ORIGINAL ARTICLE

Community versus Hospital Acquired Pressure Injuries: An Assessment of Predisposing Risk Factors

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ABSTRACT

Introduction: Pressure injuries are a common problem in acute and chronic healthcare settings with critical morbidity and mortality consequences on patients and healthcare systems. The objective of this study was to assess the predisposing risk factors associated with patients with community acquired pressure injuries and hospital acquired pressure injuries. **Methods:** Data were drawn from patients' electronic medical records from two hospitals with a total of 784 beds in the North Texas area and 94 records of HAPI and 206 records of CAPI patients were assessed. The measures examined included patients' socio-demographic variables, admission diagnosis, and Braden scale measures. **Results:** Scores for Albumin, weight, body mass index, length of stay and Braden measures were significantly higher for HAPI than CAPI patients at $\alpha < 0.05$. Higher total Braden scores (OR=1.25, 95%CI: 1.15, 1.41), friction (OR=2.44, 95%CI: 1.39, 4.27), and longer length of stay (OR=1.13, 95%CI: 1.09, 1.18) were associated with a higher likelihood of HAPI. **Conclusions:** Interventions aimed at prevention of pressure injuries should target reducing friction and length of stay at care facilities.

Keywords: Pressure injuries, Hospital acquired, Community acquired

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INTRODUCTION

Pressure Injuries (PI) are a common problem in both acute and chronic healthcare settings. The incidence of PI ranges from 6% to 10% (n=6376) in acute care hospitals (1). Furthermore, PIs are significant problems in terms of pain and suffering, delayed recovery, morbidity, mortality, and healthcare costs (2). Hospital acquired pressure injures (HAPI) affect an estimated 2.1 million people in acute care facilities and the cost of treatment may exceed $26.8 billion (1). In the critical care units, patients are at high risk for developing pressure injuries, which may occur within 12 to 24 hours of their admission (3). Failure to prevent PIs may resulted in increasing litigation; therefore, prevention of PIs is less costly than providing treatment and highlights the value of preventing them. The PI is not a diagnosis per se; it is a complication associated with other primary medical conditions. Researchers have identified certain medical diagnoses that are associated with risk PI development. For example, organ failure, diabetes, altered mental status due to stroke, sepsis, heart disease, diabetes, and malnutrition medical diagnoses were the most common diagnoses associated with PI in acute care hospitals (4-8). Poor nutritional status is also considered one risk factor of PI and included in risk assessment tools (RATs) for PI such as the Braden scale (9) and the Norton scale (10). Although the nutritional item in both tools is subjective, albumin and prealbumin are considered objective method of measuring the nutritional status (5-6).

The literature reported that older patients develop PI at higher rate than younger patients (11). In addition, the changes in skin condition either due to ageing or due to medical condition increase the risk of among older patients (12). Ethnicity is another risk factor that has been reported where African Americans found to develop an advanced stage of PI before it is detected in earlier stages (1). Moisture has also been listed on several risk assessment tools for PI (10,13) where moisture level is greater in the sacral area compared to the other high-risk pressure points (14). The factors associated with PI vary depending on type of care. For instance, those hospitalized in critical care units are receiving highly and intensive care compared to those whom occupied to beds at nursing homes and long term facilities (10). This would evoke attention to differences that might eventually exit due to type of care. To date, researchers have described Hospital Acquired pressure injuries (HAPI) and identified characteristics of patients

with this type of PI. Current interventions for prevention of HAPI attempt to remove or reduce factors associated with the incidence of PI. The characteristics of patients with community acquired pressure Injuries (CAPI) and hospital acquired pressure injury (HAPI) are not well known. Therefore, the purpose of the study was to identify the risk factors of patients with community acquired pressure injuries and hospital acquired pressure injuries. This study is informed by three questions:

1. What are the characteristics of patients with CAPI and patients with HAPI?
2. What differences exist in admission medical diagnoses of adult patients with CAPI and HAPI?
3. What patient characteristics are associated with an increased likelihood of developing a HAPI as compared to developing a CAPI?

MATERIALS AND METHODS

Design

A descriptive correlational design utilizing retrospective chart review was performed. The chart review included patients who were admitted with a diagnosis of PI (CAPI), or patients who developed PI in the acute health care facilities (HAPI). Data collected regarding pressure injuries using Braden scale and health factors such as albumin level, skin moisture and sociodemographic factors such as age, length of stay.

Sample and Setting

The patients included in the study were admitted into two not-for-profit hospitals. The two hospitals were a part of one of the largest healthcare systems in the North Texas area. One hospital had 515 beds and the other hospital had 269 beds. The population of Southwest Dallas area was Hispanic. The percentage of Hispanic in this area was 38%, 34% Caucasians, and 22% African American. The Southwest Dallas Area was considered one of the most economically disadvantaged communities in the U.S (15).

In the study, HAPI cases were identified from incident reports and totaled 94 cases. All of them were included in the analysis. For CAPI cases, more than 2,000 patients were in the list who met the inclusion criteria. Using a feature in Microsoft Excel (2010), 206 CAPI charts were randomly selected for inclusions in the sample. The randomization process was performed by choosing every other case.

A purposeful sampling technique was used. The study sample included patients who were 18 years old and older. The CAPI cases were extracted using the International Classification of Diseases, Ninth Revision-Clinical Modification (ICD-9- CM). The ICD-9-CM codes defining PIs include diagnosis codes in the following range: 707.00-707.9. For HAPI cases, the incident reports of all cases were included in the study.

Data Collection

Data were collected from the patient's electronic medical records (EMR). Data collection included admission assessment, shift assessment, nurses' notes, diagnostic procedures, the total Braden scale score, and Braden scale sub scores, and the physician's orders and the progress notes. To supplement and validate the data found through electronic retrieval, all data collectors received training and orientation by the researcher about the study and the data collection procedure that included a thorough chart review. All data collectors were registered nurses (RNs) with wound care experiences.

Measurement

Data collected using The Braden scale: The Braden scale (16) is the most common tool to assess pressure injuries (pressure ulcers) in the clinical setting. The Braden score for predicting pressure sore risk also called Braden scale consists of six subscales that reflect the degree of sensory perception, skin moisture, physical activity, nutritional intake, friction and shear, and ability to change position independently. The total score of the scale is 23. The cut off score for at risk patients is 18 or below, at moderate risk 14 and at high risk the score is below 12. All item scores range from 1 to 4 except the friction and shearing subscale that ranges from 1 to 3. The scale is used to identify the risk factors for PU. The scale has good sensitivity (0.85) and negative predictive value (0.98) (17).

Demographic and health-related factors have also been collected using an author-develop profile. The information retrieved from the medical records. Information collected such as age, gender, marital status, ethnicity, admission information, length of stay, diagnosis, insurance type, BMI., weight, albumin values, bed type and site of PI.

Ethical Consideration

The study was approved by the health care system's Institutional Review Board (IRB) at The University of Texas at Arlington (Ref No: 2013.00.638). No physical, psychological, or social harm to the participants in the study was anticipated. The greatest risk was loss of confidentiality and unauthorized release of individually identifiable health information. A waiver of informed consent was approved by the IRB, because of the minimal risks.

Statistical Analysis

The statistical analysis utilizing the statistical package for social sciences (IBM-SPSS-24) software was used. . Central tendency measures (mean, median) and dispersion measures (SD and range) were used to describe the variables of the study. logistic regression used to test the prediction power of demographic and health-related factors on PI. Differences tested using chi-squares and t-test for two independent samples.

Alpha was set to 0.05

RESULTS

Descriptive characteristics

A total of 206 CAPI patients were involved in the analysis. Age ranged from 56 to 78 years with mean of 73. 2 (SD = 1.59). Males represented 44% (n = 90), while females were 56% (n = 115). The mean score for album was 2.7 (SD = 0.6), BMI was 26.1 (SD = 8.1) indicating overweight, and length of stay was 8.7 days (SD = 6.7).

As for HAPI patients, a total of 94 patients have been involved. The age ranged from 57 to 72 with mean of 70.4. Males represented 49% (n = 46), while females were 51% (n = 48). The mean score for albumin was 2.9 (SD = 0.6), BMI was 28.5 (SD = 8.9) indicating obesity, and length of stay was 22.3 days (SD = 16.2) (Table I).

Table I: Characteristics by CAPI and HAPI patients

Variable	HAPI Mean (SD)	CAPI Mean (SD)	Total Mean (SD)
Age (years)	70.4 (13.8)	73.2 (16.6)	72.3 (15.8)
Albumin (mg/dl)	2.9 (0.6)	2.7 (0.6)	2.8 (0.6)
Weight (kg)	84.2 (29.5)	75.1 (23.5)	77.9 (25.8)
BMI	28.5 (8.9)	26.1 (8.1)	26.9 (8.4)
Length of Stay (days)	22.3 (16.2)	8.7 (6.7)	13.2 (12.5)

Description of Braden scale for CAPI and HAPI patients

Braden scale contains six items: moisture, nutrition, activity, friction, sensory, and mobility. Nurses assess the risk of PI using Braden scale every shift. The scores were averaged during hospitalization for each patient. For this study, the Shapiro-Wilk test for the total Braden score and each Braden component (moisture, nutrition, activity, friction, sensory, and mobility) were significant ($p < 0.05$). Therefore, the parametric assumption of normality was violated and the hypotheses of differences in CAPI and HAPI for total Braden score and for each Braden component were tested by the Mann-Whitney test. The statistical level of significance of α was set at <0.05. The total Braden score was significantly lower in CAPI than in HAPI patients.

Braden Item sub-scores

All Braden item subscale scores of moistures, activity, nutrition, friction, sensory and mobility were significantly lower in CAPI than in HAPI patients (Table II). Logistic regression was conducted to determine whether specific Braden scores and demographic variables were more likely to be associated with CAPI over HAPI. The outcome variable was (CAPI or HAPI), and the predictor variables included the Braden scores and the demographics that were identified as statistically significant between groups (i.e., albumin, weight, BMI, and length of stay). Two logistic regression analyses were conducted. The first logistic regression used the total Braden score as a predictor, along with albumin, weight, BMI, and length of stay. A second logistic regression used the Braden components, as predictors, along with albumin, weight, BMI, and length of stay. These steps avoided the multicolinearity that would occur if both the total Braden and components of the Braden were included together. The first logistic regression (Table III) revealed that the model including total Braden, albumin, weight, BMI, and length of stay was statistically significant (Nagelkerke $R^2 = 0.48$, $p < 0.001$).

Table III: Regression Coefficients for Braden Total Score and health and demographic factors.

Predictor	p-value	OR	OR Lower 95% CI	OR Upper 95% CI
Braden	<.001	1.27	1.15	1.41
Age	.15	1.02	.99	1.04
Albumin	.25	1.42	.79	2.55
Weight	.59	1.01	.98	1.03
BMI	.74	1.01	.94	1.09
Length of Stay	<.001	1.13	1.09	1.18

The odds ratio (OR) for the Braden total score of 1.27 in Table IV indicated that, for every unit increase in the total Braden score, a patient was 27% more likely to be in HAPI group ($p < .001$). Each additional length of stay day was associated with a 13% greater risk of being HAPI (OR = 1.13). No other predictors were statistically significant.

The second logistic regression (see table V) revealed that the combination of Braden components (moisture, nutrition, activity, friction, sensory, and mobility), along with albumin, weight, BMI, and length of stay was statistically significant (Nagelkerke $R^2 = 0.51$, $p < 0.001$). Table V shows that the OR for the Braden friction sub-score was 2.44, indicating that each unit (scaled from 1 to 3) increase in Braden friction sub-score was associated with a 2.44 times greater risk of having a

Table II: Total Braden scores for CAPI and HAPI patients

Group	Braden total	Moist	Activity	Nutrition	Friction	Sensory	Mobility
	Mean (SD)	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*
CAPI	12.8(3.1)	3.1(0.8)	1.3(0.7)	2.3(0.8)	1.5(0.6)	2.6(0.9)	2(0.8)
HAPI	15.6(3.2)	3.5(0.6)	1.6(0.9)	2.7(0.8)	2.2(0.7)	3.1(0.9)	2.5(0.8)
Z value (p)	6.7 (<.001)	4.7 (<.001)	3.6 (<.001)	3.6 (<.001)	7.3 (<.001)	4.4 (<.001)	5.1(<.001)

Table IV: Differences between the CAPI and HAPI patients related to their socio-demographic and health-related factors

Variable n (%)		HAPI	CAPI	Total	Difference
		n (%)	n (%)		
Gender	Male	46 (49%)	91 (44%)	137 (46%)	c^2 (1) = 0.59;
	Female	48 (51%)	115 (56%)	163 (54%)	p = .44
Race/ Ethnicity	African Americans	50 (53%)	115 (56%)	165 (55%)	c^2 (5) = 1.25
	Asians	2 (2%)	4 (2%)	6 (2%)	p = .94
	Caucasians	33 (35%)	72 (35%)	105 (35%)	
	Hispanics	8 (9%)	12 (6%)	20 (7%)	
	Native Americans	0 (1%)	1 (1%)	1 (1%)	
	Others	1 (1%)	2 (1%)	3 (1%)	
Site	Back	70 (75%)	164 (80%)	234 (78%)	c^2 (2) = 0.78
	Heel	18 (19%)	34 (17%)	52 (17%)	p = .68
	Hip	5 (5%)	8 (4%)	13 (4%)	
Bed Type	Low Air loss	7 (7%)	25 (12%)	32 (11%)	c^2 (1) = 1.49
	Standard	87 (93%)	181 (88%)	268 (89%)	*p = .22*
Admission Type	Not Emergency	12 (13%)	42 (20%)	54 (18%)	c^2 (1) = 2.54
	Emergency	82 (87%)	164 (80%)	246 (82%)	p = .11
Weekend Admission	No	73 (78%)	145 (70%)	218 (73%)	c^2 (1) = 1.72
	Yes	21 (22%)	61 (30%)	82 (27%)	p = .19
Insurance	Medicare	83 (88%)	186 (90%)	269 (90%)	c^2 (2) = 0.48
	None	2 (2%)	5 (2%)	7 (2%)	p = .79
	Private	9 (10%)	15 (7%)	24 (8%)	

Table V: Regression Coefficients for Braden Components and health and demographic factors

Predictor	*p-value*	*OR*	*OR Lower 95% CI*	*OR Upper 95% CI*
Moist	.29	1.35	.77	2.37
Activity	.19	.71	.43	1.18
Nutrition	.34	1.25	.79	1.98
Friction	.002	2.44	1.39	4.27
Sensory	.68	1.10	.69	1.75
Mobility	.14	1.54	.87	2.74
Age	.32	1.01	.99	1.04
Albumin	.37	1.31	.72	2.39
Weight	.46	1.01	.98	1.03
BMI	.77	1.01	.94	1.09
Length of Stay	<.001	1.13	1.09	1.18

HAPI (p < .001). Each day increase in length of stay was associated with a 13% greater risk of being HAPI (OR = 1.13) (p < 0.001). No other predictors were statistically significant. Patients in both groups were similar in demographic characteristics except for age.

CAPI patients were in poorer nutritional condition and had lower score in friction and shear. The logistic regression results demonstrated that higher total Braden scores were associated with HAPI. Furthermore, among the Braden components, only higher Braden friction scale scores were associated with HAPI when controlling for demographics and other Braden components. Greater length of stay was associated with HAPI. These findings indicated that longer lengths of stay, Total Braden scores, and Braden friction scores were more likely to be associated with HAPI.

Differences related to socio-demographic characteristics Regarding differences between the two groups related to their socio-demographic and health-related factors, the analysis (Table IV) showed that there were no significant differences between the two groups related to all selected factors (p > 0.05). Although HAPI patients were significantly older than CAPI patients (Mean diff = 2.8 years). Also, no statistically significant difference existed between the two groups in relation to gender χ^2 = 0.59, p = 0.44). The analysis also showed no significant differences between groups in relation to race/ethnicity (χ^2 = 0.80; p = 0.68). PI sites were categorized as back, heel, or hip. One HAPI was located on the elbow. PI site differences were not significant, as well χ^2 = 0.78, p = 0.68). The back PI was the most common site accounted for 75% for HAPI patients (n=93) and 80% for CAPI patients (n = 164)

DISCUSSION

Cost of healthcare is compromised due to health expenditure not only related to direct cost of treatment, but also due to complication of medical problems. Pressure injures (PI) are among those complications that may burden patients and healthcare professionals, as well. However, differences between hospital acquired and community acquired PIs are significant to better plan for medical intervention approbatively. In this study we found that no differences appeared between the CAPI and HAPI in terms of gender. The results support previous studies that that females and males regardless of their medical and biological predisposing factors were almost at the same level of risk of PI (18). While, age was a more significant finding. In this study, we found that mean age of HAPI patients was much higher than CAPI patients. This has been consistent across different

previous studies (11).

In this study, we found that patients with CAPI were in poorer nutritional condition than HAPI patients. The lower the score, the more severely the patient is malnourished. Researchers have reported causal links between wound healing and poor nutritional intake (19). Despite nutritional management in hospitals, malnourished patients with existing pressure injuries require a longer time, beyond the expected length of stay, to regain their nutritional balance. Similar to the study findings, Wann-Hansson et al. (20) found the nutrition score in CAPI patients was lower than the nutritional score in HAPI patients. Moreover, the average BMI for patients with CAPI was lower HAPI. The BMI value indicates that means that CAPI patients were categorized as overweight while HAPI categorized as obese (21). Nevertheless, poor nutrition was reported more among CAPI patients than HAPI patients; CAPI were almost two folds of HAPI. The association between BMI and the incidence of PI is controversial in the literature. Although moderate obesity provides a protective effect and reduces the incidence of PI, morbidly obese patients were at high risk for PI development (22-23). The mean sensory score for patients with HAPI was above three, indicating slight limitation in sensory perception. In patients with CAPI, the mean score was lower than three, indicating sensory impairment. A possible explanation of this finding was that the percentage of patients with diabetes and neurological diseases may have been higher in the CAPI group than the HAPI group. Sensory impairment may be due either to nerve damage in case of stroke and diabetes or to pain medications that may alter sensation (24).

Regarding the site of PI, the majority of the PI sites were in the coccygeal and sacral areas in both groups of patients. The CAPI patients were scored as having greater friction (lower score) at admission than patients with HAPI were. Friction per se is not a significant factor for PI development and was eliminated from the NPUAP wording of the definition of PI; however, friction can be a contributing factor and increases the shearing forces (25).
Lower Braden scores indicate higher risk of developing of PI. Total Braden scores were lower (worse) for CAPI patients than for HAPI patients. CAPI patients averaged ~12.5, indicating moderate to high risk, while HAPI patients averaged ~15.5, indicating mild risk (26). A possible explanation for lower Total Braden score in CAPI patients is that the presence of PI upon admission may influence nurses to subjectively underscore these patients. Another explanation is that the low score reflects the actual risk condition of these patients as evidenced by having PI. The purpose of the Braden scale is to identify patients at risk for PI. However, if patients already have CAPI, there may be limited clinical benefit of using the scale.

Regarding medical diagnoses, sepsis and malnutrition were the most frequent medical diagnoses for patients with CAPI. While for HAPI patients, the most frequent medical diagnoses were respiratory problems and CHF. The finding do add to the body of knowledge were previous studies limited medical risks to circulatory impairment and sepsis showed (27). On the other hand, the high number of sepsis admission diagnoses for CAPI patients was consistent with previous studies where high rate of sepsis diagnoses is caused by the infected chronic wounds (28). Sepsis has also been reported as the 10th leading cause of death in the United States, and 200,000 patients die annually from sepsis (29).

The study also found that the total Braden score, friction, and length of stay were the significant predictors of HAPI. The Braden score represented multiple factors related to PI development that were assessed. Higher Braden scores for HAPI patients at admission and the fact that they later developed a PI supported the hospital policy of assessing PI risk and recording a Braden score each shift. Frequent assessment is congruent with the NPUAP's (25) recommendations. As noted previously, scores on the Braden scale may be less valid for CAPI patients at admission because they already have a pressure ulcer. Friction as a subscale of the Braden scale was important. The importance of friction was similar to findings from a prevalence study in which friction was found to be the most important predictor of CAPI (30). The extent of friction present is an important risk factor that characterizes the development of PI in the community and the hospital.

Patients admitted with an existing PI may have a history of recurrent admissions to acute care facilities, making it unclear if the PI was initially developed during a previous hospitalization or if it was developed in the community. Hence, data collected may not have accurately reflected the actual length of stay if a previous hospitalization was included and, consequently, obscured the relationship between length of stay and development of PI. The present study did not include body temperature or temperature of skin in contact with other surfaces. Temperature would be an important measure to include in future studies of PI because fever has been shown to increase the likelihood of developing PI (31).

One limitation for this study is using a cross sectional approach in which a longitudinal approach may allow follow up for consequences of PI.

CONCLUSION

Pressure Injuries present challenges for the medical and healthcare providers at the inpatients and outpatient's healthcare settings. It is important to recognize the differences between CAPI and HAPI for the purpose to reduce the incidence of PI. The study found that

patients with CAPI and HAPI had similar demographic characteristics. However, HAPI patients have higher BMI than CAPI patients, HAPI patients were older, and the primary diagnosis for CAPI patients was sepsis and for HAPI were respiratory problems. The CAPI patients already had a PI at admission and were significantly worse than HAPI patients on the factors associated with PI such moisture, activity, nutrition, friction, sensory, mobility, and total Braden score. The study has implication for medical and healthcare providers; t friction between the patients' skin and the bed surface, the role of malnutrition be aware that the most common PI sites were similar for CAPI and HAPI patients. The fact that HAPI patients had higher Braden scale scores at admission and still developed a PI supports the necessity of thorough assessment of all patients every shift. Further studies need to address the effect of various forms of interventions on the development of PI utilizing longitudinal approach.

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