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Exploring HAPI Incidence in Patients Admitted Through the ED: A Quality Improvement Initiative

Alexa L. Tietgens
Belmont University, lexietietgens@gmail.com

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Alexa Tietgens

Scholarly Project Advisor:	Dr. Elizabeth Morse
Scholarly Project Team Members:	Dr. Elizabeth Morse, Dr. David Phillippi
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Abstract

Each year in the U.S., pressure injuries, or PIs, are responsible for more than 60,000 patient deaths and billions of dollars' worth of treatment costs. Research shows that roughly 95% of all PIs are preventable by following evidence-based practice guidelines which include early identification of patients at risk, frequent skin assessments, and implementation of prevention strategies. However, the ED environment creates unique risks for PI development due to the routine use of hard surfaces (i.e., stretchers, backboards, exam tables) and frequent hospital overcrowding. Although nurses play a pivotal role in PI prevention, frequent staffing shortages, high patient acuity levels, and competing patient care needs make protocol implementation difficult to prioritize. The purpose of this project was to analyze nursing workflow and healthcare technology utilization to identify opportunities to improve PI prevention protocol implementation. Additionally, this project explored how certain patient-level risk factors, when compounded by risk factors that are unique to the ED environment, create unrecognized risks for PI development. The Donabedian quality of care framework was used to guide the quality improvement project by assessing the relationship between system structures, clinical processes, and patient outcomes. Analysis of data from a retrospective chart review of 30 charts found patients were more likely to have an initial HAPI diagnosis that is at a more severe stage if they were female, younger than 65, had two or more comorbidities, or had a foley and/or ostomy. Regarding protocol compliance, the first two steps of the PI prevention protocol were met 80-90% of the time; however, the third step was met 6.67% of the time with an average of 15 days before a wound care consult was ordered after a patient was first identified as "at risk" for developing a PI. Additionally, on average, patients spent over 10 hours in the hospital before receiving a skin assessment indicating that the current 8-hour guidelines may not accurately

assess the risks for PI development in patients admitted through the ED. Lastly, the results showed high variability between the processes of care indicating that PI protocol implementation lacks standardization and consistency. Developing an ED-specific PI risk assessment tool that includes an automated communication pathway between ED nursing and wound care can mend the gap caused by human error and also improve the early identification of patients at risk, timely implementation of PI prevention, and, overall, improve patient outcomes. The findings of this project confirm the need for a more standardized, streamlined clinical process regarding PI monitoring, surveillance, and prevention implementation that begins at the point of hospital entry in the ED.

Keywords: pressure injury, hospital-acquired pressure injury, emergency department, risk, skin assessment, prevention

Introduction and Background

Across the globe, pressure injuries (PIs) are one of the most prevalent, avoidable incidents that occur as a result of prolonged pressure, immobility, excessive moisture, friction, or shear (Kayser et al., 2019). Hospital-acquired pressure injuries, or HAPIs, are pressure injuries that develop during a patient's hospital stay and can significantly impact patient morbidity and mortality, with the Agency for Healthcare Research and Quality (AHRQ) considering them "never events" despite the ongoing prevalence (Agency for Healthcare Research and Quality [AHRQ], 2014). HAPIs are associated with an increased length of stay, diminished quality of life, high healthcare costs, and poor health outcomes (Kayser et al., 2019). In July 2020, the AHRQ released the most recent update on hospital-acquired conditions reporting an increase in HAPI incidence from 2014 to 2015 which then decreased somewhat from 2015 to 2017 (AHRQ, 2020). Although this reduction is likely attributed to efforts put forth by organizations like the AHRQ to identify best practices in HAPI prevention, HAPIs have not been eliminated and continue to be a problem in the US (Santamaria et al., 2019). For example, roughly 2.5 million people develop a HAPI in acute care facilities and an estimated 60,000 patients die from pressure injury-related complications each year in the U.S. (Edwards et al., 2021).

HAPIs can be avoided in the hospital setting by following evidence-based clinical guidelines, such as those outlined in the AHRQ's toolkit for preventing pressure ulcers in hospitals (AHRQ, 2014). This toolkit includes early identification of patients at risk, frequent skin assessments, and the implementation of prevention techniques (AHRQ, 2014). Early identification of patients at risk is arguably the most essential step in preventing HAPIs so that prevention techniques can be implemented promptly (Santamaria et al., 2019).

The emergency department (ED) is one of the most frequent points of entry for hospital admissions and initiation of care, and it also has its own unique HAPI risk factors due to the routine use of hard surfaces (e.g., stretchers, backboards) and frequently limited availability of hospital beds (Edwards et al., 2021; Santamaria et al., 2019). Nurses play a pivotal role in the prompt recognition of these risk factors and prevention of HAPIs; however, ED nurses face increasingly demanding workplace challenges including increased patient workload, high patient acuity level, competing patient care needs, and a consistently fast-paced environment which can often cause delays in initiating prevention protocols (Padula & Black, 2018). It is therefore imperative that HAPI risk assessment and prevention protocols be tailored to the unique dynamics and workflow of the ED (Santamaria et al., 2019).

Available Knowledge

The most common patient-level risk factors for developing a HAPI are thoroughly documented in the literature, with age (65 years and older), mobility status, presence of comorbidities, and illness severity having a clear association with PI risk (Santamaria et al., 2019). Because these risk factors are well known among nursing staff, patients who present with classic risk factors are easier for nurses to identify and prioritize for early initiation of pressure injury prevention protocols. However, there is little evidence addressing how certain patient-level risk factors, when compounded by risk factors that are unique to the ED environment, create unrecognized risks for HAPIs that create liabilities for both the patients and hospitals. Because of this, the project leader chose to investigate HAPI incidence in the ED at a local facility.

Tristar Centennial Medical Center is an HCA facility located in the southern region of the United States (TriStar Centennial Medical Center, n.d.). The facility is a for-profit medical center

and is recognized as a level II trauma center with 741 beds and over 3,000 staff members (TriStar Centennial Medical Center, n.d.). The adult emergency department is a 27-bed 24-hour unit that sees a yearly average of over 95,000 patients (TriStar Centennial Medical Center, n.d.). The facility includes a wound care team made up of two specialized wound care registered nurses and two specialized wound care advanced practice providers (APPs) that respond to all wound care consults that are placed for admitted patients (TriStar Centennial Medical Center, n.d.).

After a discussion with Tristar Centennial Medical Center's wound care team, staff articulated an unusual trend among patients who were referred for wound care consultation. The team noted that patients with a foley catheter and/or ostomy seemed to be accumulating PIs often and were more likely to be referred for a wound care consult (L. Mullaley, personal communication, February 15, 2022). With very little published research on the topic of foley/ostomy presence and potential PI risk association, the project team chose to explore this observation to identify aspects of the clinical environment that potentiated HAPI risk for patients with a foley catheter and/or ostomy. The goal of this project is to identify opportunities for improvement in the efficient identification and response to HAPI risk for patients with a foley and/or ostomy who are admitted through the ED.

With high hospital occupancy rates and overcrowding increasingly becoming an issue, patients admitted through the ED may lay on small, thinly cushioned stretchers for hours while waiting for an inpatient bed (Curtis et al., 2021). These environmental risk factors, combined with the occupational demands, are compounded by patient-level risk factors (e.g., BMI, mobility, acuity) to make the implementation of PI prevention more challenging for ED nurses. If a thorough skin assessment is not performed on admission and a patient is not appropriately

identified as ‘at risk’, the implementation of basic prevention strategies such as turning patients every two hours, placing prophylactic dressings on high-pressure areas such as the coccyx, or consulting wound care are either delayed or omitted completely. However, the association between PI risk and foley and/or ostomy presence is not well understood, and there is a lack of evidence that explores this association.

Nurses may assume that patients with a foley and/or ostomy carry less risk for moisture-related skin compromise from incontinent episodes because they have their stool and/or urine rerouted and are therefore at less risk of developing a HAPI. However, requiring less frequent toileting means changing positions less often and consequent exposure to prolonged immobilization, which could dramatically increase the risk of HAPI development in the ED setting for this group of patients (Edwards et al., 2021). Additionally, because there is less risk of incontinent episodes, the nurse isn’t obligated to assist with hygiene as often by performing a bed bath, which would naturally lend itself to a full skin assessment. This is even more relevant in the ED setting where performing a comprehensive skin assessment is likely to be deprioritized due to the competing patient care needs and the prioritization of managing life-threatening conditions rather than focusing on prevention efforts.

Rationale and Theoretical Framework

The Donabedian quality of care model was used to guide this scholarly project. This framework is used to guide improvement by assessing the relationship between care quality and patient outcomes (Donabedian, 2005). The model suggests that comparisons of care outcomes can best be achieved by ensuring the consideration of all relevant measurement domains (Donabedian, 2005). Measures and constructs used to assess and compare the quality of health care include *structure*, *process*es, and *outcomes* (Donabedian, 2005). Donabedian believed that

structure measures impact process measures, which consequently affect outcome measures (Donabedian, 2005). This framework is used in several settings and can be suitably applied to the research questions aimed to be addressed in this quality improvement (QI) project. The application of the SPO model to this QI project is depicted in Figure 1.

Structure measures refer to the administrative processes that direct and support the provision of quality healthcare and the environment in which it occurs (Donabedian, 2005). According to Donabedian, the assumption of utilizing structural measures is that if the setting and instruments are adequate and appropriate, good medical care will follow as a result (Donabedian, 2005). Structure measures may include variables such as adequacy of equipment, staff qualifications, characteristics of the care setting, and administrative operations that provide care (Donabedian, 2005). The structural components of this scholarly project will include the emergency department and the inpatient setting, the nursing staff, the wound care team, and the electronic health record (EHR).

Process measures refer to the relationship between the provider and patient as well as the services and tasks performed during the delivery of care (Donabedian, 2005). Process variables are often based on the measurements of time of a performed clinical activity compared to another, or these variables may be expressed in terms of whether a task was performed or not (Linnen et al., 2018). The processes in this study will include the nurses' evaluation and recognition of HAPI risk factors and appropriate nursing documentation of HAPI prevention protocols following facility guidelines (i.e., documentation of a comprehensive skin assessment and skin risk assessment).

Outcome measures reflect the impact of the healthcare services or interventions on the well-being of the patient (Donabedian, 2005). Variables of outcomes commonly reflect a

measurement of change or incidence and may include mortality rates, patient satisfaction, physical disability, or rates of hospital-acquired infections (Donabedian, 2005). The variables are used to provide an unbiased and appropriate indication of the quality of healthcare provided (Linnen et al., 2018). In this scholarly project, the outcome measures include HAPI incidence/severity, and appropriate, timely nursing implementation of HAPI prevention protocols following facility guidelines (i.e., placing an order for a wound care consult).

Specific Aims

This project aims to identify opportunities for improvement related to the implementation of HAPI prevention protocols in the clinical setting of the Emergency Department. The project leader analyzed nurse workflow and healthcare technology utilization to create a set of baseline data on HAPIs in the ED. Additionally, this project assessed how the presence of a foley and/or ostomy impacts HAPI risk related to nursing prioritization in the complex ED setting. A retrospective review of the EHR for patients who were admitted through the ED and developed a HAPI within two months was performed. This project was completed to explore the following research questions:

(a) When patients had a foley and/or ostomy, did they also have a longer interval of time between the placement of an admission order and the first documented skin assessments compared to those without a foley and/or ostomy?

(b) Is a prolonged interval of time between the admission order and the first skin risk assessment associated with a prolonged interval of time between the first identification of being “at risk” of PI development by the skin risk assessment and initial wound care consult?

(c) Is a prolonged interval of time between the first identification of being “at risk” of PI development by the skin risk assessment and initial wound care consult associated with a more advanced stage of pressure injury at diagnosis?

To explore the clinical context around these questions, the project team mapped the processes from admission to subsequent wound care consults following HAPI development. Considering the local clinical context in the broader context of evidence synthesized from a probing review of published literature, the project leader assumed that:

(a) Patients admitted through the ED with a foley and/or ostomy will have a prolonged interval of time between the first identification of being “at risk” of PI development in the skin risk assessment and the initial wound care consult compared to patients without a foley and/or ostomy on ED admission.

(b) A prolonged time interval between the first identification of being “at risk” of PI development by the skin risk assessment and initial wound care consult will be correlated with an initial HAPI diagnosis that is at a more advanced stage.

Methods

This scholarly project utilized Donabedian’s SPO model to analyze characteristics of the clinical setting and processes of care in order to make the implementation of HAPI prevention protocols more systematic and feasible for nurses in the ED. Figure 1 illustrates the organization of the specific scholarly project elements into the Donabedian framework. The scholarly project was reviewed and verified as exempt by the Belmont University IRB and HCA TriStar Centennial’s Department of Clinical Education in April 2022 and October 2022 respectively.

Context

This QI initiative was conducted in three main phases: the planning and development phase, the data collection phase, and the analysis phase. The planning phase lasted from January 2022 to May 2022. In phase one of the project, a project team was formed that included the project leader, project advisor, and representatives from the wound care team, the adult ED, and the inpatient setting. In preparation, the project team reviewed the literature, discussed the local problem, and examined and mapped the processes of care in the hospital setting. Observational data related to clinical structure and workflow was collected in person by the project leader, who is currently employed as a registered nurse in the ED at Tristar Centennial Medical Center.

TriStar Centennial Medical Center uses Meditech EHR for nurse charting and routine assessments, including any required documentation outlined in the facility's Skin Breakdown Prevention Program, the P.A.R.T Program (*Skin Breakdown Prevention—PART Program*, 2000). Figure 2 is a process map of events that occur when an adult is admitted through the ED. Figure 3 depicts the skin breakdown prevention protocols that should be performed after a patient is admitted through the ED (*Skin Breakdown Prevention—PART Program*, 2000). Required nursing documentation for PI prevention protocols involves an admission/shift assessment which includes a comprehensive skin assessment, a safety/risk assessment which includes a skin risk assessment, and an optional documentation of any PI prevention strategies that were performed (*Skin Breakdown Prevention—PART Program*, 2000). To assess skin risk status, HCA uses an evidence-based clinical documentation (EBCD) system, which was created to make charting more efficient, simple, and automated. Skin risk status is determined by answering a series of yes or no questions which ask if the patient is: (1) able to comprehend and follow directions, (2) able to ambulate, (3) incontinent, and (4) existing wound. Based on the

answers to these questions, a risk status of "yes" skin integrity impairment risk or "no" skin integrity impairment risk is automatically populated. If a patient's skin impairment risk is "yes", the assigned nurse must manually order a wound care consult in the patient's EHR. If a patient's skin impairment risk is "no", the assessment is performed again every shift, and a wound care consult should be placed if the risk status changes to "yes" at any point during a patient's stay. Additionally, at the facility, a PI that is identified after 72 hours of admission is defined as a HAPI. If a patient has an existing pressure injury that is not documented as "present on admission" (POA) within the first 72 hours of admission, the facility does not receive full reimbursement and is held financially responsible by the US Centers for Medicare and Medicaid Services (CMS) (Padula & Black, 2018).

Measures

In phase two, the project leader completed a review of the EHR of all adult patients aged 18 and older admitted through the ED between May 1st, 2021, and September 1st, 2022, who developed a HAPI within two months of admission. The wound care team at the facility is responsible for tracking HAPI incidents by entering the patient information into an excel file along with the patient's date of admission and the date the HAPI was found (L. Mullaley, personal communication, February 15, 2022). This document is the only continuous method of record for HAPI incidents at the facility. The project leader created an Excel spreadsheet to collect data and each patient chart was labeled with a unique patient ID. See Form 1 for a detailed layout of the data collection form.

Patients who developed a HAPI between the established time frame were then separated into two groups: patients with a foley and/or ostomy on ED admission, and patients without a foley and/or ostomy on ED admission. Data collected on patient demographics and

characteristics included age, gender, comorbidities (cardiac disease, respiratory disease, diabetes, cancer), and presence of foley and/or ostomy. Data on intervals of time were also collected, including: (a) date/time of ED arrival to date/time of admission order, (b) date/time of admission order to date/time of first comprehensive skin assessment and skin risk assessment, (c) date/time of first skin risk assessment to date/time of first wound care consult, and (d) date the HAPI was first documented. To control for prolonged boarding times in the ED, the interval of time between admission order and when the patient physically leaves the ED was also collected. Additionally, data on the presence and stage of pressure injury within two months of admission were also recorded. Strict adherence to the regulations of the Health Insurance Portability and Protection Act (HIPPA) was maintained to protect the confidentiality and anonymity of all cases. Each case was de-identified, assigned a unique number, and recorded into the computer using an Excel Spreadsheet from Microsoft Office 365. The information was then cleaned and checked for completeness before analysis.

Analysis

The analysis phase included (1) an analysis of the structures and processes of care involved in implementing prevention protocols by nurses and (2) an analysis of the structures and process of monitoring and reporting HAPI incidence.

In phase three, the data was analyzed using Microsoft Excel 16.69 for Mac and IBM Statistical Package for Social Sciences (SPSS) 28.0 for Mac. Normality was assumed due to the sample size of the study participants. There was homogeneity of variances, as assessed by Levene's test for equality of variances. The a priori alpha (*p*-value) was set at 0.05 to indicate significance with a 95% confidence interval.

The demographic characteristics of the participants such as age, gender, presence of foley and/or ostomy, and presence of comorbidities were analyzed using descriptive statistics by using the counts (*n*) and percentages. Descriptive statistics were also used to compare demographic characteristics between participants that accumulated a superficial HAPI (i.e., stages 1 and 2) and those that accumulated a severe HAPI (i.e., stages 3 and 4). Additionally, odds ratios were calculated to examine the association between patient demographics and HAPI severity. The average lengths of time for the processes of care from ED arrival to HAPI identification were analyzed by using the mean and standard deviation.

Comparison testing was performed using five independent samples T-tests to determine whether there were any statistically significant differences in the average lengths of the time for the processes of care from ED arrival to HAPI identification between those with a superficial HAPI and those with a severe HAPI. The same five T-tests were performed using a different grouping variable to determine whether there were any statistically significant differences in the average lengths of the time between the processes of care from ED arrival to HAPI identification compared between those with a foley and/or ostomy and those without a foley and/or ostomy.

A Mann-Whitney U Test was performed to determine if there were any statistically significant differences in HAPI severity between those with a foley and/or ostomy and those without a foley and/or ostomy. A Spearman's Correlation test was used to examine if a longer interval of time between the processes of care from ED arrival to HAPI identification correlated with a more advanced stage of HAPI. Finally, a Pearson's Correlation test was used to examine if longer lengths of time between the processes of care correlated with a more prolonged length of time between the subsequent process of care.

Results

The list included a total of 101 patients with occurrences ranging from May 2021 to August 2022. After meeting with a member of the nursing analyst team, the project leader discovered that data retained in Meditech is periodically purged from the EHR and stored in a separate database (H. Williams, personal communication, October 12, 2022). Because of this, 28 of the patient charts listed in the excel file were inaccessible to the project leader and were subsequently excluded from the sample. Following the identified inclusion criteria, two patients were excluded from the study because they were under 18 years of age, 39 patients were excluded because they did not initiate their care in TriStar Centennial's adult ED (e.g, transfers, direct admissions), and two patients were excluded because they developed a HAPI longer than two months after admission. This yielded a final sample size of 30 total patients. Figure 4 demonstrates how the final number of participants included in the study was identified. The project adhered to the regulations of the Health Insurance Portability and Protection Act (HIPPA) to protect the confidentiality and anonymity of all cases. Each case was de-identified, assigned a unique number, and recorded into the computer using an Excel Spreadsheet from Microsoft Office 365. The information was then cleaned and checked for completeness before analysis.

Sample Characteristics

Of the 30 participants that developed a HAPI within two months of admission from the ED, 66.67% of the participants were male (n = 20), and 33.33% were female (n = 10). The mean age of the participants was 60.33 with a standard deviation of 11.79. Regarding comorbidities, 80.00% of the participants had two or more comorbidities (n = 24) and 20.00% of the participants had one or fewer comorbidities (n = 6). A majority of the sample had the presence of a foley catheter (66.67%), while only four participants had an ostomy (13.33%), and nine participants had no foley or ostomy (30.00%). On average, patients developed a HAPI within

18.00 days of admission (*SD* = 11.21). In terms of HAPI severity upon discovery, 56.67% (*n* = 17) were categorized as severe HAPIs (i.e., stages 3 and 4), and 43.33% (*n* = 13) were categorized as superficial HAPIs (i.e., stages 1 and 2). Further analysis of HAPI by stage revealed the following distribution: stage 1 (6.67%; *n* = 2); stage 2 (36.67%; *n* = 11); stage 3 (16.67%; *n* = 5); stage 4 (40.00%; *n* = 12). Of the participants that developed a superficial HAPI, the majority were 65 years and older (53.85%; *n* = 7) and had a foley and/or ostomy (61.54%; *n* = 8). Of the participants that developed a severe HAPI, the majority were under 65 years old (64.71%; *n* = 11) and had a foley and/or ostomy (76.47%; *n* = 13). Compared to those who developed a superficial HAPI, participants that developed a severe HAPI were more likely to have two or more comorbidities (*OR* = 1.40), twice as likely to be female (*OR* = 2.33), twice as likely to be under 65 years old (*OR* = 2.14), and twice as likely to have a foley and/or ostomy (*OR* = 2.03). Table 1 summarizes the demographics of the participants.

Process Measures

The average lengths of time for the processes of care from ED arrival to HAPI identification were analyzed by using the mean and standard deviation and are represented in Table 2. The average number of hours from when an admission order was placed in the ED and when a participant was transferred to the floor (ED boarding time) was 3.27 (*SD* = 3.95). The rate of compliance for performing the first comprehensive skin assessment within eight hours of admission was 90.00% with an average time of 3.65 hours (*SD* = 2.94). The rate of compliance for performing the first skin risk assessment within eight hours of admission was 86.67% with an average time of 4.43 hours (*SD* = 5.08). Of the 30 participants, 6.67% of the patients received a wound care consult within 24 hours of first being identified as “at risk” of developing a PI with

an average time of 15.37 days (*SD* = 12.15). Table 2 summarizes these intervals of time for the processes of care from ED arrival to HAPI identification.

Outcome Measures

Table 3 represents the results of the independent samples T-tests comparing the average lengths of time for the processes of care from ED arrival to HAPI identification between participants who developed a superficial HAPI and those who developed a severe HAPI. There were no statistically significant differences between the average intervals of time between participants with superficial HAPIs and severe HAPIs on *ED arrival to admit order* with t (28) = 0.460, p = .649, *admit order to ED departure* with t (28) = 0.043, p = .966, *admit order to first comprehensive skin assessment* with t (28) = 0.902, p =.375, *admit order to first skin risk assessment* with t (28) = 0.660, p = .515, and fir*st identified as "at risk" to subsequent wound care consult* with t (28) = 0.037, p = .971. Table 4 represents the results of the independent samples T-tests comparing the average lengths of time for the processes of care from ED arrival to HAPI identification between participants with a foley and/or ostomy and those without a foley and/or ostomy. There were no statistically significant differences between the average intervals of time between participants with foley and/or ostomy and those without foley and/or ostomy on *ED arrival to admit order* with t (28) = -1.153, p = .259, *admit order to ED departure* with t (28) = 0.110, p = .913, *admit order to first comprehensive skin assessment* with t (28) = -0.592, p =.558, *admit order to first skin risk assessment* with t (28) = -0.094, p = .926, and *first identified as "at risk" to subsequent wound care consult* with t (28) = 0.235, p = .816.

Because HAPI stage is an ordinal variable, a Mann-Whitney U test was utilized to determine if there were differences in HAPI severity between participants with a foley and/or ostomy compared to those without. The mean rank for participants with a foley and/or ostomy

was 16.69 (n = 21) and the mean rank for participants without a foley/ostomy was 12.72 (n = 2). No significant differences were found between the two groups' HAPI stages. Statistical analysis results for the Mann-Whitney U test are displayed in Table 5.

A Spearman's Correlation test was used to examine if longer intervals of time between the processes of care from ED arrival to HAPI identification correlated with a more advanced stage of HAPI. There were no statistically significant relationships between the intervals of time and HAPI stage. There was a weak negative correlation between HAPI stage and *ED arrival to admit order* with r_s (28) = -.23, p = .228, a very weak positive correlation between HAPI stage and *admit order to ED departure* with r_s (28) = .05, p = .782, a very weak negative correlation between HAPI stage and *admit order to first comprehensive skin assessment* with r_s (28) = -.03, p = .881, a very weak positive correlation between HAPI stage and *admit order to first skin risk assessment* with r_s (28) = .07, p = .723, and a very weak positive correlation between HAPI stage and *first identified as "at risk" to subsequent wound care consult* with r_s (28) = .07, p = .717. The results are shown in Table 6. Finally, a Pearson's Correlation test was used to examine if longer intervals of time between the processes of care correlated with a longer amount of time between the subsequent time intervals. There was a weak negative correlation between *admission order to first skin risk assessment* and *first identified as "at risk" to subsequent wound care consult* with r (28) = -.36, p = .054, and a moderate positive correlation between *admit order to ED departure* and *admit order to first comprehensive skin assessment* with r (28) = .49, p = .006.

Discussion

The aim of this project was to (1) identify patient and system-level risk factors that predict HAPI severity for patients admitted through the ED, and (2) analyze system structures

and clinical processes using Donabedian's SPO model to identify opportunities for improvement related to the implementation of PI prevention protocols in the ED setting.

Sample Characteristics

Analysis of the sample characteristics found that of the 30 sample participants, patients were more likely to have an initial HAPI diagnosis that is at a more severe stage (i.e., stages 3 or 4) if they were female, younger than 65 years old, had two or more comorbidities, or had a foley and/or ostomy. The contrary can be said for each contrasting characteristic (i.e., male, 65 years and older, less than two comorbidities) in relation to the likelihood of developing a superficial HAPI (i.e., stages 1 or 2).

We observed a higher prevalence of severe HAPIs among participants under 65 years old (64.4%) with an increased likelihood of more than two times that compared to those 65 years and older. This association conflicts with existing research that PI severity is higher in elderly patients (> 65 years) and increases with age (Beczek & Vámosi, 2022; de Bengy et al., 2021). Instead, this finding indicates that the odds of having an initial HAPI diagnosis that is at a more advanced stage are higher in participants admitted through the ED that are not considered elderly.

Females who developed a HAPI within two months of admission from the ED were more than two times as likely to have a severe HAPI on initial discovery compared to males. This finding also conflicts with what some may consider the typical "at risk" patient, with some studies showing evidence of a slightly higher prevalence of PI development and more advanced stages of PIs among males (Bauer et al., 2016; Lichterfeld-Kottner et al., 2020). Although the data overall is minimal and there is conflicting evidence on the relationship between gender and

PI risk, this finding may indicate that the more typical “at risk” patient characteristics are less generalizable to patients admitted through the ED.

Although the results of the Mann-Whitney U Test showed no significant differences in HAPI severity between participants with a foley and/or ostomy compared to those without, calculation of the odds ratio found that patients with a foley and/or ostomy were 2.03 times more likely to develop a severe HAPI. This finding supports the observations made by the wound care team and, as mentioned previously, no studies have attempted to explore a potential association between foley and/or ostomy presence and HAPI incidence or severity. This data supports the project team’s observation and prediction that because patients with a foley and/or ostomy are less likely to experience incontinent episodes, require less assistance with hygiene, and aren’t required to ambulate as frequently, these patients are more likely to be exposed to prolonged immobilization and receive less frequent skin checks. This, in turn, increases the risk of developing a HAPI that goes unrecognized and results in a HAPI that is at a more advanced stage on initial diagnosis.

The data suggests that patients who fall outside of the traditional “at risk” clinical picture are being missed by nursing staff and are, therefore, experiencing poorer outcomes (e.g., developing more severe HAPIs). Due to the innate prioritization skills nurses rely on intuitively, nurses are more likely to recognize and prioritize patients that fit the typical “at risk” presentation and, inadvertently, deprioritize patients who do not fit the traditional criteria. These prioritization skills may need to be remodeled to detect patients who have less obvious risk factors. Essentially, these patients are going unnoticed, undetected, and, potentially, unassessed for longer periods of time because nurses have a low suspicion.

These findings support the study's postulation that there are certain patient-level risk factors that, when compounded by the unique ED risk factors, create unrecognized risks for developing HAPIs. This evidence may indicate that the more commonly known and well-documented risk factors for PI development are not translatable to the complex ED setting and patient population.

Process Measures

The average lengths of time for the processes of care from ED arrival to HAPI identification were analyzed to determine baseline compliance with existing PI prevention protocol guidelines. Current best practice PI prevention guidelines state that the initial skin assessment should be performed within eight hours of admission (AHRQ, 2014). Results of this study showed that 90.00% of the patients had a comprehensive skin assessment documented within eight hours of admission ($M = 3.65$; $SD = 2.94$), and 86.67% of the patients had a skin risk assessment within eight hours of admission ($M = 4.43$; $SD = 5.08$). Although this finding suggests that, on average, the protocols are being correctly implemented, the eight-hour time frame from admission order to first skin assessment does not account for the total time spent in the ED.

Of the 30 participants that developed a HAPI within two months of admission from the ED, the average length of time from ED arrival to the first comprehensive skin assessment was 10.62 hours ($SD = 6.21$) with a maximum time of 27.25 hours (Table 7). This indicates that patients experience protracted exposure to a myriad of well-documented risk factors that are unique to the ED context (e.g., prolonged positioning on hard surfaces such as stretchers, backboards, and imaging tables) for as long as 18 hours in some instances and, on average, are going longer than 10 hours before receiving a skin assessment.

Additionally, the standard deviations for both time intervals were wide, indicating that there is large variability between nursing completion of both comprehensive skin assessments and skin risk assessments. This finding suggests that the processes of performing a timely skin assessment are less standardized.

While the first two components of the PI prevention protocol were met 80-90% of the time, timely placement of a wound care consult for patients who were identified as "at risk" was less consistent with high variability. Although facility protocols fail to name a benchmark time frame for when a wound care consult should be placed, best practice guidelines suggest that a wound care consult should be placed as soon as a patient is first identified as "at risk" of developing a PI (AHRQ, 2014). Therefore, in order to provide some perspective of comparison to the compliance rates of the first two components of the protocol, only 6.67% of the patients that developed a HAPI received a wound care consult within 24 hours of first being identified as "at risk". On average, a wound care consult was not ordered until 15 days after a patient was first identified as "at risk". The results also revealed a very wide distribution of the data (SD = 12.15), with times ranging anywhere from one day to 49 days. The findings indicate that these processes lack standardization, causing at-risk patients to go days or weeks without receiving appropriate prevention or treatment measures. Early implementation of basic prevention strategies could translate to earlier detection and robust intervention on superficial HAPIs, which would decrease costs and improve patient outcomes.

Limitations

The project leader acknowledges that this scholarly project has limitations. One limitation of this project was due to the facility's lack of standardization and consistency in recording and tracking HAPI incidence. While collecting retrospective data, the project leader was unable to

identify a concise approach to identifying patients who developed a HAPI during their hospital stay. The project leader discovered that the primary method of tracking HAPI incidence in the facility is by documenting the occurrence in a Microsoft Excel file. No single person oversees the maintenance of the document, the accuracy of the information, or the verification of the data. The responsibility of documenting occurrences lies on staff in various leadership roles or the wound care staff. Additionally, the occurrences only date back to 2021. For these reasons, the reliability of the data may be limited.

Because the project site's EHR routinely purges data after an unspecified period of time, the project leader was unable to access 28 patient charts and, therefore, was required to exclude these participants from the sample. This narrowed the sample size to 30 participants, which reduces the generalizability and external validity of the results. Figure 4 demonstrates how this limitation impacted the final sample size. Additionally, having a relatively small sample size decreases the statistical power, which makes it more difficult to detect statistically significant findings and increases the risk of committing a Type II error. This also negatively impacts the flexibility of the effect size, making it more difficult to measure the strength of the relationship between the variables.

Lastly, because the project team did not control for confounding variables, the internal validity may be compromised.

Implications for Practice

This study utilized Donabedian's Quality of Care Framework to analyze characteristics of the system structures and clinical processes surrounding PI prevention. By doing so, the project team identified key areas for improvement.

As evidenced by the high variability in PI prevention implementation, the system processes and procedures for monitoring and surveilling HAPIs need to be standardized. For example, the data suggests that patients who fall outside of the traditional "at risk" clinical picture are being missed by nursing staff due to the innate prioritization skills nurses rely on. Creating a universal, standardized risk assessment tool for all patients would resolve this oversight in human error and help nurses to better identify the patients who are getting overlooked. Secondly, the most apparent breakdown in these processes involves the failure to take timely action when a patient is identified as "at risk" for developing a PI. As mentioned previously, identifying risk status is automatically calculated simply by completing the skin risk assessment. The results suggest that while nurses are following assessment and documentation protocols appropriately, there is a gap between risk assessment and appropriate intervention that stems from the responsibility of the nurse to manually place an order to wound care. This gap could be addressed by utilizing healthcare technology to create an automated process that places a wound care consult if a patient's skin risk assessment is automatically populated to "yes". Standardization and streamlined processes could be further improved through automated notification of the wound care team of a new consult. Currently, the wound care team primarily utilizes a separate documentation system called "WoundExpert", which has no electronic link to the facility's EHR, Meditech (L. Mullaley, personal communication, February 15, 2022). Because of this, the team is only notified of a new consult order by receiving a fax sent to the wound care office. The wound care team spends a large majority of their day visiting patients and little time in the office, meaning they are often unaware of a new consult until the end of the day. This lack of integration neglects an opportunity to stratify wound care consults by patient risk and creates unnecessary and risky delays in systematic processes that can impede efficient

workflow and timely patient care. For this reason, healthcare technology should be leveraged to address this discrepancy and create a more efficient notification system.

Research shows that PIs can form within two hours of unrelieved pressure and immobility, and in healthy adults, lying on an unpadded backboard for just 30 minutes can result in sacral tissue hypoxia (Gamston, 2019; Santamaria et al., 2019). Current best practice guidelines do not account for the total time spent in the ED and, therefore, are not reliably assessing the risks of developing a PI for patients admitted through the ED. Some researchers support this concept stating that the guidelines should be revised to account for this gap by initiating PI risk assessments as soon as a patient enters the hospital setting, which often occurs in the ED. (Fulbrook et al., 2019; Santamaria et al., 2019). Currently, the clinical processes of assessing and identifying PI risk in the ED are minimal at TriStar Centennial. The ED EHR nursing documentation system differs from the inpatient setting in order to make patient charting more focused, concise, and expeditious for ED nurses. Because of this, the ED EHR does not include an opportunity to document pressure injury risk assessments. Due to the numerous ED environmental factors that impact PI risk (e.g., overcrowding, prolonged boarding times, sustained positioning on hard surfaces), it is imperative that PI risk assessment and prevention protocols begin at this point (Santamaria et al., 2019). Developing an ED-specific PI risk assessment tool that is tailored to the unique dynamics and workflow of the ED environment could improve the early identification of patients at risk and ultimately reduce HAPI incidence.

Conclusion

With pressure injuries being one of the most prevalent, avoidable incidents in healthcare, HAPI occurrences not only represent a failure in clinical care but may also suggest a larger issue within an organization. However, rather than criticizing nurses for unintentionally neglecting

some aspects of their role in PI prevention, the implementation should become more standardized, efficient, and feasible for nursing staff. Utilizing healthcare technology to standardize these processes can make early identification, prevention, and treatment of PIs a reality for patients admitted through the ED. Generating more automated PI prevention procedures can provide coverage for the gap in processes caused by human error.

Overall, this scholarly project suggests that there may be unique patient-level risk factors that create unrecognized risks for HAPI development in the complex ED setting. This study supports the need to re-evaluate the recommended eight-hour time frame for initial skin risk assessment and the need to initiate PI prevention protocols on initial entry to the hospital. Enhancing ED PI prevention procedures can help to improve the efficiency of hospital structures and processes and ultimately improve patient outcomes.

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Appendix

Figure 1: Donabedian's Quality of Care Framework SPO Model with specific project elements applied.

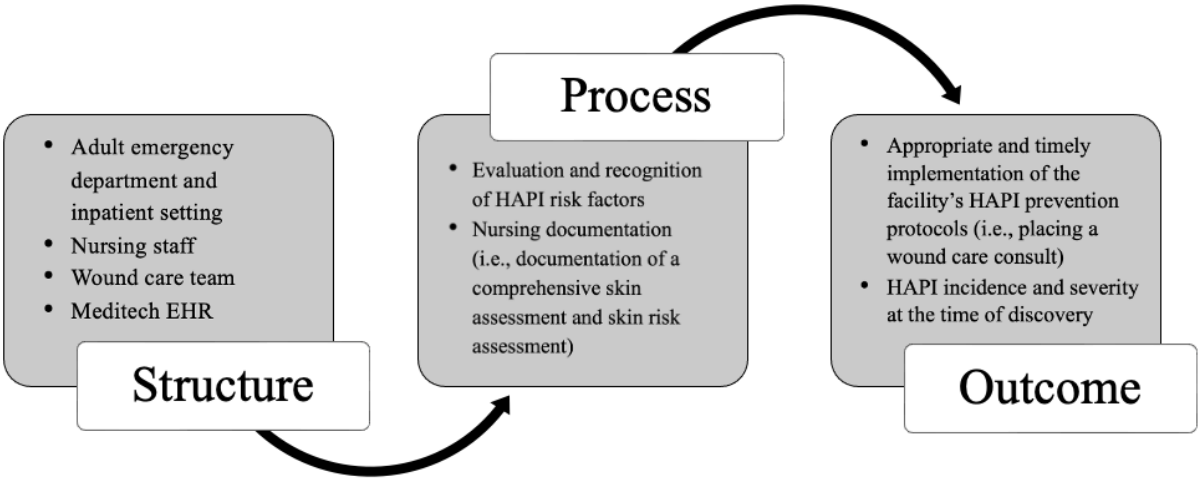


Figure 2: Process of events that occur when an adult is admitted through the ED with a representation of measured intervals of time.

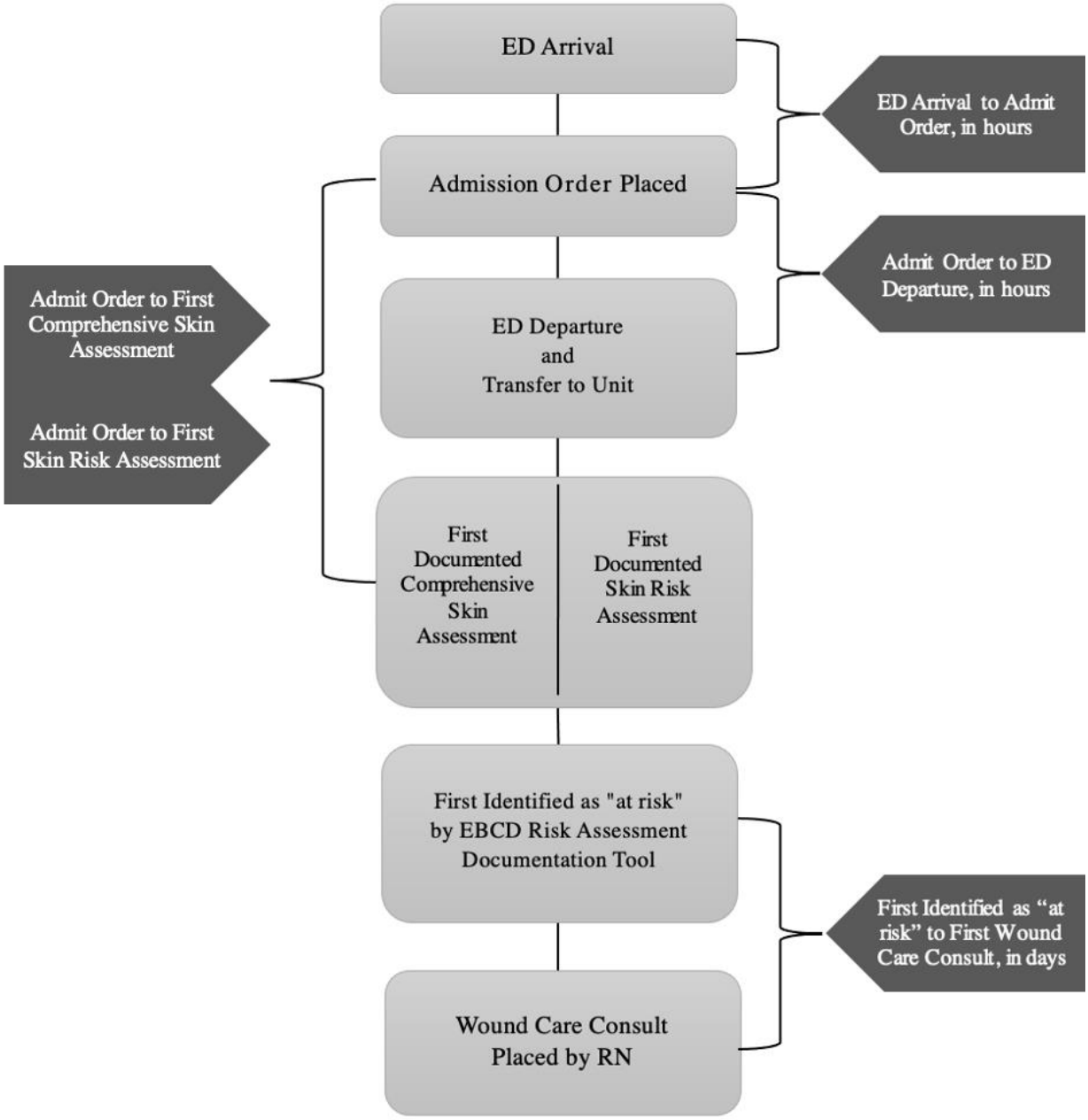


Figure 3: Skin Breakdown Prevention – P.A.R.T Program at TriStar Centennial Medical Center.

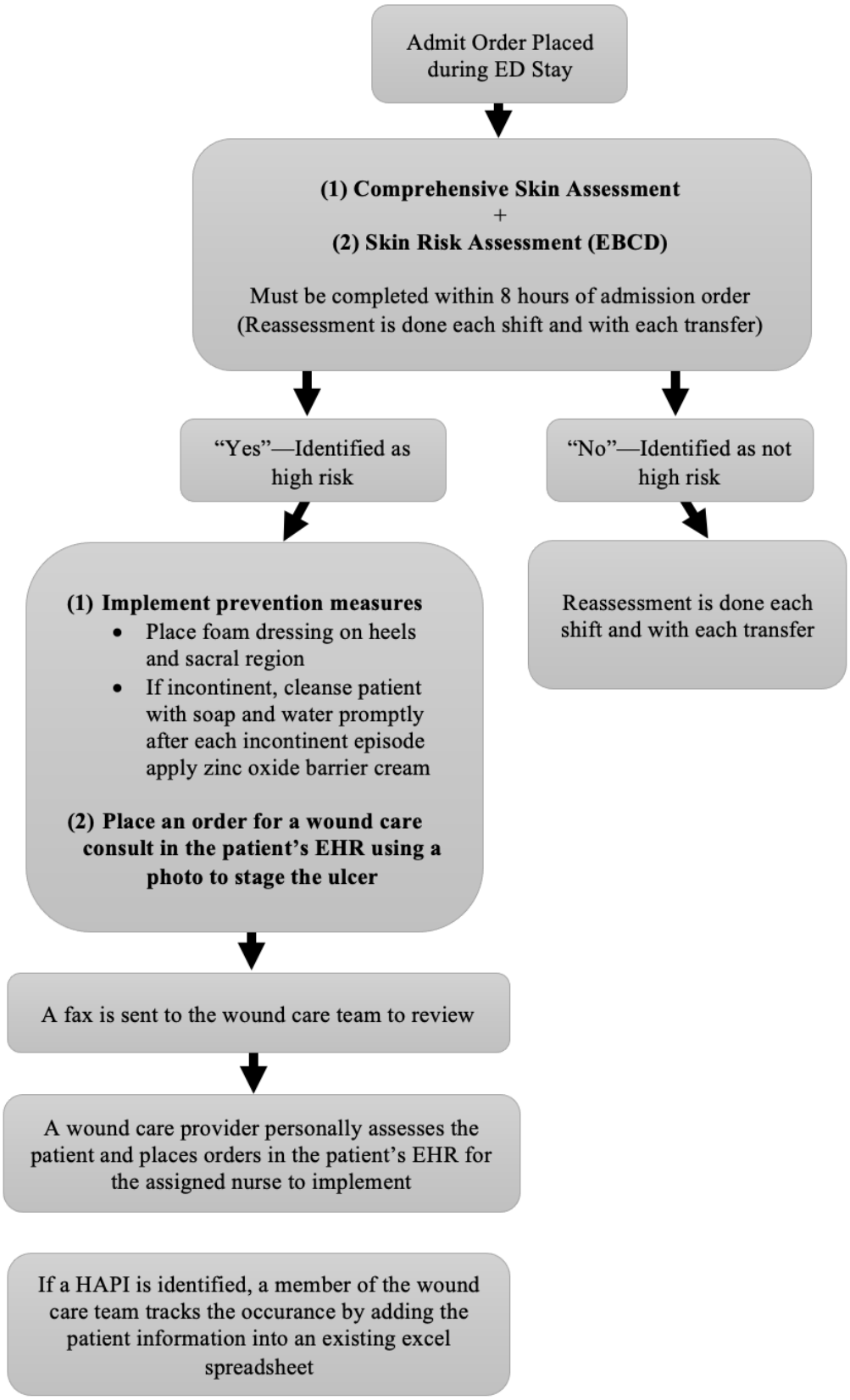
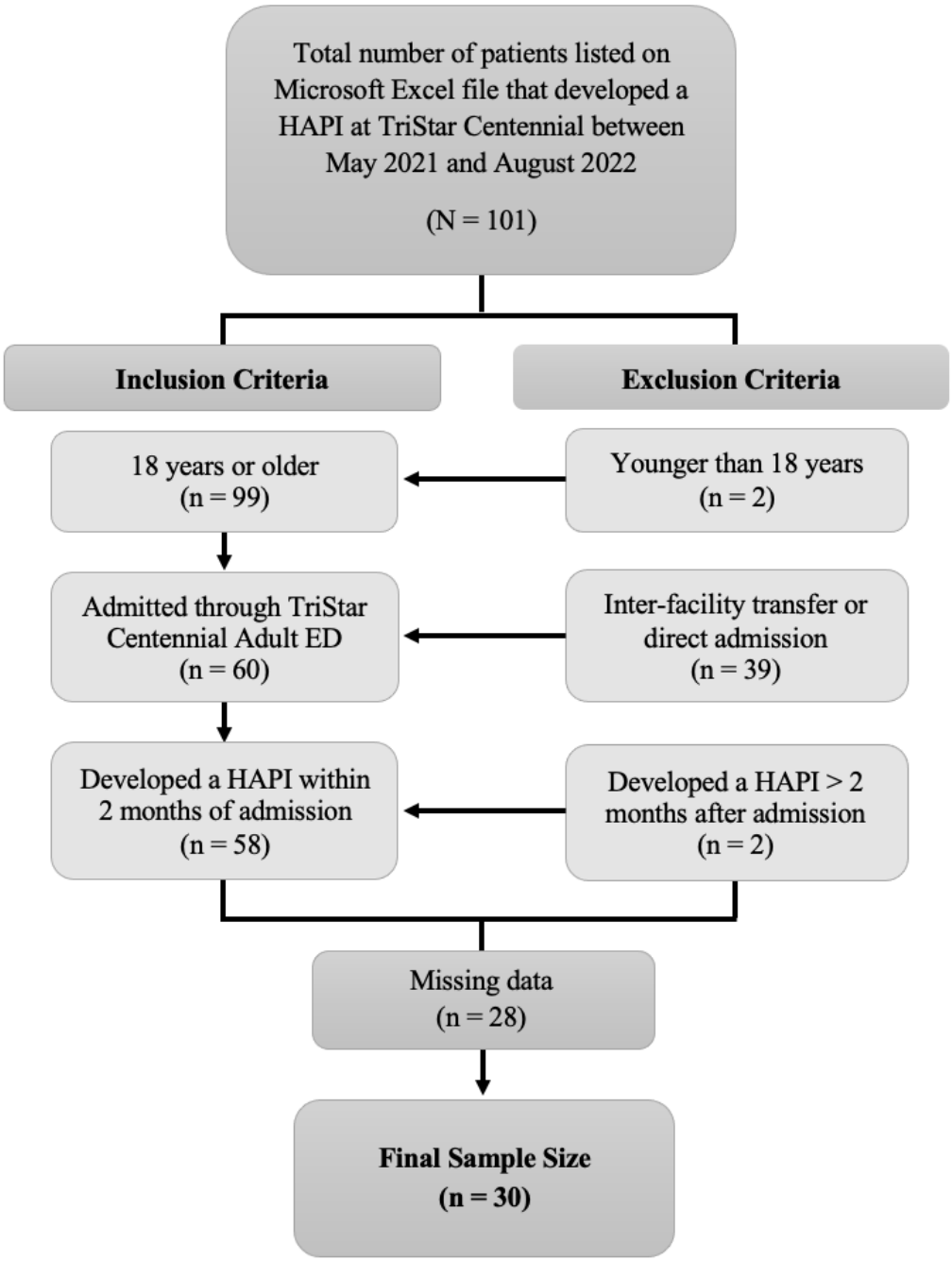


Figure 4: Process map of how the final sample size was determined using the identified inclusion and exclusion criteria.



Form 1: Blank Data Collection Sheet

Case ID: _____

Age: _____

Risk Factors:

- Diabetes Yes No
- Cardiovascular Disease Yes No
- Respiratory Disease Yes No
- Cancer Yes No

Presence of foley: Yes No

Presence of ostomy: Yes No

ED Arrival:

- Date _____
- Time _____

Admission Order:

- Date _____
- Time _____

Bed Assignment:

- Date _____
- Time _____

First Documented Comprehensive Skin Assessment:

- Date _____
- Time _____

First Documented Skin Risk Assessment:

- Date _____
- Time _____

First Wound Care Consult:

- Date _____
- Time _____

HAPI Diagnosis:

- Date _____
- Stage _____

Table 1

Demographic Characteristics of Participants

Characteristics	Superficial HAPIs			Severe HAPIs			Full sample	
	n	%	*OR*	*n*	%	*OR*	*n*	%
Gender								
Female	3	23.08	0.43	7	41.18	2.33	10	33.33
Male	10	76.92	2.33	10	58.82	0.43	20	66.67
Age								
< 65	6	46.15	0.47	11	64.71	2.14	17	56.67
≥ 65	7	53.85	2.14	6	35.29	0.47	13	43.33
Presence of Foley/Ostomy								
Yes	8	61.54	0.49	13	76.47	2.03	21	70.00
No	5	38.46	2.03	4	23.53	0.49	9	30.00
Presence of Comorbidities								
One or less	3	23.08	1.40	3	17.65	0.71	6	20.00
Two or More	10	76.92	0.71	14	82.25	1.40	24	80.00

Note. $N = 30$ ($n = 13$ for Superficial HAPIs; n = 17 for Severe HAPIs). On average, participants were 60.33 years old ($SD = 11.79$). Average participant age with a superficial HAPI was 62.46 years old ($SD = 7.78$). Average participant age with a severe HAPI was 58.71 years old ($SD = 14.14$). Comorbidities are defined as having cardiac disease, respiratory disease, diabetes, or cancer. Superficial HAPIs include PI stages 1 and 2 and severe HAPIs include PI stages 3 and 4.

Table 2

Average Intervals of Time between the Processes of Care from ED Arrival to HAPI Identification

Variable	*M*	*SD*	Minimum	Maximum
ED arrival to admit order, in hours	3.70	1.78	1.02	8.38
Admit order to ED departure, in hours	3.27	3.95	0.15	18.28
Admit order to first comprehensive skin assessment, in hours	3.65	2.94	0.35	11.98
Admit order to first skin risk assessment, in hours	4.43	5.08	0.10	22.77
First identified as “at risk” to first wound care consult, in days	15.37	12.15	1.00	49.00

Note. Mean parameter values for each of the analyses are shown for participants who developed a HAPI within two months of admission from the ED ($N = 30$).

Table 3

Results of Independent Samples T-test Analysis Examining the Average Intervals of Time based on HAPI Severity

Variable	Superficial HAPIs		Severe HAPIs		*t*(28)	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*			
ED arrival to admit order, in hours	3.87	1.76	3.56	1.84	0.460	.649	0.169
Admit order to ED departure, in hours	3.31	3.19	3.24	4.54	0.043	.966	0.016
Admit order to first comprehensive skin assessment, in hours	4.21	3.23	3.23	2.73	0.902	.375	0.332
Admit order to first skin risk assessment, in hours	5.13	6.26	3.89	4.08	0.660	.515	0.243
First identified as "at risk" to first wound care consult, in days	15.46	15.17	15.2 9	9.75	0.037	.971	0.014

Note. $N = 30$. Mean parameter values for each of the analyses are shown for patients that developed superficial HAPIs ($n = 13$) and severe HAPIs ($n = 17$), as well as the results of *t* tests (assuming equal variance) comparing the parameter estimates between the two groups. Superficial HAPIs include PI stages 1 and 2 and severe HAPIs include PI stages 3 and 4.

Table 4

Results of Independent Samples t-Test Analysis Examining the Average Intervals of Time based on Presence of Foley and/or Ostomy

Variable	Foley and/or Ostomy		No Foley and/or Ostomy		*t*(28)	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*			
ED arrival to admit order, in hours	*3.45*	*1.68*	*4.27*	*1.98*	-1.153	.259	0.460
Admit order to ED departure, in hours	*3.32*	*4.33*	*3.15*	*3.10*	0.110	.913	0.044
Admit order to first comprehensive skin assessment, in hours	*3.44*	*2.93*	*4.14*	*3.09*	-0.592	.558	0.236
Admit order to first skin risk assessment, in hours	4.34	5.73	4.56	3.38	-0.094	.926	0.037
First identified as "at risk" to first wound care consult, in days	15.71	12.73	14.56	11.37	0.235	.816	0.094

Note. Mean parameter values for each of the analyses are shown for participants with presence of foley and/or ostomy (n = 21) and participants without a foley and/or ostomy (n = 9) as well as the results of t tests (assuming equal variance) comparing the parameter estimates between the two groups.

Table 5

Results of Mann-Whitney U Test Analysis Examining HAPI Stage based on Presence of Foley and/or Ostomy

Variable	Foley and/or Ostomy		No Foley and/or Ostomy		*p*	*z*	*r*
	Mean Rank	Sum of Ranks	Mean Rank	Sum of Ranks			
HAPI Stage	16.69	350.50	12.72	114.50	.441	-0.771	.141

Note. $N = 30$. Mean parameter values for each of the analyses are shown for participants with presence of foley and/or ostomy ($n = 21$) and participants without a foley and/or ostomy ($n = 9$).

Table 6

Results of Spearman's Correlation Test Analysis Examining the Relationship between Average Intervals of Time and HAPI Severity

Variable	Spearman's Correlation Coefficient (r_s)	*p*
1. ED arrival to Admit Order	-.227	.228
2. Admit order to ED Departure	.053	.782
3. Admit order to first comprehensive skin assessment	-.029	.881
4. Admit order to first skin risk assessment	.067	.723
5. First identified as "at risk" to first wound care consult	.069	.717

Note. $N = 30$. Critical values = 0.362 and -0.362.

Table 7

Average Length of Time Patients Were in the Hospital Before a Skin Risk Assessment or Comprehensive Skin Assessment Was Performed

Variable	*M*	SD	Minimum	Maximum
Time between ED arrival to first comprehensive skin assessment, in hours	10.62	6.21	4.40	27.25
Time between ED arrival to first skin risk assessment, in hours	7.02	4.71	2.79	26.97

Note. $N = 30$.