

Effect of Implementing Nursing Cluster Bundle on Prevention of Pressure Ulcer among Critically Ill Patients

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Abstract

Background: The incidence of pressure ulcers (PU) is significant, with a low compliance rate for PU prevention standard care. Despite the fact that PU are mostly preventable, there is a lack of a Pu nursing cluster bundle based on the best evidence in ICUs. **This study** was aimed to investigate effect of effect of implementing nursing cluster bundle on prevention of pressure ulcer among critically ill patients in trauma intensive care unit. Quasi-experimental research design was carried out to meet the aim of this study. A **purposive sample** included 58 adult patients are taken from trauma intensive care unit in Aswan University Hospital. Three tools were utilized to collect data in this study. **Tool 1**, Comprehensive Skin Assessment Tool; this tool consisted of two main parts: Part one-Socio- demographic and clinical data of the patient Part two- Assessment data of pressure ulcer . **Tool 2, Braden Risk Assessment Scale** to assess the patient's level of risk for developing pressure ulcers. **Tool 3, the nursing cluster pressure ulcer prevention bundle.** **Results:** There were highly statistically significant differences of the skin integrity nursing cluster bundle application among the both patients' groups. Nearly three fourth of the study group (72.4%) reported adequate skin integrity after the nursing cluster bundle application, in contrast to the control group that demonstrated adequate skin integrity among only (13.8%). **Conclusion:** implementing nursing cluster care bundle for preventing pressure ulcer in critical care setting plays a major role in protecting critical ill patients from developing pressure ulcer and prevent complications associated with ulcer. **Recommendation:** deliver in-services educational programs for critical care nursing staff regarding care of high-risk patients for developing pressure ulcer, and to apply more researches regarding this area.

Key words: Nursing, Cluster Bundle, Prevention, Pressure Ulcer, Critically Ill, and patients.

Introduction:

Pressure ulcers (PUs), also identified as a decubitus ulcer, pressure sores and bed ulcer, are local damages of underlying tissue or in the skin that greatest frequently happen over bony prominences and which can occur because of any mixture of compression, shearing forces or friction. Pressure ulcers are most frequently situated on shoulders, hips, heels and tail bone, areas with little protecting tissue or muscle. (García, et al., 2016).

Pressure injuries were significant health problem and one of the greatest challenging issues that face critical care nurses' staff on a frequently basis. Away from the huge cost of management, pressure injuries have an important impact on patient outcome as the length of stay, morbidity, mortality rate, and rise ICU costs and on the health care provider's ability to provide a proper care to patients (Tilmazer, et al., 2019).

Critically ill patients, as one of the most vulnerable populations, are exposed to a high risk of PU due to clinical instability, invasive nature of interventions, limited physical activity, fecal or urinary retention, moisture, edema, ischemia, malnutrition, multiple treatments and increased length of ICU stay which lead to the pressure injury development in critically ill patients (Llaurado, et al., 2018).

A "care bundle" is referred to as a nursing care bundle, a patient care bundle, a prevention bundle, or a nursing cluster bundle. These terms refer interchangeably to the nursing skills of generating a sequence of evidence-based management and care interventions to address incidental or refractory clinical hazards (Zuo, et al., 2015).

Therefore, it is vital to implement pressure ulcer cluster bundle approach in critical care setting for a particular class or individual

patient, each element of the care bundle approach is to group best evidence together, implemented at the same time, and increased emphasis on patient safety and quality of care with the goal of promoting cooperation among different healthcare disciplines and promoting the translation of clinical guidelines to clinical practice. It is usually based on the best evidence and has been shown to benefit the patient's clinical outcome (Lavallée, et al., 2017).

The existing PU care bundle was developed using the most up-to-date evidence and guidelines; these universal guidelines describe PUs, a preventative care bundle for adult ICU patients. Five main factors of PU prevention and treatment are identified in this review: Risk assessment, skin assessment, support surfaces, nutrition, and repositioning are all things that need to be considered. (Haesler, E 2014 & Fabbruzzo-Cota, et al., 2016).

Preventing pressure injuries necessitates a variety of treatment options. Regardless of how skilled they are, health-care workers cannot avoid all pressure injuries on their own. Pressure ulcer prevention, to some extent, necessitates interdisciplinary efforts, such as developing and implementing a care plan that focuses on early detection and prevention, as well as providing appropriate care to such patients. As a result, improving all treatment and addressing these concerns can help to prevent pressure injury and keep other high-risk patients safe. (AHRQ., 2016).

Hence the current study evaluated the effect of implementing nursing cluster bundle on prevention of pressure ulcer among critically ill patients in trauma intensive care unit.

Significance of the study:

A care bundle is an ordered series of treatments that promotes adherence to guidelines aimed at improving care quality. (Zarei, et al., 2019). The intensive care unit (ICU) is a hospital unit that has the highest rate of PU. The worldwide prevalence of PU in ICUs is estimated to be between 3.3 and 39.3 percent. (Habiballah, L. 2018 & Parizi, et al., 2022).

Critical care nurses are in charge of implementing high-quality, safe nursing

interventions in the intensive caancial hardship. A large body of research has accumulated demonstrating that PU prevention is an important part of patient management. (Zuo X., et al., 2015). re unit (ICU). Patients with PUs have a higher risk of morbidity, and death, Therefore; it is necessary to evaluate, the effect of implementing nursing cluster bundle on prevention of pressure ulcer among critically ill patients in trauma intensive care unit.

Aims of the study:

Evaluate the effect of implementing nursing cluster bundle on prevention of pressure ulcer among critically ill patients in trauma intensive care unit.

Subjects and methods:

Research design:

Quasi-experimental research design was carried out to meet the aim of this study.

Research Hypothesis

To fulfill the aim of the study the following research hypothesis were formulated: -

- H1: Implementing nursing cluster bundle recipients will have a lower chance of getting pressure ulcers.
- H2: Nursing cluster bundle recipients will have improved skin status than control group.

Operational definition:

A bundle of care, a patient care bundle, a preventative bundle, or a nursing bundle are all terms that can be used to describe a cluster bundle. The practice of developing a sequence of evidence-based nursing strategies to deal with incidental risks or refractory clinical problems is referred to by these words interchangeably.

Inclusion criteria:

- Aged more than 18 years, both sexes.
- Patients who had a first day of admission in ICU.
- The hospital stay was expected to last at least one week.

Exclusion criteria:

- Patients who were under 18 years.
- Patients transferred in or out hospital.

Setting:

This study was conducted at trauma intensive care unit in Aswan University Hospital from the beginning of January 2020 until the end of June 2021.

Sampling:

A purposive sample included 58 adult critically ill patients taken from trauma ICU for six months.

The total sample was randomly divided into two groups (each group containing 29 patients) using simple random number table (the first patient was selected to perform the innovation skin integrity care bundle (group 1) and the second patient was selected for current routinely trauma ICU only (group 2) and so on.

Tool for data collection:

Three tools were utilized to collect data in this study.

Tool (I): Comprehensive Skin Assessment Tool; this tool consisted of two main parts:

This tool was developed by the researchers based on reviewing of the relevant literature and used to assess the studied patients regard the socio-demographic data and medical related data as base line data, it includes 3 main parts as flowing.

Part one-Socio- demographic and clinical data of the patient

Which include: Patient data as (age& sex). history of current disease, past medical diseases, cause of admission, medical diagnosis and marital status, level of education, hospital lengths of stay and identification for risk factors of pressure ulcer.

Part two- Assessment data of pressure ulcer composed from three item:

A- Evaluate patient's skin for temperature, color, moisture, turgor, and integrity and tissue perfusion.

B- Pressure ulcer Stages. (Edsberg, 2016).

- First “non-bleachable erythema”
- Second “partial thickness of skin loss”
- Third “full thickness of skin loss”
- Fourth “full thickness of skin loss & extensive destruction”

C- **Location of pressure ulcers as** (Scapula, Shoulder, Coccyx, Sacrum, Trochanter, Heel, Other sites)

Tool (II): Braden Risk Assessment Scale; the Braden Scale was developed by **Bergstrom, et al. 1987**. The Braden scale was used to measure the patient's level of risk for developing pressure ulcers. This scale is a totaled rating scale comprising six subscales; sensory perception, skin moisture, activity, mobility, nutrition, and friction/shear. Each subscale is rated numerically; all except one is scored from 1 to 4, in which a score of 4 indicates no problem regarding the specific subscale, and a score of 1 indicates a significant problem. The friction and shear subscale is the only subscale that scored 1 to 3. The scores for each of the subscales are summated to give a total score ranging from 6 to 23; the lower the scores the greater the risk. A total score of 15-18 indicates mild risk, a total score of 13-14 indicates moderate risk, a total score of 10-12 indicates high risk and a total score ≤ 9 indicates very high risk.

Tool III: the nursing cluster pressure ulcer prevention bundle: - This tool was modified from the National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel, and Pan Pacific Pressure Injury **Haesler, 2014**. For the study group's patients, it was used to implement the nursing cluster pressure ulcer prevention bundle. Supporting the body surface, examining the skin, keeping moving and repositioning, incontinence care, nourishment and hydration, and preventive skin care procedures are all part of it.

Methods for Data collection

The study was conducted through three main phases as following.

1- Preparatory phase:

- Official permission from hospital authorities to conduct the study in Aswan university hospital and approval to conduct this study was obtained.
- Informed consent was obtained from the head of the trauma care unit.

Ethical considerations

- The nature and purpose of the study was explained to every patient and to the relatives in case of unconscious patients.
- Patients were assured that the data of this research will not be reused without second permission.
- Confidentiality and anonymity were assured to the patients.
- Patients were assured that they have the right to refuse to participate and/or withdraw from the study without any rational at any time.

A Pilot study:

A pilot study was carried out before starting of data collection to test the applicability and clarity of the study tools on 10% of the sample, those selected patients don't include in the main study sample. It had also provided an estimate of time needed to fill out the tools. The necessary modification was done prior to data collection

Data collection: Data were collected in a period of 6 months starting from the beginning of January 2020 until the end of June 2021.

2- Implementation phase

The studied sample assigned into two groups (study group and control group).

- Data was collected from both groups using tool I to assess sociodemographic characteristics, clinical data, and skin characteristics.
- The researchers excluded patients who were already suffering from pressure ulcers on initial skin assessment.
- **For The control group:** the researchers assessed the patients who were received the routinely ICU nursing care practice for prevention of bed sores. This done from the first day of admission until discharge consequent daily assessment tools sheet was used to observed the general nursing practice for prevention of bed sores daily for one week to determine whether or if implementing the nursing cluster pressure ulcer prevention bundle increases or

decreases patients' risk of developing pressure ulcers.

- **The intervention (study) group:** were received the nursing cluster pressure ulcer prevention bundle. The researcher assessed the patient according to the designed assessment sheet from first day of admission as base line data until discharge.
- Tool II, was utilized daily for one week to assess whether patients' risk for pressure ulcer development increase or decrease with or without implementation of the nursing cluster pressure ulcer prevention bundle.
- The researchers organized all materials that required for the study group which included gentle wash gauze, nonirritant soap, skin moisturizer, a barrier product, air mattresses, small pillows that were applied on high-risk body parts of the skin such as heels and sacrum.
- The patient received the developed nursing preventive measures to prevent high risk patients from skin breakdown, improve patient outcome and to prevent patient complications which include the following intervention

The Following the nursing cluster pressure ulcer prevention bundle. It included 6 key items which repetitive every day for one week:

1. Appropriate pressure redistribution support surface was used.
2. Skin was examined with exclusively emphasis over bony prominences areas.
3. Repositioning and moving was kept through:
 - Every two hours, the patient's position was switched.
 - Every 30 minutes, pressure relieving lifts (leaning to the side, leaning forward, leg lift, and lying down) were performed for 30 seconds.
 - Oriented patient was educated to use manual handling assistances (such as trapeze bar or bed linens to help lift and reposition).
 - Patients were put in a 30° - 40° side-lying or flat position in bed.

- A barrier product was applied for excessive moist skin and a moisturizer was applied for dry skin.
4. Bed linen was kept clean, dry and free from wrinkles.
 5. Patients were evaluated for nutrition deficiency by means of tool I.
 6. Preventive skin care strategies:
 - Avoid perfumes and other constituents that may bother the skin.
 - Don't massage skin that is at risk for pressure sore because it becomes a fragile skin that is easy to be broken.

Evaluation phase:

Throughout this phase the researchers reassessed each patient in the study and control groups using post comprehensive skin assessment sheet and Braden risk assessment scale to estimate the effect of implementing the nursing cluster pressure ulcer prevention bundle, on prevention of pressure ulcer for the study group.

Statistical analysis:

Date entry and data analysis were done using SPSS version 19 (Statistical Package for Social Science). Data was presented as mean and standard deviation. Chi-square and Fisher Exact tests were used to compare qualitative variables. Mann-Whitney test was used to compare quantitative variables in case of non-parametric data. P-value was considered statistically significant at $P < 0.05$.

Results:

Table (1): indicates similarity on all tested socio-demographic characteristics between the two patients' groups (study and control group). insignificant differences to each other in terms of: age, gender, marital status, and level of education. The mean age in the study and control groups was 52.80 ± 14.20 , and 55.65 ± 10.71 , respectively. Regarding gender, more than half of the both study groups were males (study group: 51.7%, control group: 58.6%). In both groups, the highest percent of participants were basic level of education (study group: 31.0% %, control group: 41.4%). While, ICU stay show

significant differences the mean ICU stay in the study group was less than one week (study group: 4.57 ± 1.41 , and control group: 6.44 ± 2.97).

Table (2): provides an overview of the medical assessment of both patient groups. Regarding the risk factors, the significant statistical differences were ($P < 0.05$) detected between the both patients' groups in terms of: immobility, low serum albumin, urinary catheters, malnutrition and hypertension or hypotension while, there were insignificant differences ($P > 0.05$) regarding decreased tissue perfusion, anemia; vasoactive or vasopressors uses; ALC; and DM. In relation the skin characteristics assessment, the insignificant differences were observed toward most of the characteristics as: color ($P = 0.065$); turgor ($P = 0.599$); integrity ($P = 0.162$), perfusion ($P = 0.368$); skin ulcer stage ($P = 0.389$); except for temperature ($P = 0.005$); and moisture ($P = 0.045$). Concerning skin ulcer location, buttock, ischium, and sacrum were the most common ulcer locations among majority of both patients' groups, as there weren't significant differences ($P > 0.05$) between the both groups toward all the ulcer locations, except for heel ulcer ($P = 0.004$).

Table (3): illustrates Braden scale results for predicting pressure sore risk in terms of length of hospital stay. Regarding the 1st hospital day (study group: 11.52 ± 2.47 , control group: 12.21 ± 2.92); 2nd hospital day (study group: 9.97 ± 2.49 , control group: 1.96 ± 0.82); 3rd hospital day (study group: 9.24 ± 3.59 , control group: 12.76 ± 3.49); 4th hospital day (study group: 8.78 ± 3.67 , control group: 12.45 ± 2.90); 5th hospital day (study group: 8.79 ± 2.71 , control group: 11.17 ± 3.46); 6th hospital day (study group: 7.24 ± 2.99 , control group: 10.72 ± 3.36).

By using independent t-test, these differences were detected to be statistically insignificant regarding the first and second days of hospital stay as the following: 1st hospital day ($P = 0.522$); 2nd hospital day ($P = 0.785$). While statistically significant differences regarding the 3rd hospital day ($P = 0.036$); 4th hospital day ($P = 0.042$); 5th hospital day ($P = 0.043$); 6th hospital day ($P = 0.026$).

Figure (1): portrays the comparison of both patients groups regarding the degree of pressure sore risk at 1st and 6th hospital day as predicated by Braden scale. In relation the 1st hospital day, high pressure sore risk was observed the mean and standard deviation 11.52 of the study group, and 12.21 of the control group. In comparing with 6th hospital day, this mean of the high risk was diminished to be

10.72 of the control group, while significantly decreased in the study group with mean 7.24.

Table (4): presents results of skin integrity care bundle application among the both patients' groups. Nearly three fourth of the study group (72.4%) reported adequate skin integrity after the bundle application, in contrast to the control group that demonstrated adequate skin integrity among only (13.8%).

Table (1): Distribution of study sample related to socio-demographic data:

Socio-demographic characteristics	Study group N= (29)		Control group N= (29)		P-value
	No.	%	No.	%	
Age					
18-<35	4	13.7%	1	3.4%	0.340
35-<50	5	17.3%	7	24.1%	
≥50	20	69.0%	21	72.4%	
□±SD	52.80± 14.20		55.65 ± 10.71		
Gender					
Male	15	51.7%	17	58.6%	0.792
Female	14	48.3%	12	41.4%	
Marital status					
Single	3	10.3%	0	0%	0.237
Married	26	89.7%	29	100%	
Level of education					
Illiterate	8	27.6%	8	27.6%	0.066
Basics	9	31.0%	12	41.4%	
Secondary	4	13.8%	8	27.6%	
University	8	27.6%	1	3.4%	
ICU stay					
□±SD	4.75 ± 1.41		6.44 ± 2.97		0.012*

Chi-square test, independent t-test, P Significance * Significant ($p \leq 0.05$)

Table (2): Frequency and Percentage distribution of the studied Patients' Medical Profile among the Study and Control Groups.

	Study group (n= 29)		Control group (n= 29)		P-value
	No.	%	No.	%	
Risk assessment:					
Decreased tissue perfusion	25	86.2	20	69.0	0.115
Immobility	11	37.9	19	65.5	0.036*
Anemia	15	51.7	16	55.2	0.792
Low serum albumin	7	24.1	0	0.0	0.010*
Urinary catheters	19	65.5	27	93.1	0.010*
Vasoactive or vasopressors uses	9	31.0	10	34.5	0.780
Malnutrition	12	41.4	5	17.2	0.043*
HTN or Hypo	21	72.4	10	34.5	0.004*
ALC	7	24.1	10	34.5	0.387
DM	7	24.1	14	48.3	0.056
Skin assessment:					
Temperature:					
Normal	27	93.1	18	62.1	0.005*
Fever	2	6.9	11	37.9	
Color:					
Pink	17	58.6	10	34.5	0.065
Pallor	12	41.4	19	65.5	
Moisture:					
Moist	22	75.9	13	44.8	0.045*
Dry	7	24.1	15	51.7	

	Study group (n= 29)		Control group (n= 29)		P-value
	No.	%	No.	%	
Excessive moist	0	0.0	1	3.4	0.599
Turgor:					
Normal	15	51.7	13	44.8	
Impaired	14	48.3	16	55.2	0.162
Integrity:					
Intact	12	41.4	7	24.1	
Pressure ulcer	17	58.6	22	75.9	0.368
Perfusion:					
Normal	6	20.7	9	31.0	
Decreased	23	79.3	20	69.0	0.3897
Skin ulcer stage:					
Not present	3	10.3	2	6.9	
I	18	62.1	14	48.3	
II	8	27.6	13	44.8	0.237
Skin ulcer location:					
Occiput	0	0.0	3	10.3	
Wrist	2	6.9	2	6.9	
Shoulder	12	41.4	9	31.0	
Sacrum	19	65.5	20	69.0	
Heel	0	0.0	8	27.6	
Elbow	1	3.4	2	6.9	
Ischium	22	75.9	18	62.1	
Buttock	25	86.2	26	89.7	

Chi-square test, *P* Significance * Significant ($p \leq 0.05$)

Table (3): Comparison between the both patients' groups in mean hospital stay regarding to Braden scale for predicting pressure sore risk:

Days/ Variables	Study group (n= 29)		Control group (n= 29)		P-value
	No.	%	No.	%	
1st day/ Mean \pm SD	11.52 \pm 2.47		12.21 \pm 2.92		0.336
Severe risk "<9"	4	13.8	3	10.3	0.522
High risk "10-12"	16	55.2	12	41.4	
Moderate risk "13-14"	7	24.1	9	31.0	
Mild risk "15-18"	2	6.9	5	17.2	
2nd day/ Mean \pm SD	9.97 \pm 2.49		9.41 \pm 3.12		0.460
Severe risk "<9"	8	27.6	7	24.1	0.785
High risk "10-12"	18	62.1	18	62.1	
Moderate risk "13-14"	3	10.3	3	10.3	
Mild risk "15-18"	0	0.0	0	0.0	
No risk	0	0.0	1	3.4	
3rd day/ Mean \pm SD	9.24 \pm 3.59		12.76 \pm 3.49		0.014*
Severe risk "<9"	0	0.0	0	0.0	0.036*
High risk "10-12"	6	20.7	12	41.4	
Moderate risk "13-14"	8	27.6	9	31.0	
Mild risk "15-18"	6	20.7	7	24.1	
No risk	9	31.0	1	3.4	
4th day/ Mean \pm SD	8.78 \pm 3.67		12.45 \pm 2.90		0.026*
Severe risk "<9"	0	0.0	0	0.0	0.042*
High risk "10-12"	3	10.3	7	24.1	
Moderate risk "13-14"	5	17.2	10	34.5	
Mild risk "15-18"	8	27.6	9	31.0	
No risk	11	37.9	3	10.3	
Discharge	2	6.9	0	0.0	0.005*
5th day/ Mean \pm SD	8.79 \pm 2.71		11.17 \pm 3.46		
Severe risk "<9"	0	0.0	0	0.0	
High risk "10-12"	0	0.0	6	20.7	
Moderate risk "13-14"	6	20.7	9	31.0	
Mild risk "15-18"	8	27.6	5	17.2	

Days/ Variables	Study group (n= 29)		Control group (n= 29)		P-value
	No.	%	No.	%	
No risk	10	34.5	4	13.8	
Discharge	5	17.2	5	17.2	
6 th day/ Mean ± SD	7.24 ± 2.99		10.72 ± 3.36		0.003*
Severe risk "<9"	0	0.0	0	0.0	
High risk "10-12"	0	0.0	7	24.1	
Moderate risk "13-14"	3	10.3	5	17.2	0.026*
Mild risk "15-18"	5	17.2	3	10.3	
No risk	9	31.0	3	10.3	
Discharge	12	41.4	11	37.9	

Independent t-test, P Significance * Significant (p≤ 0.05)

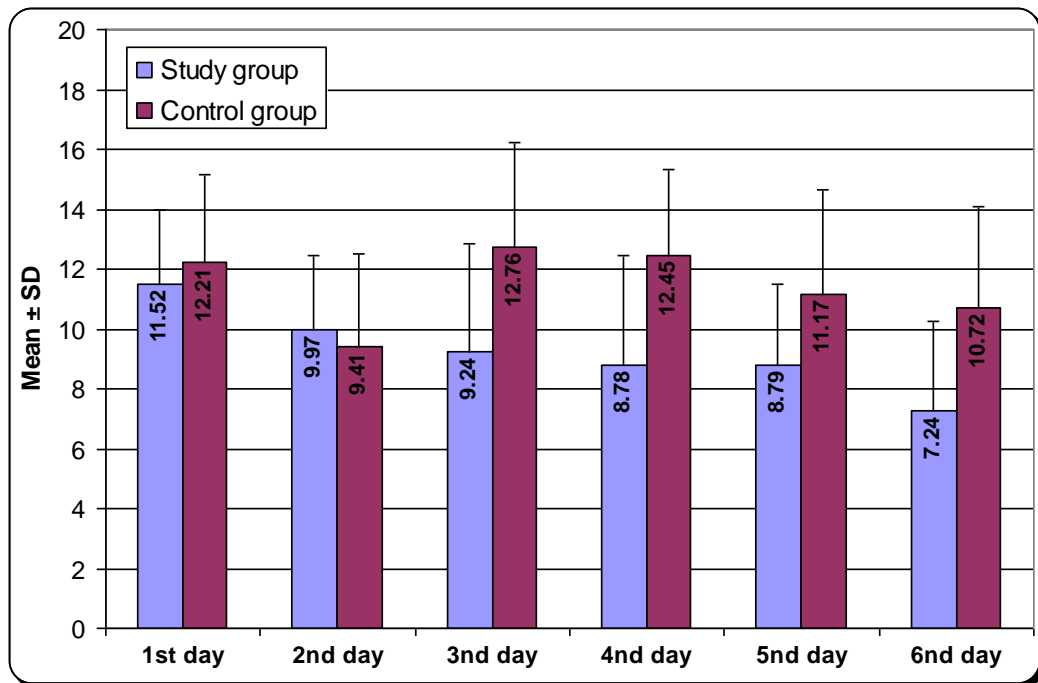


Figure (1): Comparison between the both patients’ groups toward the degree of pressure sore risk at 1st and 6th day as predicated by Braden scale.

Table (4): Comparison between the study and control group regarding to the result of Skin integrity care bundle application.

Skin integrity nursing cluster bundle	Study group N= (29)		Control group N= (29)		P-value
	No.	%	No.	%	
Moderate	25	86.2	8	27.6	0.000*
Adequate	4	13.8	21	72.4	

Chi-square test, P Significance * Significant (p≤ 0.05)

Discussion

This study emphasis was on implementing nursing cluster pressure ulcer bundle care for maintaining skin integrity for ICUs critically ill patients. current data analysis displayed that acutely ill patients in ICUs are

most susceptible to developing PUs. Initial and precise identification of PU risk factors is crucial for prevention. In intensive care units, PUs bundles maintenance with three to seven evidence-based involvements and risk assessment with the Braden scale remained effective in preventing PUs. Advanced quality

evidence is needed to better explore the influence of PUs prevention using nursing cluster care bundles with risk assessments on the outcome critically ill patient (**Lin et al.,2020**).

Pressure ulcer prevention is a quality indicator for the safety strategy and special care provided to critically ill patients. As a result, high-risk patients should have preventative tactics implemented. While assuming between 30 and 50 percent of critically sick patients are at high risk, PUs establishes between 10 and 50 percent of adverse outcomes. (**World Health Organization,2015**). The frequency of PUs in the ICUs among critically ill patients differs from 3,3 and 52,9% worldwide (**Lima et al.,2017**). ICU patients sustain a weakening of their natural perception as a result of the effects of sedation and analgesia which essential for their care. Consequently, continuing and uncomfortable pressure over any area of the body produces inability of these patients to change their position (**Cortés et al.,2021**). PUs likewise causes severe complications with infection, pain, lengthy hospitalization, psychological stress, slow recovery and death.

There are numerous risk factors for PUs in critically ill patients, like as, immobility, poor perfusion, and older age. An epidemiological study showed that the incidence of hospital-acquired pressure ulcers is 0.63% (0.20–1.20%) in China, and acutely ill patients are more expected to develop PUs than general hospital patients. This directs that it is essential to take beset actions to prevent the occurrence of PUs in intensive care units (**Alderden et al.,2017, Kottner et al.,2019**).

The current study shows that patients admitted to the Trauma Intensive Care Unit were at high risk for pressure ulcers, and the most common risk factors were (decreased tissue perfusion, anaemia; use of vasoactive or vasopressors; ALC; and DM), with no statistically significant difference between the study and control groups.

From the researchers' point of view, the current study reflected that frequently monitoring risk factors of pressure ulcer in intensive care unit are shown to be effective in reducing the rate of pressure ulcer as in other prior studies. However, there are several

reasons that may lead to critical ill patients to the risk, such as hemodynamic instability, malnutrition, reduced tissue perfusion, vascular problems, prominent bony eminences, anemia, and uncontrolled diabetes. PUs nursing cluster bundle for high-risk patients should be implemented as a part of nursing intervention in critical care setting.

In spite of a significant reduction in the rate of PUs, the rate of PUs remains high in critically ill patients. This is mainly due to PUs bundle care deviations, longer length of ICU stays, or patients with multiple comorbidities with secondary skin failure, assembly total obliteration of PUs very difficult. Additionally, may relate to ICU nurses' workload as the nurse/patient ratio was 1:2 or 1: 3, and ICU nurses carried all patient care. This in the same line of study carried out by (**Thorpe, 2015**).

This finding agrees with (**Tayyib, 2016**) who was studying the impact of an interventional patient skin integrity care bundle in the critical care unit to best manage skin integrity in acutely ill patients. Her sample constituted 84 critically ill patients were divided on a second daily basis until discharge or death, over a serial 30-day period. The study reported a significant reduction in PUs occurrence in the intervention group (7.14%) compared to the control group (32.86%) Relatively similar results were reported by (**Coyer et al., 2015**) reported that the effectiveness of a bundle in an adult ICU that resulted in 18.1% HAPUs in the intervention group compared with 30.4% in the control group (P = .4).

In addition, the current study illustrate that age, ICU stay, cardiovascular & vascular disease, diabetes, irregular repositioning, mechanically ventilated patients, and lower Braden scale scores were significant factors contributive to PUs occurrence. These results are confirmed with (**Nijs et al.,2009 & Cox, 2010**) who found that patients with cardiovascular and vascular disease were at greater probability of PUs occurrence ($\chi^2 = 6.850, p = 0.009$). On the same view critically, ill patients have a longer length of ICU stay are subsequently at a greater risk for PUs development.

The implementation practices were reliable with what are celebrated in the literature. The main finding of the present study showed that the incidence of PUs decreased among study group compared to control group after carrying out the PUs bundle care. Statistically significant variance was found following PUs bundle care ($p=0.000$).

This result is consistent with findings of the study by **(Tayyib et Al., 2015 & Donovan et al., 2016)**. Also, these findings are congruent with **(Zhang et al., 2021)** who examined the impact of the care bundle on preventing PU, and recognize changes in the compliance rate of nurses to bundle care items at different time (pre and after intervention) and reported that the bundle line is more operative than single methods in ICUs **(Mao & Zhu 2021)**.

From the researchers' point of view, the application of the PUs nursing cluster bundle that includes five elements was applied for critically ill patients Risk Assessment, Skin Assessment, Support Surfaces, Nutrition and Repositioning in the ICU with the goal of encouraging collaboration among different healthcare disciplines and promoting the change of clinical guidelines to clinical practice can be eliminate pressure ulcer.

Regarding Repositioning which is a vital strategy for eliminate PUs to reduce involuntary compression on the skin and advocated in the clinical guidelines and protocols. Reposition patients regularly at least every 2-3 hours; every 30 minutes if the patient is motionless and bedridden. This result is supported by **(Behrendt et al., 2014 & Darvall et al., 2018)** who considered a repositioning schedule containing the turning of patients every 3 hr. and initiate decline in the rate of PUs ($P=.028$) and decrease in the overall number of PUs ($P=.001$)

It is specified in the studies that keep critically ill patients' skin dry and clean are crucial for prevention and management of PUs. Rub on topical creams such as moisturizers to act as a moisture barrier have been shown to be operative in preventing PUs, establishing a barrier, skin safety, preventing skin maceration, epidermal erosion and providing aid after first application, supporting local cell nutrition and tissue restoration. Moreover, for those with

fecal and urinary incontinence, skin checkup should occur once during each shift in the ICUs. These findings are in accordance with **(Oliveira et al., 2019)** who evaluated the scientific production about ICNP nursing interventions for client with pressure injury.

Relevant PUs bundle care focused on support surfaces. However, it is necessary for use pressure reducers products (pillows, wedges, air mattresses and seat cushions) with prominence protection, which can be used to redistributing pressure to either increase the body surface area that arises in contact with the surface. On a daily basis, observe the suitability and functionality of the support surface for critically ill patient to prevent possible complications. In addition, the importance of this item was confirmed by **(Ozyurek & Yavuz, 2015)**

A further successful intervention in the current study is a nutritional supplementation, nutrition acting an essential role in the avoidance and handling of PUs. Macro and micronutrients were required to each organ of the body system in a definite volume to support the maintenance and restoration of body tissues. The nutritional status of critically ill patients should recognize upon admission and activist for the earliest conceivable nutrition supplementation as required. As well, albumin levels as a pointer of malnutrition should be evaluated regularly (weekly or biweekly) for adequacy of nutritional support.

According to the evidence-based PU guidelines mentioned the supply of 30 to 35 kcal/kg weight per day for malnutrition patients **(Al-Dorzi, 2019)**. These findings are in harmony with **(Gage, 2015)** who confirmed that nutrition involvement significantly reduced PUs ($p=0.05$). Also, A recent study by **(Trisnaningtyas et al., 2021)** mentioned that significant association between malnutrition and pressure ulcer development.

Effective PUs bundle care should be routinely arranged for critically ill patients and include a specific focus on prevention. PU bundle care led to a reduction in the number and severity of PUs in all included studies. Evidence-based PUs bundle care should be used to advance critically ill patients' outcomes. Critical care nurses must be well

educated and understand their role in PUs prevention. As a result, a more thorough meta-analysis may be created, as well as a more effective PUs preventive strategy.

Conclusion:

According to the findings of this study, the study concluded that:

The current study presented that the application of nursing cluster care bundle was successful significant reduction in the development of pressure ulcer in the intervention group of critically ill patients. It can be said that implementing nursing cluster care bundle for preventing pressure ulcer plays a major role in protecting patients from developing pressure ulcer and prevent complications associated with ulcer.

Study Limitations

A main limitation in this study, the study includes a small number of cases, which needs to be confirmed by a large sample size.

Recommendations:

Based on the results of the present study, the current study recommended that:

- 1- All critical care setting polices should support the practice of implementing nursing cluster care bundle for prevention of pressure ulcer as a standard of nursing care.
- 2- Deliver in-services educational programs for nursing staff regarding care of high-risk patients for developing pressure ulcer, and to apply more researches regarding this area.

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