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Mid-range Braden Subscale Scores are Associated with Increased Risk for Pressure Injury Development among Critical Care Patients

Jenny Alderden, APRN, MN, CCRN, CCNS¹, Mollie Cummins, RN, PhD, FAAN^{1,3}, Ginette Pepper, RN, PhD, FAAN¹, JoAnne Whitney, RN, PhD, FAAN², Andrew Wilson, PhD, MSTAT¹, Ryan Butcher, MS³, Yingying Zhang, MS, MSTAT⁴, and Donna Thomas, BSN, CWOCN⁵

¹University of Utah College of Nursing, 10 2000 E, Salt Lake City, UT 84112

²University of Washington College of Nursing, Box 357266, 1959 NE Pacific St, Seattle, WA, 98195

³University of Utah Center for Clinical and Translational Science, Biomedical Informatics Team, 26 South 2000 E, room 5515, Salt Lake City, Utah 84112

⁴University of Utah Center Study Design and Biostatistics Center, Department of Internal Medicine, Division of Epidemiology, 295 S. Chipeta Way, Salt Lake City, Utah 84112

⁵University Hospital, 50 N. Medical Drive, Salt Lake City, UT 84132

Abstract

Purpose—The purpose of the current study was to examine the relationship between pressure injury development and Braden Scale for Pressure Sore Risk subscale scores in a surgical ICU population, and to ascertain whether the risk represented by the subscale scores is different between older versus younger patients.

Methods—We identified a cohort of 6377 surgical ICU patients via electronic health record data to determine Braden Scale total and subscale scores, age, and incidence of pressure injury development. We used survival analysis to determine the hazards of developing a pressure injury associated with each subscale of the Braden Scale, with the lowest risk category as a reference. In addition, we used time-dependent Cox regression with natural cubic splines to model the interaction between age and Braden Scale scores and subscale scores in pressure injury risk.

Results—Of the 6377 ICU patients, 214 (4%) developed a pressure injury (Stages 2–4, deep tissue injury, or unstageable) and 516 (8%) developed a hospital-acquired pressure injury of any stage. With the exception of the friction and shear subscales, regardless of age, individuals with scores in the intermediate risk levels had the highest likelihood of developing pressure injury.

Conclusion—The relationship between age, Braden Scale subscale scores, and pressure injury development varied among subscales. Maximal preventive efforts should be extended to include individuals with intermediate Braden Scale subscale scores, and age should be considered along with the subscale scores as a factor in care planning.

Introduction

Hospital-acquired pressure injuries occur in 3% to 24% of acutely ill patients in the United States; they are associated with longer hospitalization stays, increased morbidity, and human suffering.^{1–3} Among hospitalized older adults, pressure injuries are twice as common among individuals who are admitted to the intensive care unit (ICU), which is particularly concerning because older age is a risk factor for both ICU admission and slower healing of pressure injuries.^{4,5}

In the United States, pressure injury risk has historically been ascertained using the Braden Scale for Predicting Pressure Sore Risk (Braden Scale) score.⁶ The Braden Scale is the sum of six subscales and was developed to be used for planning effective pressure injury prevention interventions; however, the use of a cumulative score to ascertain pressure injury risk is controversial. A recent systematic review found that formal pressure injury risk-assessment tools with associated intervention protocols were no more effective in preventing pressure injuries than usual care.⁷ Therefore, some authors propose that Braden Scale subscale scores, rather than the cumulative score, should be the focus of pressure injury prevention efforts.⁸ Studies detailing pressure injury risk associated with Braden Scale subscale scores among critical-care patients are limited, however.⁹ Moreover, although older age is a risk factor for pressure injury development in the critical-care population, no studies have examined pressure injury risk associated with Braden Scale subscale scores in older people specifically.^{3,10,11}

The purpose of the Braden Scale is to help clinicians plan effective pressure injury prevention interventions. The scale is comprised of 6 items (subscales): sensory perception, moisture, activity, mobility, nutrition, and friction/shear. Cumulative scores range from 6 (highest risk) to 23 (lowest risk). Evidence concerning pressure injury development based on cumulative Braden Scale score is mixed (Table 1). While the cumulative Braden Scale score identifies most critical-care patients who go on to develop a pressure injury (high sensitivity), cumulative scores classify most critical-care patients as “at risk” for pressure injuries, thus limiting its specificity.⁹

In contrast, few studies have examined Braden Scale subscale scores in critical-care patients. Cox⁹ conducted a systematic review of the literature and concluded that more information was needed. Among studies that examined Braden subscale scores, four subscales (friction and shear, moisture, mobility, and sensory perception) demonstrated some predictive value on multivariate analysis, whereas two (nutrition and activity) did not.^{9,10,12,22,23} However, a major methodological limitation noted by Cox¹⁰ was lack of a repeated-measures approach. Subscale scores were obtained from a single point in time (e.g., admission) or were averaged in some way, failing to reflect the dynamic nature of critical-care patients’ physiologic status.

In an effort to analyze the risk represented by the various Braden subscales, Gadd⁸ reviewed medical records of 20 patients with hospital-acquired pressure injuries, and concluded that some injuries might have been avoided if preventive interventions based on Braden Scale subscale scores were implemented. Additional research is needed to confirm these findings

and to identify the magnitude of risk represented by the various subscale scores. The purpose of this study was to identify pressure injury risk associated with the Braden Scale cumulative and subscale scores in critical-care patients, and to determine whether the risk represented by subscale scores is different between older and younger patients.

Methods

Working with a biomedical informatics team, we queried an enterprise data warehouse for electronic health record (EHR) data matching our sampling criteria and variables of interest. We refined the query and the data using an iterative approach entailing data validation procedures and iterative review by domain experts, data stewards, and the biomedical informatics team. We validated the data extracted from the EHR by manually comparing the values and date/time stamps found in the extracted data to those displayed in the human-readable system views for 60 cases. On implementing the fully developed query for all manually validated cases, we found consistent values and date/time stamps.

The sample comprised patients admitted to the ICU at an academic medical center in the Western United States (Utah) and Level 1 trauma center between January 1, 2008 and May 1, 2013. The main inclusion criterion was admission to out adult surgical ICU or cardiovascular ICU, either directly or following an acute-care stay. We included individuals younger than age 18 years who were admitted to the adult ICU in an effort to study the Braden Scale as it was actually used among all patients in the adult surgical ICUs. We excluded patients with pressure injuries present on admission to the ICU due to concern about misattribution of community-acquired pressure injuries as hospital-acquired pressure injuries. Study procedures were reviewed and approved by the University of Utah Institutional Review Board #00068783.

Outcome Measures

During the time period encompassed by the study, it was standard practice for nurses in the ICU to conduct a head-to-toe skin assessment and record Braden Scale scores at least once during each 12-hour shift (twice per day). The nurses received annual training on the Braden Scale and pressure injury identification. We averaged the Braden Scale score for each shift to derive a once-daily value. The primary outcome variable was a hospital-acquired Stage 2–4 pressure injury, deep tissue injury (DTI), or unstageable injury. The secondary outcome variable was a hospital-acquired pressure injury of any stage (1–4, DTI, or unstageable). We did not include Stage 1 pressure injuries in the primary analysis due to concern about the difficulty in differentiating between transient redness caused by friction or dermatitis versus true tissue injury²⁴; however, we did include Stage 1 injuries in a separate secondary analysis in an effort to capture the full spectrum of tissue injury.

Data Analysis

We used time-dependent survival analysis to determine the hazards of developing a pressure injury based on the cumulative Braden Scale and each subscale score. We chose time-varying Cox regression to take into account all Braden Scale measurements, assuming that the hazard of developing a pressure injury changes in synchrony with the Braden Scale

changes. For each subscale and for the total Braden Scale score, the lowest risk category represented the reference. In addition, we used time-dependent Cox regression with natural cubic splines to model the association of developing a pressure injury with age, by the total Braden Scale score and also by each Braden subscale category. We performed the analysis using statistical software STATA 13 and the statistical significance level was defined at $\alpha = 0.05$.

Results

The query produced 7218 records. We omitted 841 records due to incomplete patient IDs (examples include a date instead of an ID or single-digit numbers). The final sample comprised 6377 patients admitted to the adult surgical ICU or adult cardiothoracic ICU; their mean age was 54 ± 19 years (mean $\pm$ SD). There were 2403 females (38%) and 3924 males (62%). The majority of the sample was White ($n = 4838$; 78%). Their mean length of hospital stay was 10 ± 12 days (range 1 – 229 days).

Two hundred fourteen individuals (4%) developed Stage 2 or greater pressure injuries and 516 (8%) developed a Stage 1 or greater injury (Table 2). Demographic information for individuals with and without pressure injuries are summarized in Table 3.

Individuals with a cumulative Braden Scale scores between 10 and 12 (indicating high risk for pressure injury development) were 8.4 times (95% confidence interval [CI] 5.7–12.6) more likely to develop a pressure injury compared with people whose Braden Scale score indicated no risk (< 9). Among those in the severe-risk category (total score < 9), the chances of developing a pressure injury were similar to patients in the moderate cumulative Braden score category (13–14); their hazard rate ratios were 5.3 (95% CI 1.6–17.1) and 5.7 (95% CI 3.9–8.3), respectively (Table 4).

Additional analysis revealed that the finding that individuals at a cumulative “high risk” score were more likely to develop a pressure injury than individuals at the “severe risk” level were reflected in findings from the Braden subscale scores, with the exception of the friction/shear subscale (Table 4). The effect was particularly pronounced in the moisture and mobility subscales. People in the “often moist” category were 12.5 times (95% CI 7.8–20.2) as likely as those who were in the “rarely moist” category to develop a pressure injury, while the risk of developing a pressure injury was relatively lower in the more severe “constantly moist” category (hazard rate ratio [HRR] = 6.8, 95% CI 2.2–21.5). Similarly, individuals with “very limited” mobility were 7.7 times as likely (95% CI 4.9–12.1) to develop a pressure injury compared to patients without mobility limitations, whereas those who were deemed “completely immobile” were only 4.9 times as likely (95% CI 2.7–8.8) to develop a pressure injury compared to individuals without mobility limitations.

Risk of Pressure Injury: All Stages

Analysis based on inclusion of all pressure injuries (including Stage 1) were similar to the results for Stages 2–4, DTI, and unstageable injuries described above (Table 5). Individuals with a cumulative Braden Scale score between 10 and 12 (high risk) were 6.7 times (95% CI 4.8–9.4) more likely to develop a pressure injury compared with people whose Braden Scale

score indicated no risk (19). Among those in the severe risk category (total score 9), the chances of developing a pressure injury were similar to patients in the moderate cumulative Braden score category (13–14), with hazard rate ratios of 4.6 (95% CI 1.7–12.7) and 4.8 (95% CI 3.6–6.6), respectively (Table 4).

The finding that individuals with a cumulative high-risk score were more likely to experience pressure injury development than individuals at the severe-risk level is also reflected in the results for the various subscale scores, with the exception of the friction/shear subscale (Table 5). The effect was particularly pronounced in the moisture, activity, and mobility subscales. People in the “often moist” category were 8.8 times (95% CI 5.7–13.6) as likely as those who were in the “rarely moist” category to develop a pressure injury, while the risk of developing a pressure injury was relatively lower in the more severe “constantly moist” category (HRR = 4.2, 95% CI 1.4–13.2). People whose activity fell in the mid-range severity level of “chairfast” were 7.2 times (95% CI 4.0–13.0) more likely to develop a pressure injury, whereas those who were bedfast were at relatively lower risk, with an HRR of 4.5 (95% CI 2.5–8.0). Similarly, individuals with “very limited” mobility were 5.7 times as likely (95% CI 4.0–8.0) to develop a pressure injury compared to patients without mobility limitations, whereas those who were deemed “completely immobile” were 4.2 times as likely (95% CI 2.6–6.7) to develop a pressure injury compared to individuals without mobility limitations.

Age and Braden Scale Score

Tables 4 and 5 identify the hazards of developing a pressure injury of Stage 2 and greater and Stage 1 and greater, respectively, associated with the Braden Scale categories for the total population and also for individuals who are older or younger than 65 years. However, the relationship between the Braden Scale subscale score and age was not linear in some subscales. Therefore, in an effort to fully represent the age dimension, we used time-dependent Cox regression with natural cubic splines to model the association of developing a Stage 2 or greater pressure injury with age. Analysis indicated that individuals in the high- and severe-risk cumulative Braden Scale categories experienced increases in risk for pressure injury development with advancing age, whereas the effect of age within the moderate and mild risk categories was relatively static (Figure 1). The relationship between the sensory perception subscale, age, and pressure injury risk was linear, with increased risk at younger ages, and the increased risk among younger people was particularly pronounced in the “very limited” sensory perception group (Figure 2). Moisture was associated with increased risk for pressure injury among older individuals who were often moist, as opposed to older individuals in the occasionally or constantly moist categories, while younger people who were often moist did not experience increased risk relative to those who were either occasionally or constantly moist (Figure 3).

Pressure injury risk associated with activity was also more pronounced among older people, particularly among those who were in the “walks occasionally” category (Figure 4), whereas altered mobility (very limited mobility or completely immobile) conferred the most risk among younger people (Figure 5). The nutrition subscale showed increased rates of pressure injury development among older people, but not younger people, who had “very poor”

nutrition status (Figure 6). Finally, a friction and shear score of “problem” was associated with dramatically increased risk for pressure injury compared to a score of “potential problem” or “no apparent problem” at all ages (Figure 7).

Discussion

We evaluated the effects of cumulative Braden Scale scores and subscale scores in pressure injury development in an adult ICU and found that individuals with cumulative and subscale scores in the intermediate risk levels had the highest likelihood of developing a pressure injury among all subscale categories except the friction and shear subscale, according to which patients with the most severe score were at markedly increased risk for pressure injury development. We also found that the risk associated with the subscales varied with age.

A major strength of this study was the use of a large data set incorporating repeated measures of Braden Scale scores that therefore reflects the variability in an individual’s risk status throughout his or her ICU stay. Although other studies have examined Braden subscale scores, those studies that relied on a single assessment (e.g., admission Braden score), a mean measure, or cross-sectional approaches did not take into consideration the dynamic nature of a patient’s physiologic status in the ICU.⁹

The finding that, with the exception of the friction/shear subscale, individuals with scores in the intermediate risk levels had the highest likelihood of developing a pressure injury, was unexpected. We speculate that nurses identified patients at most severe risk and applied maximal preventive measures, which effectively prevented some pressure injuries from occurring among individuals in the highest risk categories, whereas patients with moderate risk scores may not have received the same level of preventive interventions those with highest cumulative risk scores. The lack of information about preventive measures, however, is an important limitation. Although we speculate that high-risk Braden subscale scores cued the nurses and healthcare team to apply maximal preventive interventions for high-risk patients, it is also possible that another, unrecorded, factor contributes to higher risk of pressure injury development among mid-range patients.

The interaction between age and Braden Scale scores and subscale scores, particularly the activity, moisture, sensory perception, and nutrition subscales, added an important dimension that should be considered as a factor in care planning. Older people with mid-range-severity activity scores (“walks occasionally”) were at markedly increased risk for pressure injury development compared with younger people with the same score (Figure 4). The results suggest that nurses should implement maximal preventive measures for older people with even mildly limited activity (“walks occasionally” vs. “walks frequently”).

Moisture was associated with increased risk for pressure injury among older people who were often moist, as opposed to older people in the occasionally or constantly moist categories, while younger people who were often moist did not experience increased risk relative to those who were either occasionally or constantly moist (Figure 3). It is likely that even moderate or episodic occasions of moisture are particularly harmful to older people’s

skin due to age-related changes in tissue resilience²⁵; therefore, clinicians caring for older people in the ICU should be especially diligent in moisture management.

The sensory perception subscale showed increased risk for pressure injury development in younger critically ill patients (Figure 2). Sensory perception is operationalized in the Braden Scale based on an individual's responsiveness and ability to feel pain or discomfort, and has been implicated as an important factor for pressure injury development among trauma and orthopedic patients.²⁶ Although exact numbers are not available, trauma patients make up a larger proportion of younger patients as opposed to older patients at our study site, a Level 1 trauma center. Trauma patients are more likely than others to present with conditions that alter sensory perception, such as head or spinal cord injuries. It is possible, therefore, that the increased risk associated with altered sensory perception among younger people is associated with the effects of traumatic injury in that age group.

Older people with poor nutrition had higher rates of pressure injury development, whereas younger people with equal nutrition were not at increased risk for pressure injury development (Figure 6). Although prior studies conducted among critical-care patients did not reveal an association between pressure injury development and nutrition status, it is possible that age moderates the relationship due to decreased physiologic reserves among older people.^{3,10,18}

Unlike the cumulative score and the other subscales, results for the friction and shear subscale showed markedly increased risk among individuals of all ages with the most severe subscale rating ("problem"). Experts note that friction-induced skin injuries are not true pressure injuries; in contrast, shearing forces cause a decrease in regional blood flow and therefore are important in pressure injury etiology.^{27,28} Prior studies documented the harmful effects of shear among critical-care patients. Cox¹⁰ noted that critical-care patients with a friction and shear score of "problem" were more than five times (95% CI 1.423–22.95) as likely to develop pressure injuries compared to the rest of her sample. Thus, measures to prevent or ameliorate shearing forces, including lifts, should be prioritized for all critical-care patients at risk for shear.²⁹

Conclusions

We found that patients with cumulative Braden Scale scores and subscale scores in the intermediate risk levels had the highest likelihood of developing a pressure injury among all subscale categories except the friction and shear subscale. We postulate that high-risk Braden subscale scores cued the nurses and healthcare team to apply maximal preventive interventions for the patients at highest risk, and propose that in light of our results, maximal preventive interventions should be extended to patients with mid-range risk scores. We also found that the risk associated with the subscales varied with age, indicating that age should be considered along with the subscale scores as a factor in care planning. We advocate additional research that evaluates the effects of treatment measures related to Braden Scale scores and subscale scores.

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Figure 1.
Total Braden Scale

Figure 2.
Sensory Perception Braden Subscale

Moisture Braden Subscale

Figure 3.
Moisture Braden Subscale

Figure 4.
Activity Braden Subscale

Figure 5.
Mobility Braden Subscale

Figure 6.
Nutrition Braden Subscale

Figure 7.
Friction and Shear Braden Subscale

Table 1

Braden Scale Predictive Validity

Study	Sample	Design	Pressure Injury Incidence and Stages	Findings
Jiricka et al, 1995 ¹²	85 intensive care unit (ICU) patients in the United States	Prospective	56% (Stages 1–4)	Braden Scale at cutoff point 11: Sensitivity 75% Specificity 64% Positive predictive value 73.5% Negative predictive value 66.7%
Lee et al, 2003 ¹³	112 ICU patients in Korea	Prospective	31.3% (Stages 1–4)	Braden Scale: Sensitivity 97% Specificity 26% Positive predictive value 37% Negative predictive value 95%
Pender and Frazier, 2005 ¹⁴	40 mechanically ventilated ICU patients in the United States	Prospective record review	20% (Stages 1–4)	No relationship identified between Braden score and pressure injury (PI) development
Feuchtinger et al, 2007 ¹⁵	53 surgical ICU patients in Germany	Prospective	49% (Stages 1–4; all but one injury were Stage 1)	Braden Scale at cutoff point 11: Sensitivity 31% Specificity 100% Positive predictive value 100% Negative predictive value 41%
Fernandes and Caliri, 2008 ¹⁶	48 ICU patients in Brazil	Prospective	48% (Stages 1–4)	Bivariate results showed individuals who developed PIs had lower Braden Scale scores ($p = 0.0–01$) No multivariate results reported
Kim et al, 2009 ¹⁷	219 surgical ICU patients in Korea	Prospective	18.3% (Stages 1–4)	Braden Scale at cutoff point 14: Sensitivity 92.5% Specificity 69.8% Positive predictive value 40.6% Negative predictive value 97.6%
Kaitani et al, 2010 ¹⁸	98 ICU/high-care unit patients in Japan	Prospective	11.2% (Stages 1–4)	Individuals in the “moderate risk” Braden score group (13–14) had greater PI incidence than those in the “high risk” group (<12)
Cho and Noh, 2010 ¹⁹	715 ICU patients in Korea	Retrospective	5.9% (Stages 1–4)	Note: The Braden Scale was administered to only 11% of ICU patients, for reasons that are unclear. Braden Scale at cutoff point 13: Sensitivity 75.9% Specificity 47.3% Positive predictive value 18.1% Negative predictive value 92.8%
Slowikowski and Funk, 2010 ³	369 ICU patients in the United States	Prospective	23.9% (stages not reported)	The Braden Scale was significant on multivariate logistic regression; odds ratio 1.3
Iranmanesh et al, 2011 ²⁰	82 trauma ICU patients in Iran	Prospective	13.4% (stages not reported)	Bivariate results showed that individuals who developed PI had lower Braden Scale scores ($p < 0.05$) No multivariate results reported
Cox, 2011 ¹⁰	347 medical–surgical ICU patients in the United States	Retrospective	18.7% (Stages 1–4, DTI, and unstageable)	Braden Scale at cutoff point 18: Sensitivity 100% Specificity 7% Positive predictive value 20% Negative predictive value 100%
Tschannen et al, 2012 ²¹	3,225 surgical ICU and intermediate-care patients in the United States	Retrospective	12% (Stages 1–4, DTI, and unstageable)	The admission Braden Scale was significant upon multivariate logistic regression analysis; odds ratio 0.89

Note. PI = pressure injury; DTI = deep tissue injury.

Table 2

Pressure Injury Stages

Stage	Stage 1 or Above	Stage 2 or Above
Stage 1	259 (50%)	N/A
Stage 2	214 (41.5%)	214 (83%)
Stage 3	13 (2.5%)	13 (5%)
Stage 4	4 (0.8%)	4 (1.5%)
Deep tissue injury	8 (1.5%)	8 (3.1%)
Unstageable	18 (3.5%)	18 (7%)

Table 3

Demographics

Variable	Total Population	Stage 1 or Above		Stage 2 or Above	
		Intact Skin	PI	Intact Skin	PI
Age [mean (std, minimum–maximum, years)]	54 (19), 12–100	53 (19), 12–100	59 (17), 14–96	53 (19), 12–100	59 (16), 19–96
No. available (No. missing)	6317(60)	5842(19)	475(41)	6061(59)	256(1)
Gender					
Male [<i>n</i> (%)]	3,924 (62%)	3,626 (62%)	293 (62%)	3,723 (62%)	201 (63%)
Female [<i>n</i> (%)]	2,403 (38%)	2,216 (38%)	182 (38%)	2,286 (38%)	117 (37%)
No. available (No. missing)	6317(60)	5842(19)	475(41)	6061(59)	256(1)
Race					
White [<i>n</i> (%)]	4,838 (78%)	4,455 (77%)	375 (80%)	4,601 (78%)	237 (76%)
Non-White [<i>n</i> (%)]	1,395 (22%)	1,300 (23%)	94 (20%)	1,320 (22%)	75 (24%)
No. available (No. missing)	6224(153)	5755(106)	469(47)	5972(148)	256(1)
Length of stay ^a [mean (std), days]	10 (12), 1–229	9 (9), 1–224	27 (24), 1–229	9 (9), 1–224	30 (27), 1–229
No. available (No. missing)	6317(60)	5842(19)	469(47)	6061(59)	256(1)

Note. PI = pressure injury/-ies; std = standard deviation; No. = number of cases.

^aPartial days are included as a day if > 12 hours.

Table 4

Hazards of Developing a Stage 2–4, Deep Tissue Injury, or Unstageable Pressure Injury

Braden Scale/Subscale Category	Hazard Rate Ratio (95% CI), <i>p</i> Value		
	Total ICU Population	Age > 65 Years	Age ≤ 65 Years
Total Braden Scale (ref = no risk, total score = 19)			
Mild risk (total score 15–18)	2.2 (1.6, 3.2), <i>p</i> <0.001	1.7 (1.0, 2.8), <i>p</i> = 0.053	2.4 (1.5, 3.7), <i>p</i> <0.001
Moderate risk (total score 13–14)	5.7 (3.9, 8.3), <i>p</i> <0.001	4.1 (2.4, 7.2), <i>p</i> <0.001	6.1 (3.9, 9.8), <i>p</i> <0.001
High risk (total score 10–12)	8.4 (5.7, 12.6), <i>p</i> <0.001	4.1 (2.1, 8.3), <i>p</i> <0.001	10.4 (6.5, 16.6), <i>p</i> <0.001
Severe risk (total score = 9)	5.3 (1.6, 17.1), <i>p</i> = 0.005	(Too few cases)	2.1 (0.3, 15.1), <i>p</i> = 0.480
Sensory Perception (ref = no impairment, score = 4)			
Slightly limited (score = 3)	2.1 (1.6, 2.7), <i>p</i> <0.001	2.9 (1.4, 3.0), <i>p</i> <0.001	2.1 (1.5, 2.8), <i>p</i> <0.001
Very limited (score = 2)	2.0 (1.4, 2.8), <i>p</i> <0.001	1.3 (0.7, 2.6), <i>p</i> = 0.400	2.3 (1.6, 3.5), <i>p</i> <0.001
Completely limited (score = 1)	1.1 (0.6, 2.1), <i>p</i> = 0.738	0.8 (0.2, 3.1), <i>p</i> = 0.713	1.3 (0.6, 2.7), <i>p</i> = 0.487
Moisture (ref = rarely moist, score = 4)			
Occasionally moist (score = 3)	5.7 (4.5, 7.1), <i>p</i> <0.001	5.8 (3.9, 8.5), <i>p</i> <0.001	5.7 (4.3, 7.6), <i>p</i> <0.001
Often moist (score = 2)	12.5 (7.8, 20.2), <i>p</i> <0.001	45.5 (20.7, 100.3), <i>p</i> <0.001	8.7 (4.6, 16.2), <i>p</i> <0.001
Constantly moist (score = 1)	6.8 (2.2, 21.5), <i>p</i> = 0.001	13.7 (1.9, 98.8), <i>p</i> = 0.010	5.8 (1.4, 23.5), <i>p</i> = 0.014
Activity (ref = walks frequently, score = 4)			
Walks occasionally (score = 3)	3.1 (1.7, 5.9), <i>p</i> <0.001	7.5 (1.8, 31.2), <i>p</i> = 0.005	2.0 (1.0, 4.2), <i>p</i> = 0.060
Chairfast (score = 2)	4.3 (2.3, 8.1), <i>p</i> <0.001	5.7 (1.3, 24.3), <i>p</i> = 0.019	4.1 (2.0, 8.2), <i>p</i> <0.001
Bedfast (score = 1)	3.3 (1.8, 6.0), <i>p</i> <0.001	5.6 (1.4, 22.9), <i>p</i> = 0.017	2.7 (1.4, 5.4), <i>p</i> = 0.004
Mobility (ref = no limitations, score = 4)			
Slightly limited (score = 3)	3.8 (2.4, 6.0), <i>p</i> <0.001	4.0 (1.8, 8.8), <i>p</i> = 0.001	3.6 (2.1, 6.3), <i>p</i> <0.001
Very limited (score = 2)	7.7 (4.9, 12.1), <i>p</i> <0.001	7.2 (3.2, 15.9), <i>p</i> <0.001	7.9 (4.5, 13.6), <i>p</i> <0.001
Completely immobile (score = 1)	4.9 (2.7, 8.8), <i>p</i> <0.001	1.7 (0.4, 8.1), <i>p</i> = 0.511	6.1 (3.1, 12.1), <i>p</i> <0.001
Nutrition (ref = excellent, score = 4)			
Adequate (score = 3)	4.0 (1.7, 9.8), <i>p</i> = 0.002	3.8 (0.9, 15.7), <i>p</i> = 0.060	4.2 (1.3, 13.1), <i>p</i> = 0.015
Probably inadequate (score = 2)	4.4 (1.8, 10.8), <i>p</i> = 0.001	3.8 (0.9, 15.9), <i>p</i> = 0.065	4.8 (1.5, 15.2), <i>p</i> = 0.008
Very poor (score = 1)	4.0 (1.1, 15.0), <i>p</i> = 0.038	3.0 (0.3, 33.5), <i>p</i> = 0.365	4.7 (0.9, 23.1), <i>p</i> = 0.060
Friction and Shear (ref = no apparent problem, score = 3)			
Potential problem (score = 2)	5.2 (4.0, 6.7), <i>p</i> <0.001	3.5 (2.3, 5.4), <i>p</i> <0.001	6.2 (4.5, 8.6), <i>p</i> <0.001
Problem (score = 1)	454.6 (30.8, 67.4), <i>p</i> <0.001	31.7 (16.4, 61.4), <i>p</i> <0.001	55.0 (33.7, 89.6), <i>p</i> <0.001

Note. CI = confidence interval; ICU = intensive care unit; ref = reference.

Table 5

Hazards of Developing a Stage 1–4, Deep Tissue Injury, or Unstageable Pressure Injury

Braden Scale/Subscale Category	Hazard Rate Ratio (95% CI), <i>p</i> Value		
	Total ICU Population	Age > 65 Years	Age ≤ 65 Years
Total Braden Scale (ref = no risk, total score = 19)			
Mild risk (total score 15–18)	2.6 (2.0, 3.4), <i>p</i> <0.001	2.2 (1.4, 3.4), <i>p</i> <0.001	2.8 (2.0, 4.1), <i>p</i> <0.001
Moderate risk (total score 13–14)	4.8 (3.6, 6.6), <i>p</i> <0.001	4.1 (2.5, 6.6), <i>p</i> <0.001	5.3 (3.6, 7.9), <i>p</i> <0.001
High risk (total score 10–12)	6.7 (4.8, 9.4), <i>p</i> <0.001	4.1 (2.2, 7.4), <i>p</i> <0.001	8.4 (5.6, 12.7), <i>p</i> <0.001
Severe risk (total score = 9)	4.6 (1.7, 12.7), <i>p</i> = 0.003	(Too few cases)	2.8 (0.7, 11.7), <i>p</i> = 0.151
Sensory Perception (ref = no impairment, score = 4)			
Slightly limited (score = 3)	1.7 (1.4, 2.1), <i>p</i> <0.001	1.5 (1.1, 2.1), <i>p</i> = 0.014	1.9 (1.5, 2.4), <i>p</i> <0.001
Very limited (score = 2)	1.7 (1.3, 2.3), <i>p</i> <0.001	1.0 (0.5, 1.7), <i>p</i> = 0.866	2.2 (1.6, 3.1), <i>p</i> <0.001
Completely limited (score = 1)	1.1 (0.7, 1.8), <i>p</i> = 0.736	1.1 (0.4, 2.6), <i>p</i> = 0.883	1.1 (0.6, 2.1), <i>p</i> = 0.656
Moisture (ref = rarely moist, score = 4)			
Occasionally moist (score = 3)	5.0 (4.1, 6.0), <i>p</i> <0.001	4.5 (3.3, 6.2), <i>p</i> <0.001	5.3 (4.2, 6.6), <i>p</i> <0.001
Often moist (score = 2)	8.8 (5.7, 13.6), <i>p</i> <0.001	26.3 (12.8, 54.2), <i>p</i> <0.001	6.5 (3.7, 11.5), <i>p</i> <0.001
Constantly moist (score = 1)	4.2 (1.4, 13.2), <i>p</i> = 0.013	7.6 (1.1, 54.7), <i>p</i> = 0.043	3.8 (0.9, 15.2), <i>p</i> = 0.063
Activity (ref = walks frequently, score = 4)			
Walks occasionally (score = 3)	4.6 (2.5, 8.3), <i>p</i> <0.001	7.9 (2.5, 25.3), <i>p</i> <0.001	3.3 (1.6, 6.7), <i>p</i> = 0.001
Chairfast (score = 2)	7.2 (4.0, 13.0), <i>p</i> <0.001	8.0 (2.5, 25.9), <i>p</i> = 0.001	6.9 (3.5, 13.8), <i>p</i> <0.001
Bedfast (score = 1)	4.5 (2.5, 8.0), <i>p</i> <0.001	5.6 (1.8, 17.6), <i>p</i> = 0.004	4.1 (2.1, 7.9), <i>p</i> <0.001
Mobility (ref = no limitations, score = 4)			
Slightly limited (score = 3)	3.5 (2.5, 5.0), <i>p</i> <0.001	3.3 (1.9, 5.8), <i>p</i> <0.001	3.6 (2.3, 5.5), <i>p</i> <0.001
Very limited (score = 2)	5.7 (4.0, 8.0), <i>p</i> <0.001	4.7 (2.6, 8.4), <i>p</i> <0.001	6.1 (4.0, 9.5), <i>p</i> <0.001
Completely immobile (score = 1)	4.2 (2.6, 6.7), <i>p</i> <0.001	3.3 (1.4, 7.9), <i>p</i> = 0.007	4.7 (2.7, 8.2), <i>p</i> <0.001
Nutrition (ref = excellent, score = 4)			
Adequate (score = 3)	3.1 (1.6, 5.8), <i>p</i> <0.001	1.9 (0.8, 4.3), <i>p</i> = 0.124	4.8 (1.8, 13.0), <i>p</i> = 0.002
Probably inadequate (score = 2)	3.4 (1.8, 6.5), <i>p</i> <0.001	2.1 (0.9, 5.0), <i>p</i> = 0.074	5.3 (2.0, 14.5), <i>p</i> < 0.001
Very poor (score = 1)	3.0 (1.1, 8.4), <i>p</i> = 0.031	1.9 (0.4, 9.6), <i>p</i> = 0.419	4.8 (1.2, 19.2), <i>p</i> = 0.027
Friction and Shear (ref = no apparent problem, score = 3)			
Potential problem (score = 2)	4.7 (3.8, 5.7), <i>p</i> <0.001	4.1 (2.9, 5.7), <i>p</i> <0.001	4.9 (3.8, 6.3), <i>p</i> <0.001
Problem (score = 1)	27.6 (19.1, 39.7), <i>p</i> <0.001	22.5 (12.2, 41.5), <i>p</i> <0.001	30.3 (19.2, 47.6), <i>p</i> <0.001

Note. CI = confidence interval; ICU – intensive care unit; ref = reference.