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Pressure Ulcers in the United States` Inpatient Population From 2008 to 2012: Results of a Retrospective Nationwide Study

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Abstract

Pressure ulcers are common, increase patient morbidity and mortality, and costly for patients, their families, and the health care system. A retrospective study was conducted to evaluate the impact of pressure ulcers on short-term outcomes in United States inpatient populations and to identify patient characteristics associated with having 1 or more pressure ulcers.The US Nationwide Inpatient Sample (NIS) database was analyzed using the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9 CM) diagnosis codes as the screening tool for all inpatient pressure ulcers recorded from 2008 to 2012. Patient demographics and comorbid conditions, as identified by ICD-9 code, were extracted, along with primary outcomes of length of stay (LOS), total hospital charge (TC), inhospital mortality, and discharge disposition. Continuous variables with normal distribution were expressed in terms of mean and standard deviation. Group comparisons were performed using *t*-test or ANOVA test. Continuous nonnormal distributed variables such as LOS and TC were expressed in terms of median, and nonparametric tests were used to compare the differences between groups. Categorical data were presented in terms of percentages of the number of cases within each group. Chi-squared tests were used to compare categorical data in different groups. For multivariate analysis, linear regressions (for continuous variable) and logistic regression (for categorical variables) were used to analyze the possible risk factors for the investigated outcomes of LOS, TC, inhospital mortality, and patient disposition. Coefficients were calculated with multivariate regression with all included patients versus patients with pressure ulcers alone. The 5-year average number of admitted patients with at least 1 pressure ulcer was determined to be 670 767 (average overall rate: 1.8%). Statistically significant differences between patients with and without pressure ulcers were observed for median LOS (7 days [mean 11.1 ± 15] compared to 3 days [mean 4.6 ± 6.8]) and median TC ($36 500 [mean $72 000 ± $122 900] compared to $17 200 [mean $32 200 ± $57 500]). The mortality rate in patients with a pressure ulcer was significantly higher than in patients without a pressure ulcer (9.1% versus 1.8%, OR = 5.08, CI: 5.03-5.1, *P* <0.001). Pressure ulcers were significantly more common in patients who were older or had malnutrition. The results of this study confirm the importance of prevention initiatives to help reduce the negative impact of pressure ulcers on patient outcomes and costs of care.

Introduction

Pressure ulcers are one of the most common health conditions in the United States. The Agency for Healthcare Research & Quality (AHRQ) estimates more than 2.5 million individuals in the US develop pressure ulcers annually. The magnitude of this issue is evident in the fact that it spurred the AHRQ (supported by the Health Services Research and Development Service of the Department of Veterans Affairs and the Boston University School of Public Health) to form a panel of pressure ulcer experts from 6 medical centers to develop a pressure ulcer prevention toolkit to be used in acute care settings with a goal to decrease the incidence of pressure ulcers.[1]

As a result of the subsequent increased health care utilization, medical management of pressure ulcers costs the US health care system $9.1 billion to $11.6 billion per year.[1] Since 2008, the Centers for Medicare and Medicaid Services (CMS) has discontinued hospital reimbursement for charges related to hospital-acquired conditions, which includes patients who acquire pressure ulcers during admission. A hospital stay involving a pressure ulcer may incur additional annual charges of up to $700 000.[1] Treatment costs for a Stage 3 pressure ulcer range from $5900 to $14 840; treatment of a Stage 4 ulcer may cost between $18 730 and $21 410.[2]

In addition to direct costs, pressure ulcers incur costs in the form of litigation, penalties, and patient costs. More than 17 000 pressure ulcer-related lawsuits (with an average cost of $250 000) are filed per year.[3] Under the Affordable Care Act,[3] hospitals also may be penalized up to 1% of their full reimbursement from Medicare if they have high nosocomial infection rates (includes infected pressure ulcers). The cost to the patient who develops a pressure ulcer is of utmost importance. It is estimated that up to 60 000 Americans die each year as a direct result of pressure ulcer-related complications[3]; a recent white paper[2] notes pressure ulcers negatively affect a person's quality of life and contribute to substantial psychological stress, pain, loss of work, burden to family, and mortality.

Much of the current focus regarding this public health issue is centered on the importance of prevention. Prevention and management of pressure ulcers require an interdisciplinary approach.[1] As the AHRQ pressure ulcer toolkit exemplifies, many health care systems are implementing improved care plans to deliver coordinated, high-quality care to patients with or at risk of developing pressure ulcers.[1]

The purpose of this retrospective descriptive study was to evaluate the impact of pressure ulcers on short-term outcomes in US inpatient populations and identify patient characteristics associated with having 1 or more pressure ulcers.

Methods

Data source. Hospital admissions from 2008 to 2012 listed in the National Inpatient Sample (NIS) database (www.hcup-us.ahrq.gov/nisoverview.jsp) were culled. The NIS is the largest national all-payer hospital inpatient care database in the US and is supported by the Healthcare Cost and Utilization Project (HCUP) of the AHRQ. The NIS contains data from more than 1000 community hospitals in the 47 states that participate in HCUP, which represents more than 95% of the US population. The database estimates a 20% stratified sample population of all nonfederal acute care hospitals throughout the US (excluding long-term care acute hospitals and rehabilitation centers). The NIS includes patients with Medicare and Medicaid, persons who are privately insured, and those who are uninsured. Hospital discharge data are collected annually, and the weighted data represent more than 7 million hospital admissions nationally. All patient and physician identifiers have been removed from this data set. Approval from the institutional review board was not required to conduct this analysis.

Patient selection. Within the HCUP database, patients with pressure ulcers were identified using the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9 CM). Data for all patients having a diagnosis code for pressure ulcer (707.00 through 707.09) during a hospital admission from 2008–2012 were selected with no exclusion criteria. Patient demographics and comorbid conditions were recorded. The comorbidities were calculated with the comorbidity software developed by HCUP (www.hcup-us.ahrq.gov/toolssoftware/comorbidity/comorbidity.jsp#download) based on the study by Elixhauser et al.[4] In addition, the following risk factors for pressure ulcer development were abstracted based on ICD-9 codes: malnutrition, shock/hypotension, peripheral vascular disease (PVD), incontinence, cerebrovascular disease (CVD), diabetes mellitus, and fractures (vertebral and femur) (see Table 1). Endpoints evaluated were length of stay (LOS, days), total hospital charge (TC), inhospital mortality (Yes/No), and setting to which patient was discharged. The NIS database represents data collected during hospital stay; no postdischarge information was available or analyzed for this study.

Statistical analysis. Continuous variables with normal distribution were expressed in terms of mean and standard deviation. Group comparisons were performed using *t*-test or ANOVA test. Continuous nonnormal distributed variables such as LOS and TC were expressed in terms of median, and nonparametric tests were used to compare the differences between groups. Categorical data were presented in terms of percentages of the number of cases within each group. Chi-squared tests were used to compare categorical data in different groups. For multivariate analysis, linear regressions (for continuous variable) and logistic regression (for categorical variables) were used to analyze the possible risk factors for the investigated outcomes of LOS, TC, inhospital mortality, and patient disposition. Coefficients were calculated with multivariate regression with all included patients versus patients with pressure ulcers alone. All statistical analysis was performed using IBM's Statistical Package for Social Sciences (SPSS) software version 21 (IBM Corp, Armonk, NY). Type I error rate was set at 0.05.

Results

Patient demographics and prevalence rates. The 5-year average number of admitted patients with 1 or more pressure ulcers in the US from 2008 to 2012 was determined to be 670 767. The total number of annual cases remained stable: 685 526; 678 026; 662 111; 718 550; and 609 620 in the years 2008 to 2012, respectively (see Figure 1). The average overall rate of patients with at least 1 pressure ulcer across all 5 years was 1.8%. Mean overall age of patients with a pressure ulcer was 71.2 ± 16.8 years (male 68 ± 17.4, female 74.1 ± 15.5) (see Table 2). Patients with a pressure ulcer were significantly older than persons without pressure ulcers (*P* <0.001). The rate of patients with pressure ulcers increased with increasing age. Men had a significantly higher rate than women across all age groups (*P* <0.001), except for admissions in the youngest age group (see Figure 2). The average overall pressure ulcer rate in men (2.0%, n = 325 293) was significantly higher than in women (n = 351 110, 1.6%) (OR: 1.282, 95% CI: 1.276-1.288, *P* <0.001).

African Americans had a significantly higher rate (2.4%, n = 119 113 out of 4 979 112) compared to all other races (*P* <0.05). The rate in Caucasians was the second highest (1.8%, n = 407 006 out of 22 621 329) followed by Native American (1.4%), Asian/Pacific Islander (1.3%), Hispanic (1.2%), and others (1.4%). The rate was highest in individuals with Medicare coverage (3.5%, *P* <0.05). Patients with Medicaid had a rate of 0.8%; privately insured patients (0.6%) and self-pay patients (0.4%) had the lowest rates (see Table 2). Nonelective admissions had a significantly higher rate than elective admissions (1.9% versus 1.1%, *P* <0.001).

Risk factors for pressure ulcers. Risk factors were identified by ICD-9 codes. The risk factor with the highest association with pressure ulcers was a diagnosis of malnutrition (11.5%, risk ratio [RR] = 8.45, CI: 8.41-8.5, *P* <0.001). Other factors associated with the presence of pressure ulcers included hypotension (5.5%, RR = 3.56, CI: 3.53-3.58, *P* <0.001), PVD (5.1%, RR = 3.22, CI: 3.19-3.24, *P* <0.001), incontinence (5.4%, RR = 3.16, CI: 3.12-3.21, *P* <0.001), CVD (3.8%, RR = 2.46, CI: 2.44-2.48, *P* <0.001), diabetes (3.2%, RR = 2.38, CI: 2.37-2.39, *P* <0.001), and fractures (2.7%, RR = 1.56, CI: 1.54-1.58, *P* <0.001) (see Table 3).

Pressure ulcer site, stage, and debridement. Among 676 435 pressure ulcer patients, 540 073 (79.8%) had 1 recorded pressure ulcer, 105 383 (15.6%) had 2 pressure ulcers, and 30 979 (4.6%) had more than 2. The most common area for pressure ulcers was the patients' lower back (lower back/sacral/coccygeal areas per ICD-9) (47%); 17% were located on the patients' buttock, 14% on the heel, 9% other locations, and 5% on the hip. The ankle, upper back, elbow, and locations not otherwise specified each accounted for <5%. Of the 540 073 pressure ulcers identified, 79 026 (16%) were Stage 1, 191 308 (38%) were Stage 2, 101 093 (20%) were Stage 3, 97 083 (19%) were Stage 4, and 36 081 (7%) were unstageable according to ICD-9 coding (see Figure 3). The median stage of pressure ulcers was 2 for men, women, and Caucasians; the median stage in African Americans was 3. Persons concurrently suffering from malnutrition had a median stage of 3; persons with hypotension, PVD, incontinence, CVD, diabetes mellitus, and vertebral/femur fractures had a median stage of 2. A total of 71 418 excisional debridements were performed in 65 582 patients; 5462 patients required multiple procedures.

Impact on patient outcomes.

LOS. The median LOS for individuals with at least 1 pressure ulcer was 7 days (mean 11.1 ± 15), compared to a median of 3 days (mean 4.6 ± 6.8) for patients without a pressure ulcer. Patients were significantly more likely to have a longer LOS (all *P* <0.001) if they had the following risk factors: weight loss (regression coefficient [coef] = 4.88), paralysis (coef = 3.20), coagulopathy (coef = 2.04), congestive heart failure (CHF) (coef = 1.17), fluid/electrolyte disorder (coef = 1.70), and pulmonary/circulation disease (coef = 2.05).

Cost. Multiple factors contributed to hospital charges. The presence of a pressure ulcer increased costs. The median TC for persons with pressure ulcers was $36 500 (mean $72 000 ± $122 900) compared to persons without pressure ulcers, whose median TC was $17 200 (mean $32 200 ± $57 500). Increased hospital charges were significantly associated (*P* <0.001) with LOS (coef = 8613), male gender (coef = 4464), African American race (coef = 3483), having private insurance (coef = 7643), or Medicaid beneficiaries (coef = 3729). The following comorbid conditions also significantly affected TCs: pulmonary/circulation disease (coef = 7062), PVD (coef 5887), obesity (coef 4229), hypotension(coef = 2530), and fluid/electrolyte disorders (coef = 3971).

Mortality. Patients with a pressure ulcer had a significantly higher mortality rate than patients without (9.1% versus 1.8%, OR = 5.08, CI: 5.03-5.1, *P* <0.001); the latter also were more likely to be discharged home (72.5% versus 13.4%, OR =5.42, CI: 5.39-5.45, *P* <0.001), whereas patients with pressure ulcers were more likely to be transferred to a skilled nursing facility or intermediate care facility or require home health care (76.9% versus 24.7%, OR = 3.116, CI: 3.112-3.121, *P* <0.001).

Discussion

The National Pressure Ulcer Advisory Panel[5] (NPUAP) defines a pressure ulcer as "localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear and/or friction."

Although the NPUAP recently changed the term *pressure ulcer* to *pressure injury*, the term *pressure ulcer* is used throughout this article to maintain consistency with the ICD-9 coding used during the study period.

Pressure ulcers occur in up to 23% of patients in long-term and rehabilitation facilities[6] and at an incidence of 10% to 41% in ICU patients.[7,8] The AHRQ[2] reported nearly 2.5 million individuals are affected by pressure ulcers, and more than 60 000 patients[9] in the US die each year as a direct result of pressure ulcers. The costs associated with pressure ulcers are considerable. According to a 1996 prospective, year-long study looking at 30 patients and conducted by Xakellis and Franz,[10] the incremental cost per pressure ulcer in the US was $2731. Per a retrospective review,[11] the cost could be as high as $59 000 if the ulcer was associated with osteomyelitis. Medicaid[9] estimated each pressure ulcer adds $43 180 in costs to an individual's hospital stay.

Pressure ulcers also have a significant impact on patient morbidity, mortality, and quality of life.[2] In their review of pressure ulcers in intensive care patients, Burdette and Kass[12] described pressure ulcers as one of the most expensive and debilitating diseases in the 20th century. In her review of risk factors and the assessment of pressure ulcer risk assessment, Braden[13] indicated the complexity of the management and treatment of pressure ulcers can greatly reduce the quality of life, resulting in a worldwide economic dilemma. Similarly, in their retrospective review of the 2003 NIS database, Fogerty et al[14] demonstrated the complexity of pressure ulcer development and the multiplicity of contributing risk factors.

The overall incidence and prevalence of pressure ulcers have been shown in 2 reviews of the literature[15,16] to remain high in the US despite the supposed improvement in the quality of health care in general and the drastic improvement in understanding these ulcers or the improvements in technologies available for prevention of ulcers specifically. The current study found the annual number of pressure ulcers reported in the US inpatient population was 670 767. Overall, the number of annual cases has remained constant at approximately 600 000 to 700 000 patients during the 5-year period of the study, with a rate of 1.8%. These numbers are lower than the 2.5 million reported by the AHRQ[9] due to the fact the NIS database only accounts for those individuals with pressure ulcers who were hospitalized. Advances in pressure ulcer management have enabled these patients to receive treatment in outpatient care centers, with the goal of decreasing the duration of hospitalization, readmission rates, additional patient morbidity, and total care costs.[9]

In the opinion of the authors, the observed absence of a decrease in pressure ulcer rates may be attributed to: 1) failure or inadequate application of available prevention strategies during hospital admission or in other patient care environments, or 2) improvements in pressure ulcer assessment and reporting.

Risk factors. Conflict exists as to whether pressure ulcers result from factors largely dependent on caregivers or primarily from factors associated with patient morbidity. It is well established that pressure ulcers continue to be a common health problem, particularly among individuals with physical limitations or persons who are elderly and bedridden.

Age. Perneger et al[17] evaluated the incidence of pressure ulcers (N = 2373) by conducting 3 cross-sectional surveys in a teaching hospital among patients with no pressure ulcer documented on admission. The authors assessed the development of pressure ulcers and the date on which the ulcer was documented and correlated this with diagnosis and reason for admission, among other factors. They found 247 new pressure ulcers occurred during admission (5.7 per 1000 person-days). The risk of pressure ulcer occurrence increased with age (11.2% of patients ages 70 to 79 years versus 34% in patients >90 years). Their results are consistent with the current study where the mean overall age of patients with a pressure ulcer was 71.2 years (68 years in men and 74 years in women), with increasing rates in older age groups. Jaul[18] described pressure ulcers as chronic and healing in the geriatric population; the author indicated the presence of a pressure ulcer constituted a "geriatric syndrome" that was a result of multiple factors: immobility, poor nutrition, aging skin with poor elasticity, and numerous chronic diseases.

The US is experiencing a significant increase in the aging population. By the year 2050, the population 65 years of age and older will nearly double. This creates an urgent need for better prevention strategies and management of pressure ulcers.

Gender. In the current study, the prevalence of pressure ulcers was significantly higher in men (2%) than women (1.6%) (OR: 1.282, 95% CI: 1.276-1.288, *P* <0.001). Inconsistent conclusions have been drawn as to which gender has a higher predilection for pressure ulcer development. The Waterlow score,[19] developed in 1987 as a tool for pressure ulcer risk assessment, accommodates for research showing women are at a greater risk for development of a pressure ulcer; female gender is assigned a score of 2, where men are assigned a score of 1. This scoring system accounts for gender differences in the observation of predisposition of women to pressure ulcers in individuals who had femoral fractures.[20] Similar results were found in a 2-phase epidemiological study (N = 327 patients) by Bale et al[21] that looked specifically at hospice patients. In addition, the authors found decreased pressure ulcer development with the use of a risk assessment tool and subsequent proactive measures such as offloading surfaces. Contrarily, in a prospective cohort study (N = 258), Primiano et al[22] observed higher rates of pressure ulcers in men. The authors evaluated preoperative, intraoperative, and postoperative risk factors in cases where surgery lasted >3 hours; using bivariate and logistic regression analyses, male gender was found to be predictive of pressure ulcer development. The authors suggested the difference in distribution of adipose tissue in females was protective against pressure ulcer development. The current authors think the higher prevalence among male patients can be attributed to other associated risk factors as opposed to gender predilection. A multicenter cohort study of 3361 patients by Chen et al[23] noted the higher number of spinal cord injuries observed in men could result in more pressure ulcers when compared to women. Gibson et al[24] observed similar results in their 2002 qualitative study. The Braden scale[25] does not recognize any difference in pressure ulcer risk associated with gender, which is in accordance with other prevalence/incidence research.[26,27] A review[28] of risk assessment found gender difference observed in pressure ulcer development also could be a reflection of the complexity of the overall problem, the multitude of causative events and comorbid conditions, and the lack of a universal risk assessment/classification tool.[27]

Race/ethnicity. In the US, race/ethnicity, low socioeconomic status, occupation type, and education are consistently related to reduced access to quality health care. Previous studies have reported a significant association between race/ethnicity and pressure ulcer development: a qualitative study by Saladin and Krause[29] conducted among post spinal cord injury patients of varying racial-ethnic backgrounds (105 American Indian, 127 Caucasian, 122 Hispanic, 121 African American) found variability in access to treatment may lead to minority populations experiencing higher pressure ulcer prevalence. A cross-sectional study[30] found African American ethnicity was a predictor of pressure ulcer recurrence. However, Furher et al[31] found no differences in the prevalence of pressure ulcers between African Americans and Caucasians in the general population, although they reported African Americans suffered greater pressure ulcer-related mortality and suffered from more severe, higher-staged ulcers. An age-adjusted descriptive study using matched odds ratio comparisons by Redelings et al[32] found African Americans had higher mortality from pressure ulcers than Caucasians. In general, African Americans tend to have less education and higher poverty rates at all ages compared to Caucasians, as shown by the survey analysis of health disparities using the US National Health and Nutrition Survey and follow-up interviews conducted by Farmer and Ferraro.[33] The results were no different in the current study: pressure ulcer incidence rates were higher in African Americans (2.4%, n = 119 113 out of 4 979 112) compared to all the other races (*P* <0.05). Caucasians had the second highest incidence rate (1.8%, n = 407 006 out of 22 621 329) compared to other minority races such as Native American (1.4%), Asian/Pacific Islander (1.3%), Hispanic (1.2%), and other races (1.4%).

Insurance. In November 2008, the CMS instituted a policy to withhold reimbursement to acute care hospitals for the costs of treating hospital-acquired conditions such as pressure ulcers.[34] Despite these policies, pressure ulcer rates were the highest in persons with Medicare coverage (3.5%, *P* <0.05). The prevalence rates for patients with Medicaid, private insurance, and self-pay patients were 0.8%, 0.6%, and 0.4%, respectively. The high rate of pressure ulcers in Medicare patients may be attributed to the fact that persons eligible for Medicare are 65 years or older, which subsequently places them at higher risk for development of pressure ulcers according to the literature and the current study results.

Comorbidities.

Nutrition. According to a descriptive analysis by Duncan[35] and a review by Lyder and Ayello,[36] immobility, inadequate nutrition, sensory deficiency, multiple comorbid conditions, circulatory abnormalities, dehydration, age, and incontinence are a few of the more than 100 factors identified as placing adults at risk for developing pressure ulcers. Of all the risk factors, malnutrition contributed the most significantly to pressure ulcer prevalence in the current study (11.5%, RR = 8.45, CI: 8.41-8.5, *P* <0.001). Compromised nutritional status such as unintentional weight loss, undernutrition, protein energy malnutrition, and dehydration are known risk factors for pressure ulcer development.[37] As shown in a pilot study[38] and a retrospective cohort study,[39] additional nutrition-related risk factors associated with increased risk of pressure ulcers include low body mass index, reduced food intake, and impaired ability to eat independently. These factors might reflect poor health and self-care that is associated with higher incidence of pressure ulcers.

Tissue perfusion. Reduced tissue perfusion is known to play an important role in the development and chronicity of pressure ulcers. Mechanical loading may be significant enough to compromise the capillary circulation, causing ischemia and cell death in areas of pressure and, subsequently, ulcer development. Hypotension and PVD play a similar role. In a retrospective cohort study by Man et al,[40] hypotension was found to be an important risk factor for pressure ulcer development in the geriatric population. In the current study, rate of pressure ulcers was high in patients with hypotension (5.5%; RR = 3.56, CI: 3.53-3.38, *P* <0.001) and PVD (5.1%; RR = 3.22, CI: 3.19-3.24, *P* <0.001).

pH. The pH of normal skin (pH 5.4–5.9) has a bactericidal effect and limits the growth of pathogenic organisms. In the event of urinary incontinence, due to reasons such as CVD, urinary urea decomposes on the skin to form ammonium hydroxide, which raises the skin pH and favors bacterial proliferation. A descriptive study by Leveen et al[41] also shows high pH also negatively impacts the delivery of oxygen to damaged tissue, making wound healing even more challenging. Fecal incontinence also can cause skin irritation and breakdown. The current study showed patients with CVD had a pressure ulcer rate of 3.8% (RR = 2.46, CI 2.44-2.48, *P* <0.001), and the rate was 5.4% rate (RR = 3.16, CI: 3.12-3.21) among persons with incontinence.

Diabetes and fractures. Other factors that may contribute to pressure ulcer development include diabetes and fractures. Blood sugar control is known to play an important role in wound healing. Persons with diabetes are at risk for developing both pressure ulcers and diabetic foot ulcers, owing to the neuropathy and tendency for unnoticed trauma. In the current study, the rate of pressure ulcers among patients with diabetes was 3.2% (RR = 2.38, CI 2.37-2.39, *P* <0.001). A retrospective review of data[42] found fractures that result in immobilization, such as hip[42] and femur[20] fractures, predispose to the development of pressure ulcers. In the current study, patients with fractures had a pressure ulcer rate of 2.7% (RR = 1.56, CI 1.54-1.58, *P* <0.001).

Ulcer quantity, site, and stage. Documenting the number, site, and stage of ulcers is crucial in pressure ulcer management. Among the 676 435 patients studied in this NIS database, 540 073 (79.8%) had 1 ulcer recorded, 105 383 (15.6%) had 2 pressure ulcers, and 30 979 (4.6%) had more than 2 ulcers. Bony prominences are more susceptible to pressure ulcers as a result of deformation of deep tissues and muscle atrophy. A review of the literature[43] found shear force and friction injury to skin surfaces create a process in which the epidermal and dermal layers adhere to bed surfaces causing destructive events to the underlying areas of the skin. The most vulnerable pressure points depend on the position in which most of the patient's time is spent. The current data showed a majority (47%) of the pressure ulcers were located on the patients' lower backs (sacrum). Excessive moisture results in hyperhydration of the skin, rendering it more vulnerable to dermal erosion. The high percentage of lower back pressure ulcers could be an amalgamation of the influence of shear force, friction, and moisture in patients who are bedbound. Patients also had pressure ulcers on the heel (14%), hip (5%), and other locations (9%). The ankle, upper back, elbow, and locations not otherwise specified each accounted for <5%. A systematic review of the literature[44] (including 3 RCTs and 1 economic study [N = 502]) recommends manual repositioning of these patients for both treatment and prevention of pressure ulcers. However, the ideal repositioning regimen and frequency has yet to be determined, per a systematic review by Moore and Cowman.[45]

Pressure ulcer staging affects both treatment and prognosis. The NPUAP[46] redefined the stages of pressure ulcers in 2007 to include the original 4 stages plus 2 additional stages (deep tissue injury and unstageable). The reported incidence of pressure ulcers Stage 2 or greater is between 8.1% and 12.9%.[47,48] The current data analysis showed both male and female patients had a median pressure ulcer Stage 2. Among Caucasian and other populations, the median stage of pressure ulcers was Stage 2, whereas the median stage for the African American population was Stage 3. The advanced stages seen in African Americans may be attributed to poor general condition or due to difficulty in detecting early pressure ulcers stages due to the clinical difficulty in observing erythema and blanching response in dark skin. The current authors observed patients who suffer from malnutrition had a median ulcer stage of 3, and patients with diabetes, CVD, incontinence, PVD, and hypotension had a median ulcer stage of 2. This could be attributed to frequent surveillance for pressure ulcers in these high-risk patients in nursing homes and hospitals.

For Stage 1 and Stage 2 pressure ulcers, wound care typically does not involve surgery. Management at these stages may involve topical therapy, offloading, and optimization of nutrition/moisture management, as well as proper management of the underlying cause. For Stage 3 and Stage 4 ulcers, surgical intervention may be required, although a review[49] has shown some of these lesions might be treated conservatively due to coexisting medical problems. Generally, excisional surgical debridement is the standard care for higher-stage pressure ulcers because these often present with necrosis. In the current data, a total of 71 418 excisional debridement procedures were performed in 65 582 patients; of those, 5462 patients required multiple debridement procedures.

LOS. According to a limited literature review,[50] prolonged LOS is a significant predictor of functional decline in elderly individuals during hospitalization. A 9-year, prospective observational registry study of 275 pressure ulcers by Lardenoye et al[51] showed 5.5% of all pressure ulcers resulted in prolonged hospitalization and found a strong correlation among pressure ulcer development, reason for hospital admission, gender, and age. In a cross-sectional, observational study (N = 2000), Graves et al[52] concluded the presence of pressure ulcers was a significant independent contribution to excess length of hospitalization. LOS has been shown to be prolonged an average range of 4 to 6 days, including in the descriptive, comparative study of 2 cross-sectional pressure ulcer surveys[52,53] by Gunningberg and Stotts.[54] The current study shows the median LOS for individuals with at least 1 pressure ulcer was 7 days (mean 11.1 ± 15) compared to a median of 3 days (mean 4.6 ± 6.8) in patients without pressure ulcers. Patients with significant weight loss, paralysis, coagulopathy, CHF, fluid and electrolyte disorders, and pulmonary and circulation diseases with concurrent diagnosis of at least 1 pressure ulcer were more likely to have a longer LOS.

Cost. Prolonged LOS not only affects the morbidity and mortality of patients, but it also has a significant impact on hospital charges. The current study estimated the median TC to be $17 200 (mean $32 200 ± $57 500) in patients without pressure ulcers. In contrast, the median hospital charges for patients with pressure ulcers were significantly higher at $36 500 (mean $ 72,000 ± $122 900, *P* <0.001). Along with pressure ulcers, increased LOS (coef = 8613), male gender (coef = ,464), African American race (coef = 3483), private insurance beneficiaries (coef = 7643), and Medicaid beneficiaries (coef = 3729) significantly impacted total hospital charges. Other conditions that contributed to increased hospital charges were pulmonary/circulation disease (coef = 7062), PVD (coef = 5887), obesity (coef = 4229), hypotension (coef = 2530), and fluid and electrolyte disorders (coef = 3971).

Mortality. Pressure ulcers play a significant role in influencing the mortality rate among hospitalized patients and patients in nursing facilities. A retrospective study by Lyder et al[55] showed that of 3000 individuals who entered the hospital with a pressure ulcer, 16.7% developed at least 1 new pressure ulcer during their stay. The odds of any patient dying in the hospital were 2.8 times higher if the patient had a pressure ulcer. In the current study, the mortality rate in patients with pressure ulcers was significantly higher than in patients without pressure ulcers (9.1% versus 1.8%, OR = 5.08, CI: 5.03-5.1, *P* <0.001). The current data analysis also showed 72.5% of patients without pressure ulcers were discharged home compared to 13.4% patients with pressure ulcers (OR 5.42, CI: 5.39 – 5.45, *P* <0.001). Furthermore, 76.9% patients with pressure ulcers were transferred to a skilled nursing facility or intermediate care facility or required home health care compared to 24.7% patients without pressure ulcers (OR = 3.116, CI: 3.112-3.121, *P* <0.001). This observation is consistent with previous reviews.[56,57] The additional fees for skilled nursing facilities add to the increase in health care expenditure on treatment and management of this preventable health issue.

Limitations

The results of this study are limited by the inherent limitations of retrospective analysis of administrative data, which includes the risk of erroneous coding or missing data. Given that ICD-9 codes were used, some error in pressure ulcer diagnosis and description of coding can be assumed. On the other hand, the large sample size is expected to minimize errors associated with data recording and should not interfere with the general conclusion. Also, the authors could not differentiate between pressure ulcers that were hospital-acquired and present on admission; although the aim of the study was not to delineate between them, knowledge about their onset would have enhanced overall conclusions, especially in terms of deep tissue injury and its sometimes slow clinical appearance. Readmission rates, which were not available for this investigation, also may have inflated the number of patients with pressure ulcers. Lastly, while the data facilitated the categorization of patients without pressure ulcers, this may minimally weight the data, because patients at risk are more likely to develop more than 1 pressure ulcer.

Conclusion

The results of this study show the rate of pressure ulcers among patients in US acute care hospitals was relatively stable from 2008 until 2012 (average 1.5%). Patients who had a pressure ulcer had a significantly longer LOS, higher in-hospital mortality rate, and higher TC than patients without a pressure ulcer. Patients with pressure ulcers were also more likely to be discharged to a skilled nursing facility, while those individuals without pressure ulcers were more likely to be discharged home. The ICD-9 code associated with a significantly higher risk of having a pressure ulcer was for malnutrition. Pressure ulcers have been recognized as being a public health issue in the US that contributes greatly to national health care expenditures. Early treatment and a reduction of pressure ulcer rates have been set as goals by the CMS. The Institute of Healthcare Improvement has created the 5 Million Lives Campaign; 1 of the main goals is to use science-based guidelines for prevention. It is crucial that the severity of this issue be recognized and that health care centers develop an interdisciplinary approach to the delivery of coordinated, high-quality care to patients with, or at risk for, developing pressure ulcers.

Affiliations

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