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Utilizing a Comprehensive Wound Care Team to Lower Hospital-Acquired Pressure Injuries in an Academic Public Hospital

A Retrospective Cohort Study

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ABSTRACT

PURPOSE: Hospital-acquired pressure injuries (HAPIs) have significant impacts on patient morbidity and mortality, with approximately 2.5 million patients treated for pressure-related injuries annually.[1] This study aimed to describe the influence of a comprehensive wound care team on HAPIs over an 8-year period.

DESIGN: Retrospective cohort study.

SUBJECTS AND SETTING: All inpatients at an academic public hospital system with HAPIs during the study period from May 2012 to February 2020.

METHODS: Data on wound stage, location, infection, medical device location if applicable, and risk factors were recorded from medical records. A 1-way analysis of variance was performed to assess for significance of mean number of cases, National Pressure Injury Advisory Panel (NPIAP) stage on initial presentation, and mean number of medical device-related wounds by year.

RESULTS: A total of 957 cases were included. The median stage of pressure injury on assessment was 2, with the mean NPIAP stage declining from 2012 to 2020 ($P = .003$). Thirty-three percent of pressure injuries were attributed to medical devices, most commonly endotracheal tubing. The most common site of pressure injury was the sacrum (33.6%).

CONCLUSION: Creation of a comprehensive wound care team within our academic public hospital system demonstrated a significant decline in device-related and pressure injury cases over the past 8 years. The wound care team focused on frequent assessment, education, and evidence-based treatment to lower these HAPI events.

KEY WORDS: Hospital-acquired pressure injury, Medical device, Pressure injury, Prevalence, Wound.

INTRODUCTION

Pressure injuries pose a significant and costly challenge for hospital systems, with approximately 2.5 million patients treated each year.[1] An estimated $11 billion of US healthcare expenditures are spent on pressure injury treatment.[1] The deleterious effects of hospital-acquired pressure injuries (HAPIs) include patient harm, additional need for treatment, potential for prolonged hospitalization, poor patient perception of the hospital system, litigation, and increased expenditures.[2]

Pressure injury prevention has become a focus in both long-term and acute care settings. In 2008, the Centers for Medicare & Medicaid Services (CMS) began incentivizing hospitals with financial penalties related to the development of pressure injuries.[1,3] Hospital-acquired stage 3 and 4 pressure injuries were labeled as a preventable event, with the CMS declining reimbursement for treatment.[4] This has included device-implicated pressure injuries.[4] The estimated prevalence of pressure injuries in acute care settings is 15% with an estimated incidence of 7%.[1] High-risk groups include older patients admitted for femoral fractures, as well as patients receiving critical care, are quadriplegic, or have spinal cord injuries; the risk of developing pressure injuries can range from 33% to 66% in the acute care setting.[5,6] Beyond increased care costs, pressure injuries present significant morbidity and mortality, including pain, emotional distress, and impact on quality of life.[7,8] Approximately 60,000 patients die of complications related to HAPIs each year.[9]

Acquisition of pressure injuries initiates through soft tissue damage most often located near bony prominences.[2,10] Focused body weight with a constant pressure of 70 mm Hg or more for more than 2 hours results in cell and tissue ischemia, oftentimes located at the sacrum or heels.[5,11,12] Shear forces have also been identified as contributors to the formation of pressure injuries through movement of bony prominences against subcutaneous tissues, resulting in malposition of subepidermal vasculature and increased susceptibility to pressure injuries.[13]

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TABLE 1.
Pressure Injury Cases per Month

Year	Mean (SD)
2012, 8 mo	17.5 (5.6)
2013	13.8 (2.9)
2014	9.5 (2.8)
2015	9.6 (2.5)
2016	7.0 (2.6)
2017	8.3 (2.8)
2018	8.1 (3.0)
2019	10.0 (1.7)
2020, 2 mo	11.5 (5.0)

The National Pressure Injury Advisory Panel (NPIAP) has outlined the various stages of pressure injuries, from stage 1 to stage 4. Stage 1 is classified as nonblanchable erythema with intact skin, stage 2 is partial-thickness skin loss with exposed dermis, stage 3 includes full-thickness skin loss, and stage 4 refers to full-thickness skin and tissue loss.[14] Additionally, in 2016 the NPIAP included medical device-related injuries as a cause in the definition of a pressure injury.[15]

Early identification of a pressure injury poses a challenge to healthcare providers, as HAPIs do not always initially visibly form on the skin.[2] Deep tissue damage may have already occurred prior to more superficial identification of the injury.[2,11] With greater knowledge surrounding the process of how pressure injuries develop, as well as the CMS citing pressure injuries as a preventable event, prevention of and halting progression of these injuries is a necessity.[5] Prevention measures include minimizing excessive moisture, treating and caring for fecal and urinary incontinence, frequent turning and repositioning, using specialized equipment such as mattresses, maximizing nutritional well-being, and providing staff education.[5,16,17] For prevention specific to medical devices, choosing the correct size of medical device, cushioning the skin with dressings, assessing the skin daily, and educating staff members on proper use of the device are crucial to limiting these injuries.[18] Despite insurance incentives, nursing-driven interventions, and preventative measures initiated by healthcare institutions, the risk of developing a pressure injury ranges from 2.8% to 9% in cumulative incidence based on patient length of stay.[19]

Decreasing the incidence of HAPIs is critical for healthcare institutions to promote appropriate patient treatment, enhance patient satisfaction, minimize complications and pain, and lower patient length of stay.[20] As pressure injuries are reported nationally, hospital systems are compared against both national organizations and similar healthcare systems for monitoring.[20,21] The aim of this study is to describe the prevalence of pressure injuries, both device and non-device-acquired injuries, at a large, academic public hospital system and suggest areas for early patient risk identification and future management.

METHODS

Data from this study were collected from the Virginia Commonwealth University Health System. The hospital system has a comprehensive wound care team that evaluates every pressure injury documented in the electronic medical system, which automatically alerts the wound care team that a patient needs to be seen. The wound care team comprises a physician, nurse manager, nurse clinician, and 9 clinical nurses. The majority of nurse team members are Wound, Ostomy, and Continence Nursing certified. Once the patient with a pressure injury is flagged by the wound care team, the injury is staged using the NPIAP staging definitions.[22,23] Information about location of the patient in the hospital, location of injury, presence of infection, topical management, sex, admission date, medical device location if applicable, and modifiable risk factors are recorded. Data were recorded for monthly review and reported to our quality improvement department and benchmarked against national and peer organizations. Data were reviewed from May 2012 through February 2020.

For this retrospective cohort study, inclusion criteria included inpatients of all ages, and received a wound consult that was documented by the comprehensive wound care team. Prevalence data of pressure injury per inpatient census, NPIAP stage, device-related injuries, devices implicated, anatomic location, and patient unit at the time the injury were identified. When multiple pressure injuries were present, the most severe injury was recorded when assessing for prevalence. Exclusion criteria included patients who were unstable or receiving palliative care, combative, off unit and unavailable for wound care team assessment, or patients who refused assessment and treatment of their pressure injury. This study was approved on August 19, 2020, by the Institutional Review Board at Virginia Commonwealth University (approval number: HM20019955).

TABLE 2.
Pressure Injury Cases, NPIAP Staging, and Device-Related Injuries by Year

Year	Total	DTI/Stage 1	Stage 2	Stage 3	Stage 4	Unstageable	Device Related, n (%)
2012, 8 mo	140	33	27	39	25	15	71 (51)
2013	165	43	35	29	25	33	58 (35)
2014	114	36	22	26	14	16	43 (38)
2015	115	27	17	30	13	28	27 (23)
2016	83	29	13	17	8	16	26 (31)
2017	100	40	19	16	9	16	30 (30)
2018	97	29	20	15	7	26	27 (28)
2019	120	31	21	23	8	37	31 (26)
2020, 2 mo	23	6	4	5	3	5	8 (35)

Abbreviations: DTI, deep tissue injury; NPIAP, National Pressure Injury Advisory Panel.

TABLE 3.
Annual Prevalence of Inpatient Hospital-Acquired Pressure Injuries

Year	Prevalence Percentage
2012, 8 mo	2.4%
2013	2.2%
2014	1.4%
2015	1.5%
2016	1.0%
2017	1.2%
2018	1.2%
2019	1.4%
2020, 2 mo	1.6%

Data Analysis

A statistical analysis was conducted using Microsoft Excel Version 16.35 (Microsoft Corporation, Redmond, Washington) and JMP 15.1 (SAS Institute Inc, Cary, North Carolina). The mean number of pressure injuries per month was calculated for each year along with standard deviation, and statistical analysis was performed using a 1-way analysis of variance (ANOVA) to assess for significance between groups. Participants were grouped based on months, seasons, years, pressure injury stage, device types, hospital location, and anatomic location of pressure injury. The critical value of significance was set at $P = .05$.

RESULTS

Data from 957 patients were included in this study. The mean number of pressure injury cases per month ranged from 6.9 to 17.5, generally declining from 2012 to 2020 (Table 1). Total cases by year are displayed in Table 2. The total number of annual cases during the study time frame was compared using an ANOVA, which demonstrated statistical significance ($P < .01$). This demonstrates a decline in the average number of cases, with the highest number at the start of the study (2012-2013), declining in the subsequent years. There were 19.9% of cases in which the patient sustained multiple pressure injuries. Average prevalence of HAPIs in the inpatient population was 1.5%, ranging from 1.0% in 2016 to the highest prevalence in 2012 at 2.4% (Table 3).

TABLE 4.
Average Pressure Injury Stage on Initial Assessment by Year

Year	Average Pressure Injury Stage
2012, 8 mo	2.4
2013	2.3
2014	2.2
2015	2.3
2016	2.1
2017	1.9
2018	2.0
2019	2.1
2020, 2 mo	2.3

When controlling for month or season (designated as January through March, April through June, July through September, and October through December), ANOVA differences were not significant. For analysis of variance by month, $P = 0.66$. When comparing by season, $P = 0.46$.

The median pressure injury stage on initial wound care assessment was 2 (Table 4). An ANOVA demonstrated significant variability between pressure injury stage on initial presentation from 2012 to 2020, with $P = .003$. The NPIAP stage on initial presentation was highest in 2012 at a median of 2 (most commonly stage 2 or 3), decreasing to the lowest value in 2017 at a median of 2 (most commonly stage 1 or 2). Over the past 3 years, this number has maintained at a median stage of NPIAP stage 2 upon initial presentation.

Approximately 33.1% of pressure injuries were attributed to medical devices, with the highest percentage in 2012 (50.7%), gradually lowering to 25.8% of injuries by the end of 2019 (Table 2). The prevalence of medical device-related injuries by year demonstrated significance ($P = .003$). The most commonly implicated device was the endotracheal tube, accounting for 19.0% of cases (Figures 1 and 2). This was followed by the nasogastric tube accounting for 15.6% of cases (Figures 3 and 4). Other devices implicated include pulse oximetry probe (Figure 5), splint and casting material (Figures 6 and 7), intravenous hub (Figure 8), cervical collar (Figure 9), and gastrostomy tube (Figure 10). A comprehensive list is displayed in Table 5.

Patient location in the hospital setting on initial presentation of the pressure injury varied, with the majority (45.0%) of cases in the intensive care units (ICUs), 38.3% in the main hospital, and 14.6% in the critical care hospital but not within the ICU. Injuries by hospital unit are displayed in Table 6. However, when comparing the average number of cases within

Figure 1. Pressure injury of the lip attributed to endotracheal tube.

Figure 2. Pressure injury of the tongue attributed to endotracheal tube.

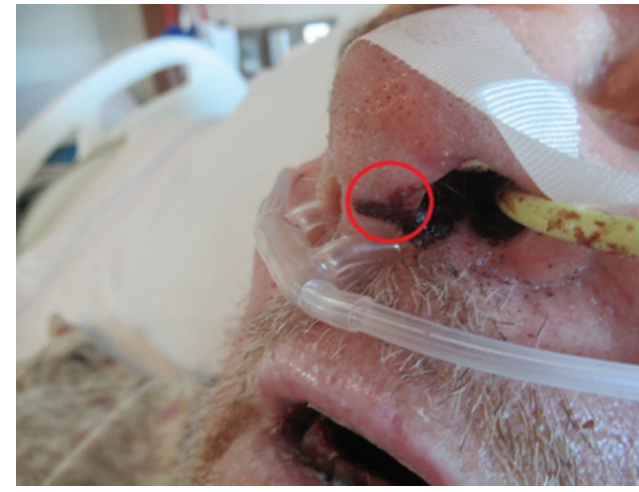

Figure 4. Left naris pressure injury attributed to nasogastric tubing.

the ICUs with critical care and the main hospitals, results were not significant ($P = .12$).

The most frequent anatomical location of pressure injuries was sacrum (33.6%), followed by the heel and foot (14%), and buttocks (11.3%). Other common locations were nares, lip, occiput, and coccyx (Table 7).

DISCUSSION

The purpose of our retrospective cohort study was to assess prevalence and related factors associated with pressure injuries in 957 patients receiving acute care in a large academic public health hospital system. While emphasis on prevention, early recognition, and advancements in the management of pressure injuries has greatly advanced over the past 6 decades, HAPIs continue to cause significant patient morbidity and mortality, and result in high healthcare expensives.[5,7,19] For an admitting diagnosis of pressure injury, the estimated mean hospital and treatment cost per patient is $230,575.[24] In contrast, prevention of pressure injuries is estimated to be 10% the cost of treatment.[13,25] Development of such wounds is not without complication, including acute sepsis, prolonged hospitalization, progression to chronic wounds, scarring, perineal and urethral fistula formation, malignant skin changes, and acute or chronic osteomyelitis of the underlying bone.[5,16,26] Thus, specialized healthcare teams knowledgeable in the prevention, assessment, and treatment of pressure injuries are vital to minimizing complications and maximizing outcomes for affected patients.[27]

In 2012, the wound care team at our hospital began consistent, monthly, quality improvement evaluations of HAPIs to identify risk factors and areas of improvement. Standardization of wound classification was refined with flagging of pressure injuries, automatic consulting of the wound care team, and staging by the team using the NPIAP system. Once a patient is identified and documented by the team, the wound care team is able to relay instructions to nurses as well as continue their own care and assessment of the patient during the hospital stay. The wound care team is involved in education of nurses, residents, physicians, and personnel on medical and surgical units to reduce incidence of HAPIs. This comprehensive team has also played a large role in the development of standard protocols and nursing pressure injury prevention competencies, aiming to reduce the number of medical device-related injuries. The wound care team continues to assess benchmarks on the national and peer hospital levels, modifying and improving protocols as necessary. The findings of this study

Figure 3. Left naris pressure injury attributed to nasogastric tubing.

Figure 5. Right forehead pressure injury attributed to pulse oximetry probe.

Figure 6. Posterior heel pressure injury attributed to splinting material.

Figure 7. Lower arm pressure injury attributed to splinting material.

are similar to other studies,[28,29] demonstrating that the implementation of a comprehensive wound care team reduces the incidence of HAPIs and improves knowledge of care teams

Figure 8. Right dorsal foot pressure injury attributed to intravenous hub.

Figure 9. Occiput pressure injury measuring 6 × 3 cm attributed to cervical collar.

Figure 10. Left trochanter pressure injury attributed to gastrostomy tube.

regarding management of these injuries. An example protocol and competency list are provided in Figures 11 and 12.

Findings of our study indicate that development of consistent, monthly assessments, standard protocols, and staff training reduced the prevalence of HAPIs in this hospital system. When the monitoring began in May 2012, 140 patient cases were documented for May 2021 through December 2012 and 165 total cases in 2013. This number declined the following years, reaching the lowest prevalence in 2016 with 83 pressure injury cases. This variability in total cases was statistically significant, demonstrating improvement, as inpatient prevalence of HAPIs declined from an initial prevalence of 2.4% in 2012 down to 1.4% in 2019. Prior research demonstrated seasonality of pressure injuries, with a greater number in January through March and declining numbers July through September.[30] However, this

TABLE 5.
Medical Device-Related Injuries by Year

	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
ET tube	16	15	6	6	4	2	3	8	1	61
NG tube	11	10	4	7	3	8	6	1	0	50
Brace or splint	4	4	7	3	3	1	4	3	3	32
Tracheostomy	12	5	4	0	2	3	2	2	1	31
Cervical collar	3	3	4	1	4	5	4	4	2	30
Pulse oximetry	3	0	0	0	4	3	2	2	0	14
Urinary catheter	2	3	4	0	0	2	0	1	1	13
CPAP/BiPAP	2	4	0	0	1	1	1	2	0	11
SCD/TED hose	4	0	4	0	2	0	1	0	0	11
PEG	3	2	0	0	0	0	0	0	0	5
Not recorded/other	11	12	10	10	3	5	4	8	0	63

Abbreviations: BiPAP, bilevel positive airway pressure; CPAP, continuous positive airway pressure; ET, endotracheal; NG, nasogastric; PEG, percutaneous endoscopic gastrostomy; SCD, sequential compression device; TED, thromboembolic-deterrent.

TABLE 6.
Pressure Injury Cases by Hospital Location

ICU	CCH	Main Hospital	Other
431	140	367	19

Abbreviations: CCH, critical care hospital; ICU, intensive care unit.

study did not demonstrate variation by season. While the median pressure injury stage on initial presentation was NPIAP stage 2 (most often stage 2 or 3) in 2012, this number has largely declined, falling to a median of 2 (most often stage 1 or 2) from 2017 through February 2020.

Device-related injuries also declined during the 8-year period, with 50.7% of 2012 cases attributable to medical devices.

TABLE 7.
Annual Pressure Injury Cases by Anatomic Location

	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Sacrum	28	46	39	52	31	30	39	57	0	322
Heel/foot	16	27	17	13	12	23	11	15	0	134
Buttocks	19	20	16	15	9	12	10	7	0	108
Nares	16	14	3	6	3	10	7	5	1	65
Lip	11	11	5	5	3	2	0	6	0	43
Occiput	3	4	7	4	1	4	10	8	0	41
Ear	2	12	5	7	4	2	2	3	0	37
Coccyx	6	7	2	5	4	5	2	5	1	37
Other	6	3	1	2	1	3	5	4	1	26
Neck	5	3	4	0	2	2	2	2	0	20
Leg	5	0	5	4	2	0	2	1	0	19
Back	1	5	3	0	1	0	2	3	3	18
Scapula	1	0	0	0	1	0	0	0	12	14
Gluteal fold	7	2	0	0	0	0	2	1	1	13
Forehead	1	4	0	0	4	2	1	1	0	13
Chin	2	1	0	2	4	2	2	0	0	13
Genitals (penis/labia)	2	2	3	0	0	2	0	1	0	10
Abdomen	4	2	4	0	0	0	0	0	0	10
Ischium	4	1	0	0	0	1	0	0	1	7
Knee	1	0	0	0	0	0	0	1	2	4
Chest	0	1	0	0	1	0	0	0	1	3

VCU Health System

Adult Pressure Injury Prevention for Nurses

Competency Statement	Method of Validation
The nurse will demonstrate competency in implementing interventions to reduce the incidence of pressure injuries. The nurse will demonstrate competency in assessment of skin, documentation of skin abnormalities, and treatment of pressure injuries.	Observation of daily work, Verbal

Behaviors for Competency

- Demonstrates head to toe, front to back skin assessment per unit protocol.
- Demonstrates two RN full skin assessment at time of admission and transfer to unit.
- Demonstrates proper assessment and treatment of Stage 1 & 2 pressure injuries.
- Demonstrates proper patient repositioning in the bed and in the chair.
- Demonstrates proper patient repositioning for the unstable patient.
- Demonstrates proper assessment and application of Mepilex Sacrum.
- Demonstrates proper offloading of heels using decision tree.
- Demonstrates proper assessment and intervention of medical devices with each skin assessment.
- Demonstrates proper assessment and intervention of all bony prominences and high risk areas.
- Demonstrates proper assessment and intervention of the patient's skin pre- and post-operatively.
- Demonstrates proper assessment and intervention of patients with darker skin tones.
- Demonstrates proper assessment and intervention of patients on ECMO, if applicable to patient population.
- Demonstrates proper use of the Braden Scale.
- Demonstrates ability to correctly measure and document pressure injuries.
- Demonstrates proper assessment and intervention of the bariatric patient.
- Demonstrates how and when to consult the Wound Care Team.
- Demonstrates how to care for non-compliant patients (related to pressure injury prevention).
- Demonstrates adequate understanding of standard bed and specialty bed surfaces.
- Demonstrates competency in presence of validator. Include validator signature below.

Team Member Name: _____ Date: _____
PRINT CREDENTIALS

Validator Name: _____ Date: _____
(Return Demo Only) PRINT CREDENTIALS

References for Critical Behaviors, if not online sources within VCUHS:

- Please meet with Champions of Skin Integrity Team Member(s) to review Pressure Injury Prevention Education for Nurses.
- Please see Pressure Injury Prevention Education for Nurses in Lippincott.

Figure 11. Virginia Commonwealth University Health adult pressure injury prevention in nursing competencies.

They steadily decreased, with medical devices implicated in 2019 for 25.8% of the HAPIs. Analysis of medical device related pressure injury based on year showed a significant reduction in occurrences within this hospital system. Medical device-related pressure injuries typically account for approximately 40% of this hospital system's pressure-related injuries each year. The wound care team has been developing standardized protocols for medical devices and delivering monthly device-related pressure injury prevention education to nurses and care partners. Specific protocols related to management of endotracheal tubes, pulse oximetry devices, and tracheostomy plates have been developed to decrease pressure injuries and are available to all staff members. A protocol for cervical collars is currently in development.

Prior studies have shown the most common location of patients developing pressure injuries during hospitalization was

Virginia Commonwealth University Health

Adult Pressure Injury Prevention for Nurses

Performance Criteria	Complete
Skin Assessment	
Demonstrates head to toe, front to back skin assessment per unit protocol. a. Inspect **AND** palpate patient's skin, including all bony prominences. Pressure injuries may be difficult to visualize due to presence of hair or darker skin. b. Look for changes in skin color, palpate for areas of tenderness and differences in skin temperature. c. Inspect under all garments (including socks) and medical devices. d. Ensure adequate lighting for thorough visual assessment. e. Ensure any skin injury noted corresponds with a band on iView. **Document:** a. All skin findings in a timely manner. b. If unsure about whether a finding is a pressure injury, document it under wound or skin abnormality and place WCT consult.	
New Admissions & Transfers to the Unit	
Demonstrates two RN full skin assessment at time of acceptance to unit: a. Includes bony prominences, under/around medical devices, and in folds/creases. b. Ensure any skin injury noted corresponds with a band on iView. c. Review Wound Care Team (WCT) notes and wound care orders for updates in plan of care. **Document:** c. All skin findings in a timely manner. d. If unsure about whether a finding is a pressure injury, document it under wound or skin abnormality and place WCT consult.	
Standard Nursing Management of Stage 1 & 2 Pressure Injuries	
Demonstrates proper assessment and treatment of Stage 1 & 2 pressure injuries: a. Stage 1 pressure injuries do not usually require a dressing. Reposition to relieve pressure from injured area. b. Stage 2 pressure injuries may require a dressing. Place a Mepilex Border in areas where repetitive shear, pressure or friction may worsen the injury, or in areas that have moderate drainage. c. Use barrier cream for areas where dressing application is difficult, where incontinence injury is also a risk, or for non-draining wounds.	
Repositioning	
Demonstrates proper patient repositioning every 2 hours: a. Ensure the sacrum is offloaded from the surface by demonstrating that a hand can be placed between sacrum and bed surface. May use wedge or pillow to offload sacrum. b. Ensure feet are not pressed against footboard or any medical device attached to the footboard. c. Ensure NO medical devices are trapped under the patient.	

Figure 12. Virginia Commonwealth University Health adult pressure injury prevention for nurses' protocol.

d. Keep HOB at <30 degrees, unless contraindicated. e. If placing the HOB >30 degrees, first raise feet to decrease shear. **Document:** a. Position that patient was turned toward. b. If patient is independent with turning, avoid documenting "self" turning. Instead, document patient's position at time of rounding and intervention used to encourage or guide their repositioning. c. Document patient and family education related to pressure injury prevention and risk.	
Demonstrates proper patient repositioning in the chair: a. Educate patient to do pressure relieving maneuvers every 15 minutes. b. If patient cannot do this by him/herself, RN should assist by repositioning. c. Ensure use of air cushion under patient in chair. d. If patient is emaciated, or at high risk for sacral pressure injuries, limit time in chair to 1-2 hours. **Document:** a. Time out of bed, and time back into bed. b. Document patient and family education related to pressure injury prevention and risk.	
Demonstrates proper patient repositioning for the hemodynamically unstable patient (HDU): a. Describe "Turning the Hemodynamically Unstable Patient Tool" and identify where to access it. b. If patient is found to be too unstable to turn: 1. Retry at least every 8 hours. 2. Optirest mattress function 100% of time. 3. Shift hips from side to side every hour. 4. Perform range of motion. 5. Heel floating, and use of fluidized head pillow. **Document:** a. Limits to turning angle or frequency based on individual assessment using HDU Tool. b. Use of Optirest. c. Hip shifts.	
Sacrum	
Demonstrates proper assessment and application of Mepilex sacrum: a. Ensure skin is clean and dry before applying. b. Apply Mepilex sacrum to ALL patients that do not independently ambulate. c. Change Mepilex sacrum every 72 hours, and PRN, ensuring that it is peeled back and area underneath dressing is assessed during every skin assessment. d. AVOID applying barrier cream under Mepilex dressing. e. Turn every two hours to offload from sacrum. f. With each assessment, examine sacrum for skin breakdown, moisture injury, or pressure injury.	
Heels	
Demonstrates proper offloading of heels using pillows: a. 1st line defense: Float heels by placing one pillow under each leg, from knee to ankle.	

Figure 12. (Continued)

1. Reassess patient frequently to ensure heels continue to be offloaded. 2. Offload heels while in chair. **Demonstrates proper application of Heel Protector Boot:** b. 2nd line defense: Apply heel protector boot and ensure heel is placed into reservoir and the "flag" is at the plantar aspect of the foot. 1. Keep foot dorsiflexed while applying boot. 2. Wrap straps around bottom of boot at toes to support dorsiflexed position. 3. Wedge may be positioned from side-to-side to prevent adduction/abduction. 4. Boots should be worn at all times (EXCEPT DURING AMBULATION) in high risk patients. **Demonstrates proper application of Mepilex Heel dressing:** c. 2nd or 3rd line defense: Mepilex Heel dressing may be appropriate for patients who cannot comply with pillow placement, tolerate heel protector boots, or cannot wear heel protector boots due to traction, splints, or removal due to agitation. 1. Apply Mepilex Heel dressing to patients with existing heel injury. 2. Limit # of times dressing is peeled back for inspection to once daily or no more than 2x if absolutely necessary. 3. Change dressing every 3 days. **Document:** a. Interventions in pressure injury band in iView. b. Document patient and family education related to pressure injury prevention and risk.	
Medical Devices	
Demonstrates proper assessment and intervention of medical devices with each skin assessment: a. Avoid placing devices over current pressure injuries. b. Ensure NO medical devices are trapped under the patient. c. Remove and assess under external medical adjuncts, such as SCDs, BP cuffs, catheters, drive lines, NG tube every shift. d. Consider use of foam dressing to protect skin from device. **Demonstrates proper assessment and intervention of ETT:** *The management of ETT is a joint partnership between Nursing and Respiratory Therapy.* a. Ensure appropriate securement device is used for tube (tape or Hollister). b. Tape: change tape and reposition the ETT every 24 hours with the help of an RN or RT. c. Hollister: reposition tube every two hours. d. If the Hollister is snug against the skin between the nare and the upper lip, a pressure injury will likely develop. Place a small rectangle of Mepilex Lite between the Hollister foam bumper and the skin. **Demonstrates proper assessment and intervention of pulse ox devices:** a. Review Order of Operation for Pulse Ox Probes: 1st Nellcor adhesive finger pulse ox probe. 2nd Nellcor Velcro finger pulse ox probe. 3rd Nasal clip pulse ox probe. 4th Nellcor Forehead pulse ox probe without headband. 5th Nellcor Forehead pulse ox probe with headband.	

Figure 12. (Continued)

b. Reposition Nasal Pulse Ox Clip and Forehead Pulse Ox probe every 2 hours. c. If applying forehead probe, place Mepitel as a barrier between forehead and probe. **Demonstrates proper assessment and intervention of trach plates:** a. If sutures are present, ensure a small rectangle of Mepilex Lite is between the inferior edge of trach plate and the patient's skin at all times. b. Ensure sutures are removed on day 7, with permission from the team. c. When sutures are not present, ensure a piece of Mepilex Lite cut in split sponge fashion is present between the trach plate and the patient's skin, wrapping around trach tube. d. If a patient has excessive secretions, use a piece of Calcium Alginate also cut as split gauze underneath the Mepilex Lite for increased absorption. **Demonstrates proper assessment and intervention of c-collars:** **Ordering Information: Replacement Pads SP** a. Inspect under collar every shift and change pads daily and as needed for soiling. b. Perform a hands on assessment of the scalp to assess for induration or bogginess. Pressure injuries may be difficult to visualize due to presence of hair, particularly in patients with thick or dark hair. c. Use sizing guide to select appropriate size collar for patient. d. Ensure the Mepilex Lite and/or Mepilex Border are placed between the patient's skin and the collar at the following points: mandible, chin, chest, scapula, and upper back. **Document:** a. Interventions in pressure injury band in iView. b. Every reposition of patient and medical device in iView.	
Occiput	
Demonstrates proper assessment and intervention of the occiput with each skin assessment: a. Turn and reposition patient's head every turn. b. Ensure no medical devices are under the head/ears. c. For patients that have an existing skin injury to the occiput, place patient on fluidized positioner (Z-Flo pillow). **Document:** a. Interventions in pressure injury band in iView. b. Every reposition in iView. c. Document patient and family education related to pressure injury prevention and risk.	
Ears	
Demonstrates proper assessment and intervention of the ears with each skin assessment: a. Use soft silicone nasal cannulas to prevent injury. b. If patient requires the use of high flow O2 tubing, please place Mepilex Lite dressing on ears where tubing comes in contact with the skin to prevent damage. c. Ensure ear is not pressed against fluidized positioner or pillow for extended periods of time. **Document:** a. Interventions in pressure injury band in iView. b. Every reposition in iView.	

Figure 12. (Continued)

c. Document patient and family education related to pressure injury prevention and risk.	
Nose	
Demonstrates proper assessment and intervention of the nose with each skin assessment: a. Confirm that NG tube is taped so that it is not applying pressure to the nares. b. Proper taping: 1. Approximately 10cm of 1" tape will be needed. Tear tape length-wise in half. 2. Apply one end of tape at bridge of nose on the nare-side of tube placement. 3. Smooth tape downward to the tip of the nose, and fold a flag in the tape to allow the tube to float and decrease skin injury related to tube position. 4. Wrap the bottom edge of tape a 3-4 centimeters distal to the tip of the nose on the tube so that it does not contact the skin. 5. Put an additional piece of tape across the nose to secure in place. 6. Assess for skin injury every shift. Change tape every 24 hours and as needed (as stated in Lippincott). 7. Refer to WCT intranet site: CSI page for video demonstration c. **Bridle: Often surgeons will use bridle string** without the included clip. This results in the string being tied tightly against the nasal septum. 1. Ensure the string is not tight against the nasal septum. 2. If it is tight, use forceps to stretch and loosen the string just enough to keep it from pressing against the nasal septum. 3. Place a small piece of Mepilex Lite between the string and the nasal septum to prevent pressure and/or laceration. 4. Refer to mannequin for demonstration. **Document:** a. Interventions in pressure injury band in iView. b. Every reposition in iView. c. Document patient and family education related to pressure injury prevention and risk.	
High Risk OR Procedures	
Demonstrates proper assessment and intervention of patient's skin Pre- and Post-Operatively: a. If patient is on unit prior to procedure, assess skin and keep patient positioned out of planned surgical position if possible (i.e. have patient turned on side if patient will be supine for surgery). b. Upon return from procedure, a 2 RN head to toe, front to back visual and hands on skin assessment should be performed noting ANY areas of redness, discoloration, induration, bogginess, increased tenderness, or breakdown. c. OR pressure injury may present up to 72 hours after procedure. d. Continue to monitor bony prominences and areas of concern. e. Place WCT Consult if necessary. **Document:** a. Interventions in pressure injury band in iView. b. Every reposition in iView. c. Document patient and family education related to pressure injury prevention and risk.	

Figure 12. (Continued)

Darker Skin Patients	
Demonstrates proper assessment and intervention of patients with darker skin tones: a. Visual assessment may not be enough to identify areas of concern. b. Palpation of area may be only indicator of impending or actual pressure injury. **c. Feel for changes in skin temperature and texture of area in relation to surrounding skin.** 1. Induration = hardening of tissue 2. Bogginess = soft or mushy tissue d. Pay close attention to pain response during palpation of the area in question. e. Consult WCT if necessary. **Document:** a. Interventions in pressure injury band in iView. b. Every reposition in iView. c. Document patient and family education related to pressure injury prevention and risk.	
Care of Patient on ECMO	
Demonstrates proper assessment and intervention of patients on ECMO: a. Lyofoam or Mepilex Lite should be applied underneath cannulation tubing to prevent pressure injuries. b. Ensure Lyofoam is between the IJ cannulation tubing and the patient's ear/head. **c.** For neck cannulation securement, use a Nellcor Pulse Ox Velcro Band (from forehead probe) to secure tubing.	
Braden Scale	
Demonstrates proper use of the Braden Scale: a. Completes Braden scale on every patient once every 12 hours and again with changes in patient's clinical status. b. Verbalizes understanding that a Braden score of 18 or less indicates patient is at risk for developing a pressure injury. c. Demonstrates appropriate pressure ulcer prevention interventions for patients at risk for developing a pressure injury. **Document:** a. Braden score in iView every 12 hours and again with changes in patient's clinical status. b. Implementation of additional interventions based on changes in Braden score.	
Measure Mondays	
Demonstrates ability to correctly measure a pressure ulcer: a. Measure a pressure ulcer upon discovery and then weekly on Mondays. (See Measure Mondays tool on WCT website) b. Measurement should include Length x Width x Depth. c. Measurement should include undermining and/or tunneling if present. **Document:** a. Measurement of all pressure injuries in iView on Mondays. b. Document appearance of wound bed in iView.	
Care of the Bariatric Patient	
Demonstrates proper care of bariatric patients:	

Figure 12. (Continued)

a. Consider a bariatric surface for patients >400 lbs that do not have adequate bed surface area or turning space. b. Ensure that the side bolsters are extended to provide extra surface area for the patient. c. Be aware that bariatric patients are at increased risk for developing skin related conditions such as intertriginous dermatitis, candidiasis, friction/shear injuries, and pressure injuries. d. Assess the skin folds of bariatric patients with every skin assessment. Additional staff, sling lifts, flashlights, or mirrors may be needed to adequately assess skin. e. Apply Mepilex border dressings on the sacrum and other areas of increased friction. f. Use lift equipment or additional staff to turn and reposition the patient in bed. g. Elevate the knee gatch prior to raising the HOB; limit HOB to 30 degrees. h. Place Interdry fabric in all skin folds. Use Interdry or Mepilex Lite under trach ties. i. If candidiasis rash develops, Nystatin powder should be ordered for topical application. j. Turn patient every 2 hours when in bed. k. Use the bariatric wedge (yellow; may need multiple) to offload patient's posterior surfaces. l. Protect heels using bariatric heel protector boots, pillows, and/or Mepilex heel dressing. m. Follow bathing protocol. Ensure all areas are dried thoroughly; particularly skin folds. DO NOT apply moisturizer to skin folds. n. Apply barrier cream to incontinence and moisture exposed areas. o. Offload the pannus with pillows to relieve pressure and allow air flow to skin. p. Follow protocol for preventing skin injury related to medical devices. **Document:** a. Interventions in pressure injury band in iView. b. Every reposition in iView. c. Patient and family education related to pressure injury prevention and risk.	
Wound Care	
Demonstrates knowledge of the following: a. When and how to place a consult for the wound care team. b. Wound Care Team or provider will recommend or write orders for wound care. Order will contain frequency of wound care to be performed. c. Wound product standardization tools for adult, neonatal, and pediatric patients are listed on the Wound Care Team website. **Document:** a. Wound care provided to the patient in iView. b. Assessment of wound in iView (wound bed appearance, surrounding skin, odor of drainage, etc.).	
Patient Refusal of Care	
Demonstrates knowledge of the following: a. Benefit of explaining to patients the interventions *before* you implement them.	

Figure 12. (Continued)

b. Benefit of asking patient's permission *before* implementing the interventions. c. Necessity of explaining to patients and families the purpose of pressure injury prevention. d. Consider the reason for patient refusal: lack of education, pain, fear, etc. If unable to overcome these barriers through intervention and/or communication with the patient and family, be sure to document efforts to educate patient and document patient's refusal of care. e. Offer to provide interventions frequently. For example, if patient refuses to turn one time, give them another opportunity. **Document:** a. Patient and family education related to pressure injury prevention and risk. b. Frequent re-evaluation of patient. c. All attempts to implement interventions. d. Patient/family refusal of care.	
Standard VCU Health Bed Surfaces	
Demonstrates proper assessment and understanding of our standard hospital beds: a. Ensure all ICU patients are on a Hill-Rom TotalCare Sport or Progressa Bed. b. Ensure all Med/Surg patients are on a Hill-Rom Versacare Bed. c. Minimize number of layers of linen between the surface and the patient. Please do not use multiple underpads beneath patients. d. Ensure the bed is zeroed before the placement of patient. Note: the patient's actual weight is needed for adequate pressure redistribution.	
Specialty Bed Surfaces	
Demonstrates proper assessment of patients requiring a specialty bed: a. Specialty beds do not take the place of turns. b. Describe Specialty Bed Algorithm and where to access it. c. Describe the ordering and discontinuation process. d. Demonstrates proper documentation and order entry in Cerner. e. Identifies all specialty beds currently on formulary. f. Recognizes need and educates patients and family members.	
Wound Care Consults	
Demonstrates proper order entry of WCT consult: a. Stage 3, 4, Unstageable, Deep Tissue Injury b. Complex Wounds c. All Ostomies & Fistulae d. Covering MD Team Requests WCT Recommendations	
Miscellaneous	
Review Wound Care Team Website	
Review Role of CSI Member	
Review current organizational and unit prevalence rate	
Other skills specific to the unit:	

Figure 12. (Continued)

in the ICUs.[5,6] Aligned with previous research, the majority of injuries were located on the sacrum, followed by the heel and foot, buttock, lip, nares, and occiput.[6,10] For the 33.0% of patients with medical device-related pressure injuries, the most commonly implicated device was endotracheal tubing, followed by nasogastric and tracheostomy plates, this finding is similar to previously published literature.[31] All of the patients received aggressive care and frequent monitoring by the comprehensive wound care team once identified by nursing staff.

Using a standardized approach by this dedicated team has resulted in greater consistency in documentation, aggressive early intervention through prompt automatic notification of the wound care team once the patient wound has been identified, and regulation of wound care practices. Interventions include the standard of care for pressure injury prevention such as frequent turning and skin monitoring, novel therapies such as noncontact low-frequency ultrasound, specialized mattresses and beds, nutritional recommendations, identifying potential psychosocial issues, patient education, and evaluation by the plastic and reconstructive surgical teams as indicated. Specific nursing-driven interventions have included consistent use of well-lit environments when performing the initial skin assessment, using both visual and tactile examinations of the skin, decreasing the number of linens placed under patients to limit moisture and generation of body heat, using barrier creams, and use of offloading medical devices. Efforts surrounding medical device use include rotating the device at least once every 24 hours, frequent assessment of the mouth, lips, and tongue, ensuring appropriate fit of the device, and ensuring that devices are not inadvertently left underneath the patient following repositioning.

Through automatic flagging of patients with pressure injuries, a comprehensive wound care team with standardized assessment, documentation, and evidenced-based treatment regimens has been a vital component of the success of lowering HAPIs within this large, academic setting. Through consistent monthly quality improvement committee meetings and broadened education programs for hospital staff, the wound care team aims to continue to reduce the incidence of HAPIs and find ways to improve current protocols.

Limitations

Limitations of this study include potential differences in provider assessment of pressure injuries using the NPIAP staging system, potential for patients with existing pressure injuries that were not initially identified on admission, and a very small percentage (<1%) of pediatric patients. Thus, these data are much less generalizable to the pediatric population and more greatly represent the impact of this wound care team on adult patients. Future studies should address specific interventions by the wound care team to assess time to discharge and rates of complications, and further investigation into quantifying the degree to which the team has lowered expenditures at this healthcare institution. In addition, broadening the data set to compare directly to peer institutions and national data may provide further insight into areas of success, as well as room for improvement within this particular institution.

CONCLUSION

Findings from this study demonstrated that while HAPIs have declined over the past 8 years, these injuries continue to pose a challenge. Determining best practices is crucial; our comprehensive wound care team focused on frequent assessment, education of medical teams, and evidenced-based treatment with efforts to lower these pressure injury events and contribute to lowering hospital expenditures.

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