing the pathway in the electronic health record could assist with identification and documentation of the pressure injury prevention interventions implemented. By making the pathway a routine part of nurses' workflow, compliance may be able to be increased.

Future work will need to focus on identification of barriers to compliance with the pathway and implementation of interventions for pressure injury prevention. Once the barriers are identified, organizations can reduce or eliminate those barriers, which may help with compliance and pressure injury reduction.

Limitations

This quality improvement was conducted in a single PICU. Further testing of the pathway among other populations and organizations will need to be conducted in the future to ensure it is generalizable to all patient populations and care settings.

Conclusion

Pressure injury prevention has become a focus across the country of care providers in all settings and populations. Development and implementation of tools and clinical pathways to assist nurses in identification of patients at risk and interventions to implement to mitigate the risk factors is a key component of pressure injury prevention. The pathway developed and implemented for this quality improvement project could be adapted to other populations and care settings to provide guidance across the continuum. Little education and staff training was required to implement the pathway and successful outcomes were demonstrated by this project. In the future, further exploration could occur to examine ways to expand the pathway and enhance interventions focused on reduction of device related pressure injuries.

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