

RESEARCH ARTICLE

PRESSURE ULCER PREVENTION IN ACUTE CARE USING THE PRESSURE ULCER BUNDLE OF CARE



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Abstract

A study was conducted to determine the effectiveness of the pressure ulcer bundle of care (PUB) in preventing pressure ulcers among patients in acute care. The pre and post-test quasi-experimental design was utilized to predict a model of preventing pressure ulcer in acute care setting. Thirty acute care patients with moderate risk for pressure ulcers were randomly selected to receive the following five PUB interventions: assessment of pressure ulcer risk, repositioning, head elevation, heel elevation, and frequent diet monitoring. Pressure ulcer risk was assessed using the Braden risk assessment scale before and after PUB interventions. This scale assesses important aspects of ulcer formation according to six subscales: sensory perception, moisture, mobility, physical activity, nutrition, and friction/shear. Profile of the patients according to age, sex, and length of hospital stay was described using frequency and percentage distribution. Bundle compliance, as measured by performance of the five interventions was described using mean scores and standard deviations. The t-test was used to determine the differences in pressure ulcer risk or occurrence between pre- and post-intervention phases. Multiple linear regression analysis was used to

determine the relationship of Pressure Ulcer Risk Assessment Scores (PURAS) to the PUB, and to identify the predictor(s) of PURAS among the four interventions in the PUB. Statistical significance was considered at the .05 level. Pressure ulcer risk scores of patients improved significantly from "mild risk" to "not at risk" post-PUB ($p < 0.001$). Head elevation, heel elevation, and diet monitoring were found to be predictors of pressure ulcer risk scores after PUB interventions. Repositioning was not significantly associated with pressure ulcer risk scores of patients after PUB interventions. The three predictor model revealed the PUB interventions were able to account for 52% of the variance in pressure ulcer risk scores, which indicates a strong significant relationship between patients receiving PUB and their improvement in pressure ulcer risk. In conclusion, the pressure ulcer bundle of care intervention is effective in prevention of pressure ulcers in patients at risk. Nurses should adopt the provision of bundle of care intervention(s) to enhance patient safety and quality of care.

Key words: Bundle of care, Pressure ulcer, Prevention, Acute care

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Introduction

Bundle of care is the most common term used in the group of nursing intervention given to patients requiring care. The bundle of care has continuously become famous in providing quality patient care around the world. Evidenced based researches proved the effectiveness of the bundle of care. A bundle of care is a grouping of evidence-based practices that individually improve care, but when applied together, result in substantially greater improvement (Institute for Healthcare Improvement, 2012). Pressure ulcers are socio-economic and affects health of patients that has an important financial impact, with its prevention being less costly than its treatment. Pressure ulcer treatment ranks third among the most expensive health treatments, less expensive only than cancer treatment and heart surgery (IHI, 2012) Pressure ulcers (PUs) are serious and costly complication for many individuals with reduced mobility and sensation. Clinical observations and research have demonstrated staggering costs and human suffering because of PUs, including profound negative effect on general physical effect, socialization, financial status, body image and level of independence and control. The International Pressure Ulcer Prevalence Study from 2006 to 2009 demonstrated a change in PUs prevalence in the U.S. healthcare facility population. Overall, PUs prevalence was slightly lower in 2009 than in 2006. Pressure ulcers is reasonably preventable condition; it was assumed that pressure ulcers would generally not develop on patients receiving care according to current evidence guidelines. Unfortunately, although international guidelines for pressure ulcer prevention recommended a wide range of measures, the evidence for the effectiveness of many of these measures is fairly weak.

The European Pressure Ulcer Advisory Panel (EPUAP) and National Pressure Ulcer Advisory Panel (NPUAP) created guidelines that summarized evidence-based guidelines on pressure ulcer prevention and treatment. The goal of the international collaboration was to develop evidence-based recommendations for the

prevention and treatment of pressure ulcers. The clinical guideline evidences showed weak evidences in the international and the national clinical guidelines. A systematic review was conducted to determine effectiveness of repositioning in preventing pressure ulcers. The study results revealed that there were limited evidences that suggest repositioning was effective in preventing pressure ulcers (Henzel et al, 2011). There were also studies conducted to predict validity and effectiveness of the Braden risk assessment scale and other assessment scale to predict pressure ulcers. Braden scale in clinical practice was highlighted as a very useful instrument to predict pressure ulcer development or occurrence. The use of this instrument permitted knowledge on patients' individual risks and the early establishment of preventive nursing actions in line with this risks (Latini, et al. 2011). The Pressure Ulcer Bundle (PUB) of care is considered effective at preventing pressure ulcers based on studies by Gray-Siracusak and Schrier (2012), Baldelli and Paciella (2008), and Gibbons, Shanks, Kleinhelter, and Jones (2006). Each nursing intervention was believed to contribute to the prevention of pressure ulcer.

However, the results of the studies indicated that health science do not yet have evidence for the efficacy of pressure ulcer bundle of care in preventing pressure ulcers. Further investigation and consideration of current Evidence-Based Practice (EBP) is vitally important in the development and implementation of prevention, treatment and rehabilitation strategies for PUs. Although international guidelines for pressure ulcer prevention recommend a wide range of measures, the evidence for the effectiveness of many of these measures is scarce.

To ensure that the measures recommended by international clinical guidelines lead to reduction in pressure ulcers in the national setting, it is critical to confirm if the pressure ulcer bundle of care measures is effective and implemented. Confirming the effectiveness of pressure ulcer bundle of care five interventions are appropriate in

preventing pressure ulcers. In this premise, it is necessary to conduct investigation. The study aimed to determine the effectiveness of the pressure ulcer bundle of care in preventing pressure ulcers among patients in acute care setting. The results of the study will suggest model to prevention of pressure ulcer in acute care setting.

Study Framework:

The study framework (Figure 1) utilized the five PUB interventions: assessment for pressure ulcer risk scores, repositioning, head and heel elevation, and frequent diet monitoring in pressure ulcer prevention. Utilizing pre and post research design

the effectiveness of the PUB intervention was determined. Patient with "mild risk" to pressure ulcer was subjected to the five interventions to determine the effectiveness of the bundle of care or each of the nursing intervention to the prevention of pressure ulcer.

Method

Research Design

The study utilized the pre and post quasi-experimental research design to determine the effectiveness of the Pressure Ulcer Bundle (PUB) of care and predicts a model of preventing pressure ulcer in acute care setting.

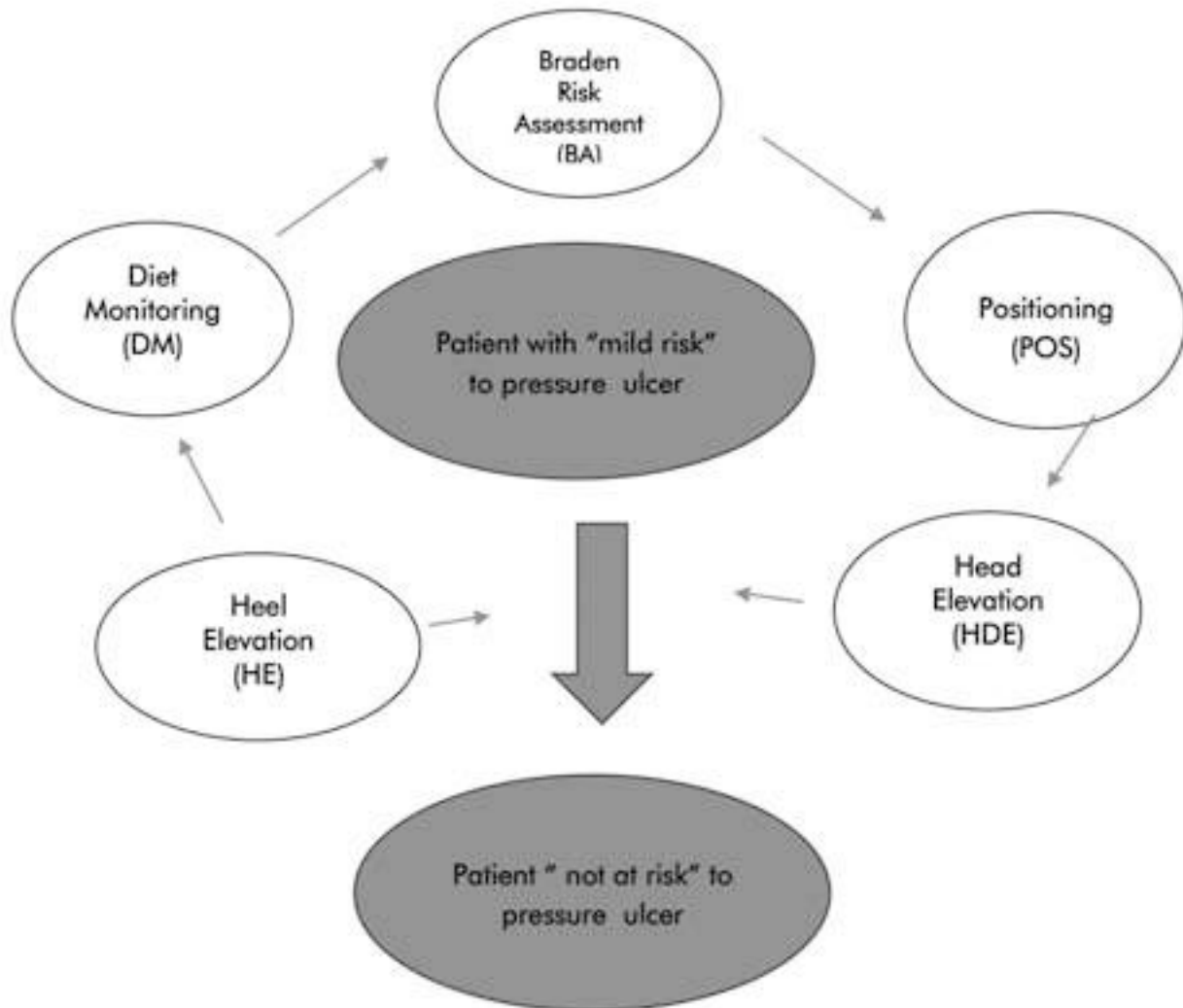


Figure 1. Pressure Ulcer Prevention Using the Pressure Ulcer Bundle of care

Participants

Thirty acute care patients confined in the Medicine ward of the Quirino Memorial Medical Center was randomly selected and consented to participate in the study. Selection criteria in the study were patients with debilitating disease, who were bed-bound (impaired mobility), and had been hospitalized for a minimum of 5–10 days. These 30 patients had no pressure ulcers at the time of first assessment, but were all considered to be “mild risk” for pressure ulcer development based upon their Braden risk assessment score at admission.

Ethical Clearance

Our research study complied with ethical rules for human subject research. The study was reviewed by the Centro Escolar University (CEU) Institutional Review Board (IRB) and Quirino Memorial Medical Center (QMMC) IRB. After receiving approval from both IRBs, medical record review was conducted at QMMC after obtaining written informed consent from the patients selected for study inclusion.

Data Collection

Patients' pressure ulcer risk scores were measured using the Braden risk assessment scale before and after the PUB interventions. The Braden risk assessment scale assesses important aspects of ulcer formation according to the following six parameters or subscales: sensory perception, moisture, mobility, physical activity, nutrition, and friction and shear. Each of these parameters was rated from 1 to 4, except friction and shear, which was rated on a scale of 1 to 3. Thus, the maximum score would be 23, and the minimum would be 6. The Braden risk classification is as follows: mild risk = 15–18; moderate risk = 13–14; high risk = 10–12; and very high risk < 9. Hence, the lower the score is, the more severe the risk for developing a pressure ulcer. The Braden risk assessment scale was adopted from studies by Serpa, Santos, Campanti, and Queros (2011); Cox (2012); and Tescher, Brander, Byrne, and Naessens (2012). The instrument has undergone repeated testing with varying reports of inter-rater reliability (Cowan, Stechmiller, Rowe, & Kairalla, 2012). Cowan et al. (2012) reported Braden Scale inter-rater reliability

with Cronbach's alpha of 0.83 to 0.99, with specificity between 64% and 90% (with cutoff risk scores of 18 or less), and sensitivity ranging from 83% to 100%.

Bundle compliance for repositioning patients was assessed using a positioning checklist (POS), and rated as follows: 5 = very frequent intervals, 4 = frequent intervals, 3 = moderate intervals, 2 = less frequent intervals, and 1 = not at all. Bundle compliance for head and heel elevation were assessed using head elevation (HDE) and heel elevation (HE) checklists, with ratings of: 3 = frequent intervals, 2 = moderate intervals, and 1 = not at all. Bundle compliance for diet monitoring was assessed using a diet monitoring (DM) schedule checklist, with ratings of: 3 = frequent intervals, 2 = moderate intervals, and 1 = not at all. Three experts in nursing practice and education validated the four checklists (POS, HDE, HE, and DM). Cronbach alpha of 0.81 revealed that the four checklist are highly reliable for use in this study.

Procedure

The effectiveness of the PUB was evaluated by implementing five interventions in the pressure ulcer bundle of care. Data from medical record review determined the profile of the patient according to age, sex, and length of hospital stay. Patients were assessed for pressure ulcer risk, repositioned, received head and heel elevation at frequent intervals, and their diet was monitored frequently. Researchers were assigned to assess pressure ulcer risk of study patients. Pressure Ulcer Risk Assessment Scores (PURAS) of patients were obtained before and after PUB interventions; Braden risk assessments (BA) were performed on patients during the PUB intervention. The rest of the bundle of care (repositioning, elevating the head of the bed to 30 degrees, heel elevation, and diet monitoring) was performed by the nurse counterpart assigned to the study patient. The nurse counterparts were Registered Nurses, who participated in the study by performing the nursing interventions in the PUB. These nurses also validated the PURAS obtained by the researchers

by acting as rater B in the performance of pressure ulcer risk assessments. The nurse counterparts visited, performed, and monitored the patient for PUB compliance every day during the patient's hospital stay. The researcher monitored PUB compliance every other day of the patient's hospital stay.

The research study was divided into three phases. In the pre-intervention phase, nurses were oriented to the PUB interventions, screening patients for eligibility, and patient selection using the Braden risk assessment scale following study inclusion criteria. Patient PURAS were measured before the PUB interventions. The mean PURAS obtained by Rater A (researcher) and Rater B (nurse counterpart) was used to describe the PURAS of patients before PUB interventions. Changes from baseline data were used to determine effectiveness of the pressure ulcer bundle of care in preventing pressure ulcers.

In the intervention phase, patients received the five PUB interventions depicted in Figure 2 below followed by detailed descriptions of each.

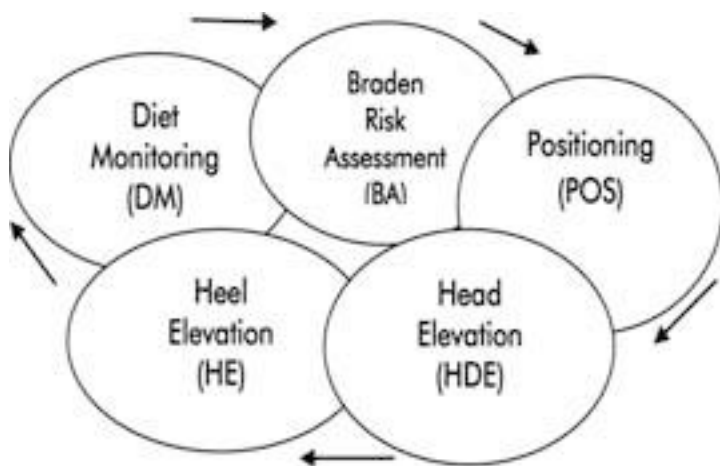


Figure 2. Pressure Ulcer Bundle of Care

Braden risk assessment (BA) denotes monitoring of patients for pressure ulcer using the Braden risk assessment scale. After obtaining baseline risk assessments during the pre-intervention phase, patients were assessed for

pressure ulcers thrice during their hospital stay to determine risk of developing pressure ulcers. The researcher recorded the BA scores and interval frequency in the patient's BA record.

Positioning (POS) involved repositioning bed-bound patients every 2 hours. Nurse counterparts assigned to the care of patients were educated on repositioning techniques that included proper postural alignment, distribution of weight, balance and stability, and pressure redistribution. A written repositioning schedule was posted at the bedside for use as a guide in repositioning schedules. The nurse counterpart documented repositioning frequency and adoption of specific position in the patient's POS checklist. Lifting devices (e.g., trapeze or bed linen) were used to move patients rather than drag them during transfers and position changes. Hospital standards were followed regarding turning of patients (i.e., reposition every 2 hours as follows: 8 a.m.–10 a.m. flat on bed; 10 a.m.–12 p.m. right side; 12 p.m.–2 p.m. flat on bed; 2 p.m.–4 p.m. left side; 4 p.m.–6 p.m. flat on bed; 6 p.m.–8 p.m. right side; 8 p.m.–10 p.m. flat on bed). Nurses assigned to the care of the patient documented repositioning schedule with frequency and position used in the patient's POS checklist.

Head elevation (HDE) denotes elevation of the head of the patient's bed to 30 degrees. Nurse counterparts assigned to the care of patients were educated and performed HDE, and documented HDE frequency in the HDE checklist.

Heel elevation (HE) involved positioning the patient to redistribute pressure. Nurse counterparts assigned to the care of patients were instructed to have patients use a pillow as a footrest when in bed, thereby relieving pressure from the heels. Nurse counterparts documented frequency of HE in the patient's HE checklist. The researcher retrieved records of repositioning from the patient checklists (POS, HDE, and HE).

Diet Monitoring (DM) involved daily monitoring of diet for every patient at risk of pressure ulcers throughout their hospital stay. Nurse counterparts

assigned to the care of patients documented the frequency of diet monitoring in the patient's DM checklist. The researcher retrieved records of DM from the patient's DM checklist.

The post-intervention phase followed the intervention of the pressure ulcer bundle of care. Patient PURAS were measured after PUB interventions. The data were used in comparison with baseline data to determine the effectiveness of the PUB in preventing pressure ulcers. As was done during the pre-intervention phase, both the researcher and nurse counterpart measured PURAS after PUB interventions. The mean PURAS obtained by Rater A (researcher) and Rater B (nurse counterpart) were used to describe the PURAS of patients after PUB interventions. Patient PURAS before and after the PUB intervention were compared.

Internal validity of data was ensured using the following methods: 1) researchers visited patients and nurse counterparts in QMMC every alternate day during the whole duration of the intervention phase; 2) PURAS of patients before and after interventions, including the BA of patients during the PUB intervention, were measured during the patient's hospital stay by the researcher, with validation by the nurse counterpart; 3) mean PURAS of patients were used to present the PURAS before, during, and after PUB intervention by getting the average of the PURAS ; and 4) data captured in the BA record, POS checklist, HDE checklist, HE checklist, and DM checklist were utilized to provide validation of data collection and to ensure that data were recorded during the PUB intervention.

Data Analysis

Statistical Package for Social Science (SPSS) software version 19 was used for data processing and analysis of data. Profile of the patients according to age, sex, and length of hospital stay was described using frequency and percentage distribution. Bundle compliance, as measured by performance of the five interventions (BA, POS, HDE, HE, and DM) was described using mean scores and standard

deviations. The t-test was used to determine the differences in pressure ulcer risk or occurrence between pre- and post-intervention phases. Multiple linear regression analysis was used to determine the relationship of PURAS to the PUB, and to identify the predictor(s) of PURAS among the four interventions in the PUB.

Results

The profile of study patients according to age, sex, and length of hospital stay are displayed in Table 1. The majority of patients was 51–60 years of age, male, and confined to QMMC for 5–10 days.

Table 1. Patient Characteristics (N = 30)

Variables	Frequency	Percentage
AGE		
19 and below	2	6.7
20–30	2	6.7
31–40	7	23.3
41–50	5	16.7
51–60	9	30.0
61–70	2	6.7
71 and above	3	10.0
SEX		
Male	20	66.7
Female	10	33.3
HOSPITAL STAY		
5–10 days	22	73.3
11–15 days	8	26.7

The Bundle of care element compliance is depicted in Table 2. The mean Braden assessment score of patients was 17.34, which is interpreted as mild risk. Patients were repositioned at very frequent intervals, as reflected by the rating of 4.85 out of 5 (POS checklist). The heads of patients' beds were elevated to 30 degrees at frequent intervals (every 8-hour shift or thrice a day), as reflected by the mean rating of 2.67 out of 3 (HDE checklist). Patients' heels were elevated at frequent intervals (every 8-hour shift or thrice a day), as reflected by

the mean rating of 2.66 out of 3 (HE checklist). Patients' diets were monitored at frequent intervals each day, as reflected by a mean rating of 2.67 out of 3 (DM checklist).

a problem in friction and shear (mean, 1.89; scale of 1–3). The resulting PURAS mean was 15.13, which is interpreted as mild risk. After the PUB intervention, study patients had no impairment in sensory perception (4.00 mean; scale of 1–4); occasionally moist skin (mean, 3.83; scale of 1–4); “chair fast” activity (mean, 2.80; scale of 1–4); slightly limited mobility (mean, 3.20; scale of 1–4); adequate nutrition (mean, 3.80; scale of 1–4); and a potential problem in friction and shear (mean, 2.43 ; scale of 1–3). The resulting PURAS mean was 19.90, which is interpreted as not at risk for pressure ulcer development.

Table 1. Patient Characteristics (N = 30)

Variables	Mean ± SD	Verbal
Interpretation		
Braden assessment	17.34 ± 1.78	Mild risk
Positioning frequency	4.85 ± 0.15	Very frequent intervals
Head elevation	2.67 ± 0.88	Frequent Intervals
Heel elevation	2.66 ± 0.29	Frequent Intervals
Diet monitoring	2.67 ± 0.88	Frequent Intervals

Table 3 shows the PURAS of patients before and after intervention. As shown in Table 3, prior to the intervention study patients had slightly limited sensory perception (mean, 3.31; scale of 1–4); very moist skin (mean, 2.79; scale of 1–4); “bed fast” activity (mean, 1.73; scale of 1–4); very limited mobility (mean, 2.80; scale of 1–4); probably inadequate nutrition (mean, 2.35; scale of 1–4); and

observed in all six subscales of the Braden risk assessment scale from pre-intervention to post-intervention. The total Braden score was also significantly higher post-intervention in comparison to pre-intervention (p = 0.010). The five interventions in the pressure ulcer bundle of care were effective as measured by the difference in Braden scores of study patients before and after the intervention.

Table 3. Pressure Ulcer Risk Assessment Scores (PURAS) of Patients

Braden scores	Pre-intervention Mean ± SD	Verbal Interpretation	Post-intervention Mean ± SD	Verbal Interpretation	t value	Sig.
Sensory Perception	3.31 ± 0.82	Slightly limited	4.00 ± 0.00	No Impairment	-4.54	p=0.0010*
Moisture	2.79 ± 1.01	Very Moist	3.83 ± 0.38	Occasionally Moist	-6.43	p=0.0010*
Physical Activity	1.73 ± 0.79	Bed fast	2.80 ± 0.62	Chair fast	-7.15	p=0.0010*
Mobility	2.80 ± 0.71	Very Limited	3.20 ± 0.70	Slightly Limited	-3.89	p=0.0010*
Nutrition	2.35 ± 0.94	Probably Inadequate	3.80 ± 0.48	Adequate	-7.91	p=0.0010*
Friction and shear	1.89 ± 0.50	Problem	2.43 ± 0.49	Potential Problem	-5.67	p=0.0010*
Total	15.13 ± 2.22	Mild Risk	19.90 ± 1.81	Not at Risk	-9.21	p=0.0010*

* Statistical significance was set at p < .05

Table 4. Pressure Ulcer Risk Assessment Scores related to Four Interventions in the Pressure Ulcer Bundle of Care (N = 30)

Variable	Zero-Order r					β	sr^2	b
	DM	HE	HDE	POS	PURAS			
POS					.229	.019	.053	.229
HDE				0.20	.464*	.074*	.215	.464
HE			.986*	.032	.496*	.079*	.246	.496
DM		.986*	1.00*	.020	.464*	.074*	.187	.464
						Intercept=		
						.118		
Mean	2.67	2.66	2.67	4.86	19.9			
SD	.288	.290	.288	.15			$R^2 =$.524*

* $p < .05$

Multiple linear regression analysis was used to develop a model for predicting PURAS of patients from the four PUB interventions (BA, POS, HDE, HE, and DM). Basic descriptive statistics and regression coefficients are shown in Table 4. Three of the four interventions had a significant effect ($p < .05$) in the full model; positioning had no significant effect in the model. The three predictor model was able to account for 52% of the variance in pressure ulcer risk scores of patients after the PUB interventions.

Discussion

Pressure Ulcer Risk Assessment Scores (PURAS)

PURAS of patients improved significantly from mild risk pre-PUB intervention to no risk post-PUB intervention on the Braden risk assessment scale. Braden risk assessment scores are predictive of a patient's pressure ulcer risk before and after intervention with the pressure ulcer bundle of care in this study. As shown in the findings of Serpa et al. (2011), Costa & Caliri (2011) and Satekova & Ziakova (2014), the predictive validity of Braden score for pressure ulcer risk in critical care patients revealed very good accuracy. However, Cox (2012) suggested that just four of the Braden subscales (sensory perception, mobility, moisture, and friction

and shear) were associated with an increased likelihood of pressure ulcer development; whereas, physical activity and nutrition subscales were not found to be predictive. Tescher et al. (2012) expressed that the total Braden score is predictive of pressure ulcer development, but it does not assist the clinician in identifying a target population; however, the use of the subscale scores can enhance prevention programs and resource utilization by focusing care on the risk factors specific to the individual patient. The Braden subscale scores were utilized in our study, but their use was limited to the evaluation of the effectiveness of the PUB in preventing pressure ulcers.

Pressure Ulcer Bundle of Care (PUB)

Patients were assessed for pressure ulcer risk, repositioned, received head and heel elevation at frequent intervals, and their diet was monitored frequently. It is conclusive that patients received the five interventions in the PUB at frequent intervals. It is inferred that three PUB interventions (head elevation, heel elevation, and diet monitoring) were significantly associated ($p = 0.012$) with the prevention of pressure ulcers as revealed by the significantly improved pressure ulcer risk scores after the PUB intervention. In this study, as well as

those cited within this paper, 1) the Braden risk assessment scale was found to be effective at measuring PURAS of patients, and 2) Braden assessments, head and heel elevation, and diet monitoring were effective at improving PURAS and preventing pressure ulcers (Reddy, Gill, & Rothen, 2006; Krapfl & Gray, 2008; Bluestein & Javaheri, 2008). The PURAS was significantly higher after the PUB intervention in comparison to pre-intervention in our study. Head elevation, heel elevation, and diet monitoring were found to be predictive of PURAS after the PUB interventions. The results are consistent with the result of the findings of Kimberly et al (2007), Baldelli & Paciella (2008), Young et al, (2010), Gray-Siracusa et al (2011) Cecile et al (2012), and Carson et al (2012). However head elevation is not found effective in the study of Cong et al (2012) and Estilo et al (2012). Positioning had no significant relationship with PURAS of patients after the PUB interventions. While repositioning is a mainstay in most pressure ulcer prevention protocols, there is insufficient evidence to recommend specific turning regimens for patients (Reddy, et al. 2006, Cecile et al. 2012 and Carson et.al 2012. The three predictor model revealed that the PUB interventions were able to account for 52% of the variance in the pressure ulcer risk assessment scores.

Conclusion

The three PUB interventions that included head elevation, heel elevation, and diet monitoring were effective in preventing pressure ulcers, while repositioning was not found to be effective in preventing pressure ulcers. Nurses should adopt the provision of bundle of care intervention(s) to patients in acute care settings to enhance patient safety and quality of care. Because of study limitations, the results may be applicable only to patients involved in this study. Additional research is needed to investigate the effectiveness of providing groups of nursing interventions (bundles of care) in a larger patient population, in a variety of care settings, using a complete set of evidence-based interventions to prevent pressure ulcers.

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