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ORIGINAL ARTICLE

Characteristics of hospitalised US veterans with nosocomial pressure ulcers

Teresa Tarnowski Goodell[1] & Zoe Moskovitz[2]

1 School of Nursing, Oregon Health & Science University, Portland, OR, USA
2 Serenity Hospice & Palliative Care, Portland, OR, USA

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Correspondence to
TT Goodell, Oregon Health & Science University, School of Nursing, 3455 SW US Veterans Hospital Rd SN6S, Portland, OR, USA
E-mail: goodellt@ohsu.edu

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Abstract

The objective of this study was to describe demographic and clinical characteristics of hospitalised US veterans with nosocomial pressure ulcer (NPU) referred to a certified Wound, Ostomy & Continence Nurse (WOCN). We conducted a retrospective review of electronic records at a Veterans Affairs Medical Center in the northwestern USA. Records of veterans with NPU referred to a WOCN ($n = 29$) from May 2005 to June 2006 were reviewed. Location and stage of pressure ulcer(s), Braden score on admission and when the ulcer was first noted, day of hospital stay when the ulcer was first noted, medical diagnoses and clinical conditions and events such as surgery, hypoxemia, hypoalbuminemia and hypotension were recorded. Mean age of the patients was 69·8. The most common location was the sacrum/coccyx. Most ulcers were stage 1 when identified. Braden score during admission classified half of the sample at risk, but 81% of Braden scores at ulcer occurrence were <18. Ninety percent of the sample had three or more comorbidities. Over half had died in the 1–14 months after the reviewed hospitalisation. Hospitalised veterans referred for WOCN consultation had multiple risk factors and comorbid conditions, including hypoxemia, serum albumin depletion, anaemia and hypotension. Veterans cared for in Veterans Affairs Medical Centers are known to have multiple health problems, and those in this sample not only had nosocomial pressure ulcer, but also other physiological derangements that may shorten survival.

Prevention of nosocomial pressure ulcers (NPUs) in hospitals has long been a concern of health care providers and regulatory agencies because of the suffering, disability and health care costs associated with them. NPU incidence in acute care is estimated at 7–9%, costing $2·2–6·4 billion annually in the USA, with higher incidence in intensive care units (ICUs) (1,2). This study's purpose was to identify characteristics of US veterans who developed NPU during hospitalisation, which have not been described previously in the literature. Data were obtained from referrals to a certified Wound, Ostomy & Continence Nurse (WOCN). Describing the characteristics of this population may facilitate early identification of hospitalised veterans at high risk of developing a NPU.

Introduction

Nosocomial pressure ulcers

Pressure ulcers (PUs) are thought to be caused by local tissue ischaemia, interstitial and lymphatic blockage, reperfusion

Key Messages

- US veterans are known to have multiple health problems, and studies show this group is less healthy than the general population
- no prior studies have been published specifically describing NPUs in hospitalised US veterans

- risk factors for pressure ulcer found in this sample were similar to those in the literature; nearly half died within 14 months of hospitalisation
- most PUs were stage 1 and in the sacro-coccygeal region; Braden scores at the time of ulcer identification were lower than at admission
- the sample had many concurrent illnesses, surgeries and other clinical factors that may be implicated in the high death rate in this sample

injury related to free radical damage and mechanical deformation of cells by compressive forces (3,4). One conceptual scheme proposes that tissue tolerance of pressure and oxygen deprivation mediates the effect of compressive and shearing forces in ultimately determining NPU occurrence (5,6). Tissue tolerance is affected by clinical and demographic variables that will be reviewed in this section.

Mean ages of hospitalised patients with NPU fall between 59 and 73 years (7–14). Patients with NPUs tend to be older than those without, but, in some studies, age is non significant (9,15–18) and in others age becomes non significant when analysed with age-related conditions such as decreased weight, sensory deficit, incontinence, altered mental status, malnutrition, immobility andlow serum albumin (9,14,15,19).

The largest percentage of PUs occur on the sacrum, followed by the heels (1,7,9,19,20). Some authors classify locations in the pelvic girdle such as the sacrum, coccyx, ischial tuberosities and the buttocks together and report this as the most common location (11,19). In one ICU study (21) incidence was higher on the heels than on the sacrum.

Incidence studies report NPUs as largely stage 1 and 2 (7,11,13,22). Some do not report stage 1 ulcers, and find the majority of breakdown to be partial thickness (10,12). Some studies (9,11,20) found stage 1 to be more common than stage 2, while others (7,22) found the opposite. These differences may be the result of different measurement intervals, populations and length of follow up or difficulty in detecting stage 1 PU (1).

Literature on ICU stays and overall length of stay (LOS) varies. Although many sources cite higher PU incidence in ICUs versus acute care, the actual reported incidence in ICUs varies widely, from 1% to 56% (23), and studies are not consistent with regard to an ICU stay as a risk factor (13). In a study of surgical ICU patients (8), 96% of NPUs occurred in patients whose LOS was greater than 7 days. Among all patients whose LOS was at least 7 days, those who developed NPUs had a total stay twice as long as those who did not. However, LOS was not significant in multivariate analysis when age, emergent admission, days without nutrition and days in bed were included in a predictive model. Lindgren (24) found LOS to be significant in predicting NPU incidence and Scott (25) found LOS to be significantly longer in those with NPUs compared to those without (mean difference = 6·7 days). Although associations between longer LOS and NPU appear valid, no causal association can be inferred from these studies.

Most studies show that NPUs occur relatively early in the hospital stay (1). Baumgarten (22) found 6·2% NPU incidence within 2 days of admission in hospitalised older adults. Whittington (20) found a 7–9% incidence after 5 days of hospitalisation. In an ICU study, stages 1, 2 and 3 NPUs developed within an average of 5–6, 12–17·5 and 17–20 days of admission, respectively (21). An ICU study of mechanically ventilated patients reported that stages 1, 2 and 3 NPUs developed within 13, 16·1 and 19 days of admission (26). In a third ICU study, 68·7% of patients acquired their NPUs within 7 days (13). Schultz et al. (11) found 21·5% incidence of NPU within 6 days in a surgical population.

The Braden scale is the most extensively studied PU risk assessment scale. Total scores, ranging from 6 to 23, are obtained by summing six subscale scores: sensory perception, moisture, nutrition, activity, mobility and friction/shear. A lower score indicates higher risk. Most studies find that lower Braden scores are significantly associated with PU occurrence (7,11,13,21,27,28). Pender and Frazier (26) found that the lowest Braden score was not predictive in an ICU where all the study participants were at risk. In a study of the predictive validity of the Braden scale in tertiary care, Veterans Affairs Medical Centers (VAMCs) and skilled nursing facilities, Bergstrom et al. (29) recommended an overall cutoff score of 18, although the cutoff that maximised sensitivity and specificity in the VAMCs was 19. The study also showed that in VAMCs, Braden scores on admission and 48–72 hours after admission were predictive of NPU development, but the score at the time of NPU occurrence was the most predictive. Keller et al. (23) noted that scales and cutoff scores with acceptable sensitivity generally lack specificity, but ultimately concluded that the Braden was preferable to other scales for use in predicting NPUs in ICUs.

Relationships between medical diagnosis and NPU are not clear. Lindgren et al. (24) found that cardiovascular diseases were the most common medical diagnoses among patients with NPUs. Whittington and Brionnes (20) found that 18–22% and 20–23% of acute care patients with NPUs had primary cardiovascular and respiratory diagnoses, respectively. Bergstrom et al. (7) found that cardiovascular diseases were the only diagnoses associated with NPU occurrence, but this was not significant after controlling for Braden score. In an ICU (21), cardiovascular disease was the most common reason for admission (50·7%), but people with cardiovascular disease had the lowest NPU prevalence. Despite the predominance of cardiovascular disease in some studies, it is not clear whether the percentage of people developing a NPU who have cardiovascular disease is merely reflective of the prevalence of cardiovascular disease or whether there is actually an association between cardiovascular disease and NPU development.

Individual cardiovascular diagnoses, such as coronary artery disease, stroke, hypertension and congestive heart failure have been studied with mixed results (7,10,13,15,27). Endothelial cell dysfunction may link hypertension and NPUs (30). Endothelial dysfunction is associated with diabetes, coagulopathy and peripheral vascular disease, which have been studied for their association with NPU development, albeit with inconsistent results (7,11,15,23,25,27,31). The use of

ankle-brachial pressure index has been advocated to identify arterial insufficiency as a risk factor for heel PUs (32).

Infection and sepsis have been examined in relation to NPU development in multiple studies. Reed et al. (10) found that neither pneumonia nor white blood cell count >20 000/ml was associated with NPU development. Bergstrom et al. (7) found no link between sepsis and NPU. Others have found that most NPUs occurred in people with a diagnosis of infection or sepsis (8,12,21,25). In a study of acute care patients with HIV, CD4 count <100 cells/μl was a predictor of NPU development and 12 of 44 NPUs occurred in people with bacteremia, half originating from the NPU (33). Redelings (34) showed that septicemia was much more prevalent in persons who died with a pressure ulcer than those who did not. Blood flow irregularities in sepsis include higher skin blood flow and lower peak hyperemic response (35), phenomena that may be associated with susceptibility to NPU.

The role of nutritional supplementation, body mass index (BMI) and indicators of nutritional status is unclear (36). In three studies of surgical patients, serum albumin was not significant in multivariate analysis (9,11,31). Schultz et al. (11) found no difference in serum albumin between surgical patients with and without NPUs, although lower BMI, which affects the intensity of pressure over bony prominences, was associated with NPU occurrence. Others (15,36) have reported relationships between low BMI and NPU, and between decreased serum albumin and NPUs (12,20). A very large prevalence study (37) showed higher prevalence of stage 1 NPU in those with low BMI and higher prevalence of stage 2 NPU in people with very high BMI. It is not clear if these findings are related to the difficulty in identifying stage 1 NPU in the very obese patient, or a true effect of extremes of body habitus.

Although, in some studies, serum albumin was not a NPU predictor (9,11,22,31), serum albumin depletion has been associated with NPUs in many other studies, including a study of 2771 VAMC patients (10). Both Theaker et al. (31) and Baumgarten et al. (22) found that although serum albumin was not significant, reduced nutritional intake was associated with NPU occurrence, likely due to the time required for decreased nutrition to be manifested in serum albumin decrements. In a hierarchical model including the Braden subscales, Fisher et al. (14) found that the Braden moisture, mobility and sensory perception subscales were more predictive than nutrition. Nutritional intake may not be closely related to nutritional state when illness causes hypermetabolism and cachexia. Four of five studies reviewed by Reddy et al. (38) found that nutritional supplementation had no significant effect on pressure ulcer occurrence. A Cochrane review of nutritional interventions (39) identified only one study of acceptable quality; that study found that nutritional supplements reduced the number of new NPUs in nutritionally depleted critically ill elders (40).

Theaker et al. (31) found anaemia increased incidence of NPUs threefold, but haematocrit <30% was not related to the development of NPUs in another study (10). A review of risk factors for cardiac surgical patients (27) noted that preoperative haematocrit was a significant NPU predictor in two studies, and haemoglobin in one study.

Vasopressors and hypotensive episodes potentially affect skin integrity by decreasing peripheral blood flow. A number of studies have found vasopressors to be a significant factor in NPU development in the ICU (20,25,26,31). In one study, 14% of people with NPUs were on vasopressors, and 5% of those without NPUs were on vasopressors (26), although no statistical analysis was provided. Another study found that use of intravenous norepinephrine for more than 60% of a patient's LOS increased incidence of NPU eight times when compared to patients receiving intravenous norepinephrine for 0–40% of the ICU stay (31).

NPUs appear to be associated with mortality. Allman et al. (41), found that 4 of 6 (67%) patients who developed NPUs died in the hospital, compared to 11 of 72 (15%) at-risk patients who did not develop NPU. Critically ill surgical patients with NPU had (8) mortality rates between 33% and 61% in one 5-year study. Keller et al. (23) cite a study of 638 ICU patients in which 63% of patients with NPUs died, compared to 15% of patients without NPUs. A study of patients with HIV infection found a mortality rate of 50% for those with NPUs, and 7·2% for those without (33). A longitudinal study (42) found that more patients with NPUs died (59·5%) within 1 year of discharge than those without (38·2%), but NPUs were not significant in predicting death in multivariate analysis when other indicators of prognosis and illness severity were included. Reed et al. (10) found that having a do-not-resuscitate (DNR) order was a significant predictor of NPU, perhaps because illness severe enough to necessitate a DNR order links NPU occurrence to the end of life.

Patients may have concurrent illnesses that increase risk of NPU and bring about consideration of end of life choices. Although it is possible that DNR status may cause neglect of NPU prevention, there is evidence that seriously ill patients develop NPUs despite preventive care (10,43–45). PUs may be part of a syndrome of progressive organ failure, and the term 'skin failure' has been proposed to describe this phenomenon (43). The National Pressure Ulcer Advisory Panel issued a press release endorsing the existence of skin failure and stating that certain NPU, such as those in haemodynamically unstable patients, are not always preventable (45).

In summary, our review of the literature identified a number of potential risk factors for NPU that we chose to examine in this study. It remains clear that risk factors vary considerably and that more study is needed to define a robust set of variables influencing tissue tolerance and NPU formation.

The US veteran population

The health of the veteran population differs substantially from that of the general US population. In the 4-year Veterans Health Study ($N = 2425$) (46), 22% of participants were more than 50% disabled, and 46% had combat experience. The median age was 65 years and the mean number of medical diagnoses was six. In a nationwide sample, Nelson (47) showed a higher prevalence of obesity among veterans receiving care through the US Veterans Health Administration (VHA) compared to other veterans and civilians (27·7, 23·9 and 22·8% respectively.) There are two explanations for

the relatively poor health status of US veterans as compared to US civilians. Veterans qualify for care through the VHA either because they have a disability related to their military service or because their annual income is below an established threshold (46). Veterans seeking care through the VHA thus tend to be more disabled and poorer than others. Additionally, military service exposed veterans to unique health risks both physically, such as Agent Orange used in the Vietnam War, and psychologically, such as combat, to which the civilian population is not exposed.

The diminished health status of US Veterans seeking care through the VHA may increase risk of NPU when these people are hospitalised. Disability may impede mobility, and chronic illnesses may impair tissue tolerance. It is thus important to describe this population and begin to understand its characteristics in order to improve prevention of NPU.

Methods

A retrospective chart review was done to identify the veterans who developed NPU and received WOCN consultation. A data collection instrument that listed pressure ulcer risk factors was developed from the literature review and consultation with Veterans Affairs (VA) practitioners. Demographic and clinical factors were included. A list of all the study variables and their operational definitions is given in Table 1. The data collection form was reviewed by a WOCN at the VAMC where the study was done for completeness, appropriateness to the population and consistency with the literature.

WOCN consultation notes were obtained for the 13-month period from May 2005 to June 2006. A retrospective review of all WOCN-authored consultation notes, and corresponding electronic health records (EHRs), identified 29 patients with NPU. PUs caused by devices such as braces and prostheses were excluded. The two researchers extracted data from the EHRs on the relevant variables and recorded the data on a study form. A subset of five records was cross-checked to confirm the accuracy of data recording. In cross-checking, the researchers accessed EHRs independently to confirm the accuracy of the other's data abstraction. Disagreements were discussed and mutually resolved.

Medical diagnoses collected were systemic diseases known to occur frequently in the VA population (46). These were coronary artery disease, congestive heart failure, atrial fibrillation, peripheral vascular disease, hypertension, chronic obstructive pulmonary disease, diabetes mellitus, renal failure, liver failure, sepsis and depression. Additional systemic illnesses were classified as 'other'. Non systemic illnesses such as glaucoma and peptic ulcer were excluded. Medical diagnoses with systemic implications, such as cardiac, pulmonary, renal and liver disease, were recorded, but common illnesses without systemic effects, such as glaucoma and haemorrhoids, were not. Institutional Review Board approval was obtained from the VAMC. Consent was waived because the study entailed only a retrospective chart review, and all recorded data were de-identified.

Results

Data were analysed using IBM (Armonk, NY, USA) SPSS versions 19 and 20. The sample ($n = 29$) of veterans had a mean age of 70; most (97%) were men (Table 2). All subjects had at least two comorbid illnesses, as shown in Figure 1.

Table 1 Study variable definitions

Variables	Definitions
Age	Age in years
Gender	Male or female
Total LOS	Number of days in hospital
ICU admission	Whether in ICU at any time during hospital stay
Surgery	Whether had any surgery during hospital stay
Length of surgery	In hours to the nearest half hour
Died	No longer alive at the time of data collection in July to August 2006
Admission Braden	First recorded Braden score during hospital stay
Days before NPU noted	Days between admission and first recording of NPU
Braden when NPU noted	Braden score recorded nearest in time to the first recording of NPU
Lowest Braden	Lowest Braden during hospital stay
Location of NPU #1	Sacrum/coccyx, heel, occiput, scapulae, or other; pertains to NPU identified earlier, if two
Stage when NPU #1 noted	NPUAP-defined stage of NPU #1 as recorded by WOCN
Highest stage of NPU #1	Highest NPUAP-defined stage of NPU #1 as recorded by WOCN
Location of NPU #2	If two NPU, location of NPU identified later
Serum albumin	Mg/dL albumin; value closest in time to the first recording of NPU
Serum prealbumin	Mg/dL prealbumin closest in time to the first recording of PU
Hypotension	Positive if any two systolic blood pressures under 90 mm Hg
Hypoxemia	Positive if any two oxygenation saturation values under 90%
Haematocrit	As recorded by hospital laboratory in %; value closest in time to the first recording of NPU
Vasopressor therapy	Positive if any infusion of dopamine, norepinephrine, phenylephrine, vasopressin or epinephrine
Without nutrition	Positive if 48 hours or more without oral, enteral or parenteral nutrition
Medical diagnoses	As recorded in electronic health record at time of death or discharge

LOS, length of stay.

Table 2 Demographic and clinical characteristics

Variables	Findings
Age	X = 70, SD = 9·5
Gender	Male = 97%
Total LOS	X = 23, R = 3–80
ICU admission	Yes = 69%
Surgery	Yes = 55%
Length of surgery	X = 5·2, SD = 2·8, R = 1–9·5
Died during or since hospitalisation	Yes = 51%
Admission Braden scale score	M = 19, R = 9–23
Number of days hospitalised before NPU noted	M = 4·0, R = 1–20
Braden Scale Score when NPU noted	M = 15, R = 9–21
Lowest Braden	M = 13, R = 8–22
Location of NPU #1	Sacrum/coccyx = 62%, heels = 7%, elbow = 3%, other = 28%
Stage when NPU #1 noted	One = 55%, two = 35%, unstageable/closed = 10%
Location of NPU #2	Sacrum/coccyx = 66%, heels = 34%

LOS, length of stay; NPU, nosocomial pressure ulcers; X, mean; M, median; SD, standard deviation; R, range.

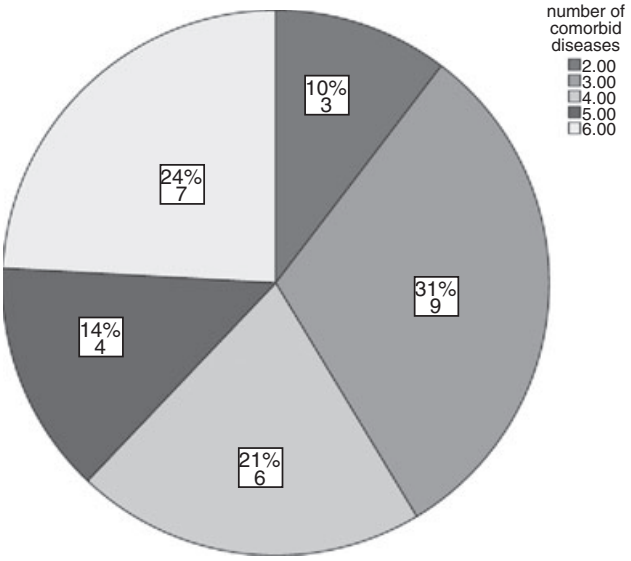

Figure 1 Number of comorbidities in the sample (*N* and percentage).

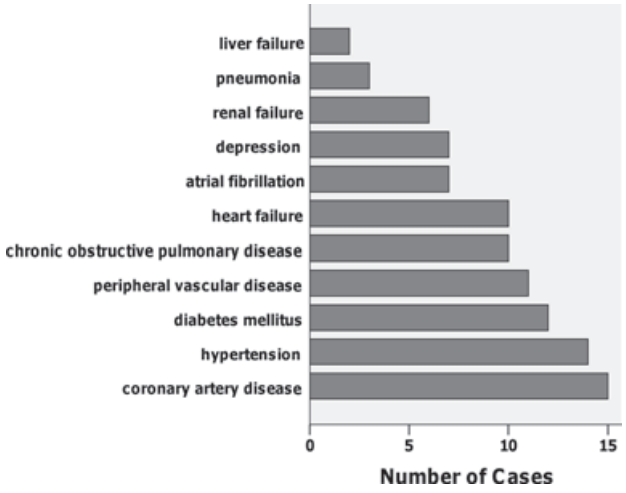

Figure 2 Specific medical diagnoses in the sample.

Ninety percent of the sample had at least three comorbid illnesses. The mean number of comorbidities was 4·1 and the median was 4. Figure 2 shows the number of specific comorbidities in the sample. Serum albumin, prealbumin and haematocrit values were below normal. Serum albumin was subnormal in 20 of 25 subjects (80%) (M = 2·9, SD = 0·7). Serum prealbumin concentrations were available on 13 subjects, and ranged from 4·4 to 28 mg/dL (reference range 18–36 mg/DL). Eight (62%) serum prealbumin values were subnormal. Haematocrit was subnormal in 25 of 29 veterans (86%) (M = 30·6, SD = 6·5).

Certain clinical events possibly associated with NPU occurred in over 30% of the sample. Hypotension occurred in 70%, surgery in 55%, hypoxemia in 41%, lack of nutritional intake in 41% and vasopressor infusion in 30%. More than two thirds of veterans ($N = 20$) were admitted to the ICU during the hospital stay, and ICU LOS (mean = 10·9 days) was nearly as long as ward LOS (mean = 11·9 days). More than half of the patients in the sample had died by the time the data were collected, which took place from 1 to 14 months after the hospital stay in which the NPU occurred.

Thirty-three percent of NPU were documented within 3 days of hospitalisation, 62% within 1 week and 86% within 2 weeks. Fifty-five percent of NPUs were stage 1 and 34·5% were stage 2 when first noted. Median NPU stage at the time of detection was 1, and median highest stage was 2. Three NPUs were documented as closed, but unstageable, with characteristics indicative of deep tissue damage upon detection. Six patients had more than one pressure ulcer.

The sacrum or coccyx was the most common location, followed by heels and elbows. Other NPU locations were the gluteus, scrotum, thoracic spine and earlobe. The type of mattress in use was recorded in only 12 cases; of these, 8 were the hospital's standard foam mattresses.

Non parametric tests were used to determine whether those who had died versus survived and those whose highest PU stage was 2 versus 1 differed with respect to number of comorbid illnesses, serum albumin levels, occurrence of any surgery, length of surgery, length of ICU stay, length of ward stay, overall LOS, whether they went 48 hours or more without nutrition, occurrence of hypoxia, occurrence of hypotension, any use of vasopressors, serum haematocrit, and age. Only older age differentiated those who died from those who did not (Mann-Whitney $U = 50$, exact P value = 0·029), with more aged veterans dying. Only length of surgery differentiated those with stage 2 as the highest stage of PU versus stage 1 (Mann-Whitney $U = 3·5$, exact P value = 0·031), with those who had longer surgeries incurring more stage 1 PU.

Limitations

This study does not compare risk factors in this group with a population norm or to a group of patients without NPUs, nor does it analyse the relative importance of risk factors in NPU development. Because this was a retrospective chart review, the researchers relied on prior documentation and there were some incomplete data. The investigators identified charts to review by referrals made to the WOCNs, so hospitalised veterans with NPUs who did not receive WOCN referrals were excluded. The demographic and clinical characteristics of those with NPU but without WOCN referrals are not known. Although including only patients seen by a WOCN did limit the sample size, the expertise of these certified nurses imparted credibility to the data regarding NPU staging and differentiation of NPU from other types of wounds such as moisture-associated skin damage and incontinence-related dermatitis.

Discussion

In previous studies (24,31), longer LOS was associated with NPU development, but the LOS in those studies was shorter than in this study, which may be indicative of the overall illness severity of the hospitalised veterans who received WOCN consultation. We cannot tell whether LOS increases because of NPU or if illness severity increases both LOS and NPU occurrence. Research into these potential causal relationships would shed light on the pathogenesis of NPU.

The median lowest Braden recorded during each patients' stay (13) was lower than the median on admission (18·5), indicating variability in patient condition over the course of hospitalisation, increasing NPU risk and need for continuous assessment over the course of their stay. The current results were consistent with literature on the Braden in VAMCs (29), showing higher sensitivity with subsequent assessments compared to admission assessments.

Cardiovascular diseases were common in this sample. This group of patients with NPUs had approximately twice the incidence of diabetes (41%) as patients with NPUs from other studies (23·7, 21·5, 19%) (20, 35, 41) and the incidence of hypertension in this sample (48%) was much higher than that in the general population. These rates are, in part, reflective of the veteran population. The hypertension incidence is comparable to that found in the Veterans Health Study (46), which was 49·2% in the 65–91-year-old age group, but the diabetes incidence in this sample remains considerably higher than the 20·3% rate in that study.

Thirty-four percent of the patients in this sample had chronic obstructive pulmonary disease and 41% experienced hypoxic episodes during their stay. Hypoxemia decreases oxygen available to tissues, impairing the tissue's ability to withstand pressure-related ischaemia. Shear may also cause NPUs in patients with respiratory compromise, as these patients often sit upright, a position that contributes to shear forces (30).

More than half of our sample had undergone a surgical procedure. Many studies have shown that surgical patients are at increased risk of NPU (9,23,24,28,48). Reported rates vary widely, however, from 4% to 66% (11,30), likely because length of surgery, operating room support surfaces and patient characteristics vary. Length of time without repositioning on an operating room support surface would lead to the expectation that longer surgeries would be associated with stage 2 versus stage 1 PU, but we found the opposite. This may be related to the differing aetiologies of stage I and stage II PU and the concept that PU do not proceed through the stages in a linear fashion, as hypothesised by some prominent investigators (49).

Severity of illness has been shown to be a NPU indicator in multiple studies. Disease severity indices such as the Apache II (Acute Physiology and Chronic Health Evaluation II) (50), SAPS II (Simplified Acute Physiology Score II) (48), ASA (American Society of Anesthesiology) score and NYHA (New York Heart Association) class have been shown to be NPU predictors (9,21,25,31,33).

These indicators appear more predictive of NPU than medical diagnoses (10,25,32). The high incidence of hypotension, use of vasopressors, and depressed haematocrit and albumin levels in this sample are consistent with the literature. Mean albumin was lower than in previous studies (9,11). The finding that over half of the patients (51·2%) in the current study died within 14 months of developing a NPU is consistent with the literature and lends weight to the argument that NPUs are associated with more serious illness (43,51).

This study shows that caregivers should prioritize skin care early in the hospital stay. Nurses should use PU risk assessment tools throughout the hospital stay, as later assessments may be more predictive than admission assessments. Although validated PU risk assessment scales have widespread support (52), it is also important to consider overall illness severity, treatment variables such as surgery, ICU stay, nutritional status, hypoxemia, hypotension and vasopressor support as well as comorbidities when assessing NPU risk. Skin failure should be considered when clinicians make decisions about palliative versus aggressive care, as it may be a part of the multi-system alterations that occur at end of life.

This sample of acutely ill US veterans experienced many factors associated with NPU that were consistent with published evidence. While expert nursing care is crucial in preventing NPUs in hospitalised people, many other factors must be considered in NPU causation. Clinicians should consider broadening NPU risk evaluation from the Braden and other standard scales to include other cooccurring factors. Including other influences on NPU formation may enhance the validity of NPU risk assessment and encourage earlier use of prevention techniques, reducing NPU incidence. Further research is needed in this and other severely ill populations to determine the effectiveness of such an approach.

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