Effect of Implementing Care Bundle on Preventing Pressure Ulcers Development among Immobilized Orthopedic Patients

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Abstract

Background: Pressure ulcers are localized injuries of the skin or underlying tissue caused by prolonged pressure, and exposure to shear forces or friction. Patients with pressure ulcers experience significantly increased morbidity, mortality and financial burden. Evidence based researches has indicated that pressure ulcers prevention is an essential component of patient care. As there are some standardized guidelines and protocols could be implemented for pressure ulcers prevention among immobilized patients. **This study aimed to** evaluate the effect of implementing care bundle on preventing pressure ulcers development among immobilized orthopedic patients. **Method**: A quasi experimental research design was utilized by the investigators to conduct this study. A purposeful sample technique was used to carry out this study. The number of the subjects was 80 (40 patients in each intervention and control groups). **Data collection tools:** Two tools were used in this study**: First Tool was; Patient Assessment Tool:** This tool consisted of two parts: P**art I:** Patient's Demographic and Medical Data that was used to assess patient's gender, age, educational level, marital status, occupation, date of admission, medical diagnosis on admission, and length of hospital stay. **Part II: Braden Risk Assessment Scale:** It was used to assess presence of risk factors for developing pressure ulcers. **Second Tool: Observation Checklist for Assessing Pressure Ulcers Preventive Interventions:** This tool was used to observe the nurses interventions regarding nursing care bundle elements and routine nursing care on preventing development of pressure ulcers. **Results:** Stated that, 52.5% of the patients who were cared through implementing care bundle elements did not develop pressure ulcers after four days, however, the majority of the patients who were cared by routine nursing care developed pressure ulcers after four days. **Conclusion:** This study concluded that, implementing care bundle elements had statistically significant effect on reducing development of pressure ulcers among immobilized orthopedic patients. **Recommendation:** This study recommended that implementing care bundle elements is considered as one of the most organized steps of care for immobilized orthopedic patients to prevent development of pressure ulcers.

Key words: care bundle – intervention- pressure ulcers development - immobilized orthopedic patients

Introduction

Pressure ulcers are common health problems amongst immobilized patients that extend to their period of hospitalization. Pressure ulcers start from mild reddening of skin to the damage of tissues and infection spread to muscles and bone, elbow, hip, back of head, heels, toes, shoulders, knees and thighs are body areas which are commonly predisposed to pressure ulcers development ***(Caldini et al., 2017; Mitchell, 2018; Nasira et al., 2020; & Payne, 2020).***

Pressure ulcers are painful and cause discomfort, have a negative effect on quality of life, and are costly to be treated. The incidence and severity of preventing development of pressure ulcers is an important indicator of quality of nursing care; it is essential that healthcare providers monitor prevalence and incidence rates of developing pressure ulcers to ensure that implemented care strategies are effective ***(Richardson et al; 2017).*** Immobilized orthopedic patients who are admitted to the hospital are at increased risk of developing pressure ulcers. They are more susceptible for the development of pressure ulcers due to changes associated with limitation of mobility that increases the fragility of the skin. Knowledge of pressure ulcers risk factors and the proper care strategies that could be implemented are playing

crucial role for preventing pressure ulcers development among immobilized orthopedic patients ***(Chacon et al., 2017; Saleh et al., 2019; & Nadukkandiyil et al., 2021).***

Development of pressure ulcers have serious consequences on the patients such as increases the length of hospital stay from 4 to 30 days, decreases quality of life, and increases pain, morbidity, and mortality. Prevention of pressure ulcers requires interdisciplinary collaboration and approaches, in order to keep the integrity of patients' skin and prevent the complications that could result from it. Prevention begins by identifying high-risk individuals, systematical examination of skin, using several approaches of care support surfaces, changing posture, mobility, and nutritional support ***(Bhattacharya & Mishra, 2015., Dalvand et al., 2018; Turja-Rostedt et al., 2018; & Yousef et al.,2019).***

Each patient has unique characteristics and health conditions, as well as intrinsic and extrinsic factors that might lead to pressure ulcers development. Therefore, when considering all patients risk factors for developing pressure ulcers, nurses must take into consideration each patient's individuality and special needs ***(Zuo & Meng, 2015; & Tayyib et al., 2021).*** In addition, several researches proved that, there are some other significant risk factors and variables that have crucial effect to develop pressure ulcers such as: Immobility which is considered a significant risk factor which leads to developing pressure ulcers ***(Zuo & Meng, 2015; & Jaul et al., 2018).*** Age is another significant risk factor, as advanced age contributes to the risk of pressure ulcers development; this is due to that elderly individuals have less subcutaneous fat, decreased dermal thickness and decreased sensory perception ***(Bhattacharya, & Mishra, 2015; & Hyochol et al., 2016).*** Furthermore, nutrition has been identified as a potential risk factor for pressure ulcers development; patients who are malnourished have more bony prominences, they are at greater risk for pressure ulcers development. Additionally, moisture related factors that include urinary incontinence, fecal incontinence, dual incontinence and urinary catheters. It contributes to soaking of skin, and this might make the damaged epidermal layers more vulnerable to further pressure related degradation ***(Chaboyer et al., 2016; Neloska et al., 2016; & Guzman et al., 2018).***

Pressure ulcers prevention is an essential component of nursing practice, with all patients who are potentially at risk of developing pressure ulcers. Pressure ulcers become a worldwide concern for all care providers, with the cost burden of managing them and its associated complications. Preventive actions should be started immediately after patient admission and for patients who are confirmed at risk for developing pressure ulcers ***(Amir et al., 2017; Mitchell, 2018; & Nadukkandiyil et al., 2021).*** Several health institutions are recommending pressure ulcers prevention care guidelines as (National Institute for Health & Care Excellence: Pressure ulcers, 2014; National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel, & Pan Pacific Pressure Injury Alliance, 2014), one of these recommended guidelines is care bundle, which has the potential to improve patient outcomes when performed collectively and reliably. The Institute for Healthcare Improvement suggests that every eligible patient should receive all of care bundle elements unless is medically contraindicated ***(Lavallée et al., 2019; Mohammed et al., 2018).*** A "care bundle" is also referred as a bundle of care, a patient care bundle, a prevention bundle, or a nursing cluster bundle. A care bundle includes three to five elements that focus on key actions believed to reduce the risk of pressure ulcers development which are; "Surfaces of Skin, Keep Moving, Incontinence, Nutrition and Hydration, and Safe Discharge Planning" (SKINS) ***(Zuo & Meng, 2015).***

Significance of the Study

Development of pressure ulcer among immobilized orthopedic patients is a common health problem with high expectation of occurrence during hospitalization. Several studies revealed that there is noticeable increase in prevalence rates among patients with orthopedic conditions and this indicates that pressure ulcer is one of the most common and major problems among the immobilized patient. Development of pressure ulcers is still remaining a significant health care problem among different immobilized patients especially those who have orthopedic conditions. As there are several adverse health outcomes associated with pressure ulcers development, which affect a patient's quality of life, morbidity, and mortality, once pressure ulcers developed complications such as, infection

with the potential for sepsis and death may occur, development of pressure ulcers can interfere with functional recovery, produce pain and discomfort, result to social isolation, and contribute to excessive length of hospital stay. In addition to all these physical problems, there are financial consequences as well, which are enormous and variable. Annually, 2.5 million patients are treated in acute care facilities from developing pressure ulcers at the cost of an estimated $11 billion per year and rising ***(Marcia, 2013, & Ebi et al., 2019).*** In spite of this, pressure ulcers are still largely a preventable health problem. As there are several guidelines could be used to prevent pressure ulcers development such as care bundle. Since, health team members especially nurses have a primary and significant role in preventing pressure ulcers development, therefore, the current study evaluated the effect of implementing care bundle on preventing pressure ulcers development among immobilized orthopedic patients ***(Roberts et al., 2016; Lavelle et al., 2019; & Taylor et al., 2021)***.

Aim of the study is to:

Evaluate the effect of implementing care bundle on preventing pressure ulcers development among immobilized orthopedic patients.

Research Hypothesis:

To fulfill the aim of this study the following research hypothesis was formulated: immobilized orthopedic patients who would be exposed to nursing care bundle for pressure ulcers would not develop pressure ulcers.

Research Design:

A quasi experimental research design was utilized by the investigators to conduct this study.

Subjects of the Study

To calculate the sample size of the current study, the investigators used the Epi info version 6 to obtain the required sample, with taking into consideration this study is intervention study, and the investigators found that the accurate sample size for 95% confident level is 79 patients, and the sample of this study was 80 participants, 40 patients in each intervention and control groups. With regard to assessment of homogeneity of both groups, the investigators used Kolmogorov – Smironv Test (K-S Test) and the result was ≤ 0.05 which indicated that both groups under the current study were homogenous. The sampling technique which was utilized in this study was a purposeful sample. The inclusion criteria and exclusion criteria of the recruited sample were as follows; adult patients with age ranged from 18 till 60 years, both gender, different educational level, patients recently admitted to the hospital for not more than 24 hours, patients have major orthopedic conditions that would let them stay in the hospital at least between seven and ten days, and patients agreed to participate in this study. Patients were excluded if they had any diseases that may has effect on their skin condition, patients who had cognitive limitations that may affect direct interaction with the investigators, or any terminally ill patients.

Setting

The study was conducted in 8 orthopedic departments of one of the governmental hospitals in Egypt, in each department there was one side for female patients and the other side was for male patients, and the investigators selected this setting as there are many immobilized patients who would have hospital stay for at least 7 days and they would meet the inclusion and exclusion criteria of the study sample.

Data Collection Tools:

Data were collected by using two tools; **First Tool was; Patient Assessment Tool:** This tool consisted of two parts: **Part I:** Patient's Demographic and Medical Data Tool that was used to assess patient's gender, age, educational level, marital status, occupation, date of admission, medical diagnosis on admission, and length of hospital stay. **Part II: Braden Risk Assessment Scale:** This tool adopted from ***Bergstrom et al. (1987) and Moore & Patton (2019),*** it was used for assessing presence of risk factors for developing pressure ulcers; this scale was developed to enhance early identification of patients at risk for developing pressure ulcers. It composed of six subscales that reflect sensory perception, skin moisture, activity, mobility, friction and shear, and nutritional status assessment.

Scoring system: When assessing a patient by using Braden Scale, exposure of the skin to friction and shear forces measured using a three-point scale. While the other five items measured

by using a four point scale. The sum of the total score ranged from 6 to 23. A higher score indicated a lower risk for developing pressure ulcers, and patients classified according to the Braden Scale as follows: very high risk (score <9), high risk (score ranging from 10 to 12), moderate risk (score ranging from 13 to 14), low risk (score ranging from 15 to 18), and no risk (score ranging from 19 to 23).

Second Tool: Patient's Observation Checklist for Assessing for Pressure Ulcers Preventive Interventions: This tool adopted from ***Wilborn and Dassen (2010);*** it was used to observe the implementation of care bundle elements to prevent development of pressure ulcers in the intervention group, as well implementing routine nursing care for immobilized orthopedic patients in the control group. This checklist was grouped into five themes related to pressure ulcers prevention, as follows; risk assessment for developing pressure ulcers, skin inspection and care, positioning and mobilization, nutritional status assessment, and educational instructions. However, the investigators omitted one item that was related to encouraging the patients to move from the bed in order to decrease pressure as this item was not applicable for the participants involved in this study.

Scoring system: Each item was categorized "Done", "Not done" and if the respondent did the intervention would get "1" and if the respondent didn't do the intervention would get "0".

Validity and Reliability of Data Collection Tools:

Validity and reliability are the main components to assess the quality of data collection tools. Validity was done to assess to which degree the tools measured what proposed to be measured. Meanwhile, the reliability was done to identify the accuracy of the obtained data in the research study, it was assessed by using Cronbach's alpha test, and its values were as follows; Braden Scale = 0.97 and observational checklist = 0.89. With regard to this study, validity of the tools was tested by 3 Professors from Medical Surgical Nursing. In addition, they ensured that the tools were assessed all components of the study that justify the study hypothesis and achieved its aim. Moreover, the assessors ensured that the translated version accurately reflecting the meaning before conducting the pilot study.

Pilot Study: It was done by using 10% of the study sample (8 patients) to ensure that the implementation of the study plan and the tools were accurately working. The results of pilot study revealed that, the data collection tools needed some wording modifications and omitting the items that were not applicable. The tools were modified accordingly and patients who participated in the pilot study were excluded from the main study sample.

Ethical Considerations

Approval from the Hospital Director after explaining its aim, data collection tools, implementation plan, and the policy of maintaining the participants' rights throughout the study. Based on the hospital administration request the hospital name was kept. The investigators informed the patients that, they had the right to withdraw from the study at any stage and without giving any reasons and without any harm for them. In addition, the investigators informed them that, the data collection tools were anonymously designed. After all these clarifications, the investigators obtained patient's confirmation that proved that she/he was willing to participate in the study.

Procedure

The current study was carried out on three phases; preparation phase, implementation and evaluation phase.

Preparation Phase: This phase was concerned with arrangement with the hospital to get the approval for data collection process, and this was done through submitting a formal letter used from the Faculty of Nursing to obtain the hospital director approval. After that the investigators checked the patients' diagnosis in the orthopedic departments to make sure that they met the inclusion criteria, and then the investigators met nursing director, supervisors, and staff nurses in the selected departments to explain to all of them the purpose and the nature of the study to gain their assistance whenever needed.

Implementation Phase: Data of the current study were collected over a period of seven months beginning of February 2021 end of

August 2021. The implementation of the current study was done as follows; the investigators arranged with the head nurses in each department involved in this study to inform them by newly admitted patients who met the inclusion criteria maximum within 24 hours from the patient's admission, and this happened through informing them by the allocated admission day for those patients who admitted with major orthopedic conditions, and the investigators confirmed with the head nurse and this was done on a daily base. Accordingly, the investigators went to see each patient in the intervention group in her/his department and explained to each one the aim of the study and data collection tools and obtained their approval to participate in the study, and after that the investigators used tool one for assessing patients' demographic and medical data, and their risk factors for developing pressure ulcers and filling in this tool took 40 minutes to be completed. After that, the investigators started to implement care bundle elements for each patient immediately after confirming that they has risk factors for developing pressure ulcers, and accordingly the investigators informed each patient this care would be done every shift especially in the morning and afternoon shifts, and their assigned nurses would cover night shifts.

With regard to the patients in control group the investigators assessed their demographic and medical data as well assess the presence of any risk factors for developing pressure ulcers by using Braden Assessment Scale and after that the investigators informed the assigned nurses for the patients in the control group, they could start to provide routine nursing care according to the hospital policy.

Evaluation phase: Concerning evaluation of the effect of implementing care bundle elements and routine nursing care on preventing pressure ulcers development, the investigators informed the head nurse and nursing staff in each department that, there would be a daily follow up visit in the morning and afternoon shifts by one of the investigators to assess if the patients in the intervention and control groups developed pressure ulcers or not during the implementation phase and this would continue till the patients discharge, and the same would be done by the assigned nurses for those patients during night shifts for both groups. Assessment for developing pressure ulcers numbers and grades was done by using pressure ulcers grading sheet that contained two items to be filled in related to numbers of pressure ulcers developed and site of development and this sheet took 10 minutes to be filled in.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 18, through using frequencies, percentages, Kolmogorov- Smirnov Test (K-S test) to assess if there is homogeneity between the two groups involved in the study or not, and Chi Square test used as a test for assessing statistical significant relations. The results of the study were reported by using descriptive statistics (frequencies, percentages, bar charts, and means).

Results

Table (1) shows that, 53.8% and 52.5% of the patients in intervention and control groups respectively were males. Concerning age of the patients in intervention group, it ranged between 35 to 65 or more, while in control group, it ranged between 45 and 65 or more with a mean age of 60 ± 6.2, and 60.35 ± 5.21 respectively. The same table reveals that, there was statistical significant relation between the patients in intervention and control groups at P = 0.000.

Figure (1) reveals that, diagnosis of the patients on admission in intervention and control groups who had major orthopedic surgeries was 26.3%, and 50% respectively.

Figure (2) shows that, length of hospital stay of the patients was 42.5%, and 40% in intervention and control groups respectively were ranging between 8-11 days.

Table (2) reveals that, 67.5%, 35%, 67.5%, 67.5%, 45% and 80% of the patients in intervention group their risk factors that might lead to development of pressure ulcers were as follows; complete limitation of sensory perception, constantly moist, complete limited physical activities, completely immobile, having very poor nutrition status, and the reasons that increase friction and shear against skin respectively. With regard to the patients in control group the same table presents that, 2.5%, 10%, 40%, 57.5%, 2.5%, 90% of them had the above mentioned risk factors respectively that might lead to development of pressure ulcers. In

addition, the same table shows that, there was no significant statistical relation between risk factors for developing pressure and intervention and control group at $P \leq 0.05$.

Table (3) shows that, 80%, 95%, 92.5%, 92.5%, and 92.5% of the patients in intervention group were provided by nursing care bundle elements that included; risk assessment for pressure ulcers on patient's admission, skin inspection and care, changing patient position, assessing patient's nutritional status, and provision of educational instructions respectively. Meanwhile, 45%, and 100%, of the patients in control group who were provided only by routine nursing care that included; skin inspection and care and changing position respectively, while, for risk assessment, it was done based on the investigators' recommendations. In addition, the same table shows that, there is no statistical significant relation in both groups regarding nurses' commitment regarding implementing care bundle elements and routine care to prevent pressure ulcers development.

Table (4) states that, 60%, and 92.5% of the patients in intervention and control groups respectively developed pressure ulcers after two days from implementing care bundle elements and routine nursing care. Meanwhile, 47.5% and 95% of the patients in intervention and control groups respectively developed pressure ulcers after four days. Concerning grades of developed pressure ulcers the same table represents that, 5% and 50% of the patients in intervention and control groups respectively developed grade two pressure ulcers after two days from implementing care bundle elements and routine nursing care for each group in the study. With regard to development of grade three of pressure ulcers after four days the same table indicates that 0.0% and 70% of the patients in intervention and control groups developed it respectively. In addition, the same table states that, there is no statistical significant relation in both groups regarding sites and grades of developed pressure ulcers.

Table (5) reveals that, there is no statistical significant relation between patients' demographic data and grades of developed pressure ulcers in intervention and control groups.

Table (6) reveals that, there is no statistical significant relation between patients' demographic data and length of hospital stay in intervention and control groups.

Table (1): Frequency and Percentage Distribution of Demographic Characteristics of the Patients in Intervention and Control Groups (n=40 each)

Items	Intervention group		Control group		Chi Square
	No.	%	No.	%	
Gender					
Male	43	53.8	21	52.5	0.726
Female	37	46.3	19	47.5	
Age (in years)					
35 - < 45	1	2.5	0	0	
45 - < 55	6	15	5	12.5	0.450
55 - < 65	20	50	31	77.5	
65 +	13	32.5	4	10	
	± SD 60 ± 6.2		**± SD 60.35 ± 5.21**		
Educational Level					
Read & write	25	62.5	20	50	0.000*
Intermediate	12	30	8	20	
Above intermediate	3	7.5	12	30	
Occupation					
Self employed	23	57.5	18	45	0.000*
Retired	17	42.5	22	55	
Marital Status					
Married	17	42.5	26	65	0.000*
Widow	23	57.5	14	35	

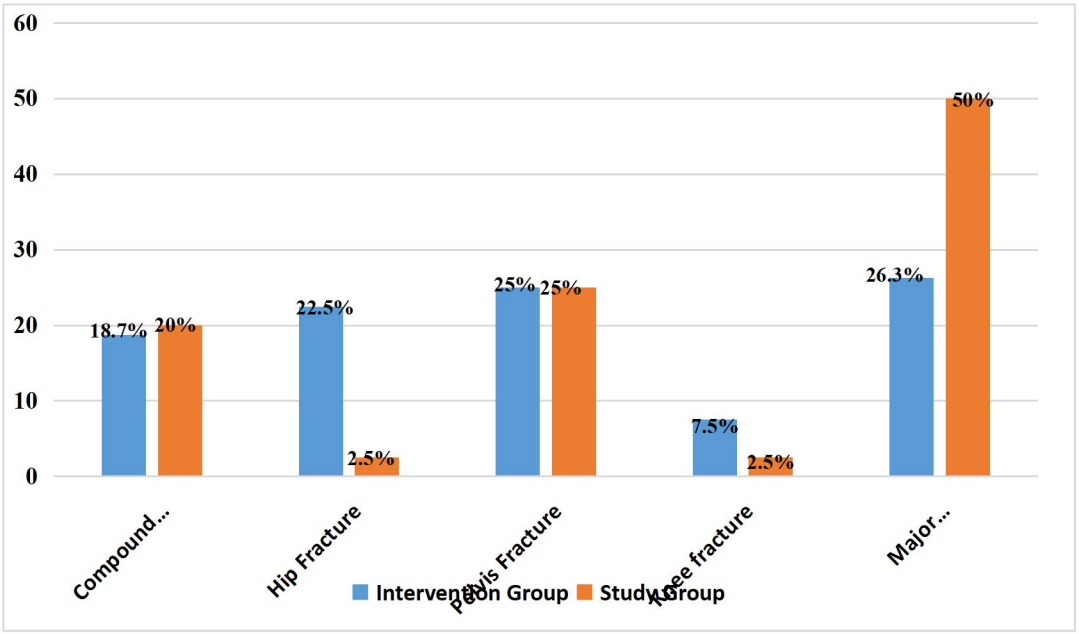

Figure (1): Patients' Diagnosis on Admission in Intervention and Control Groups

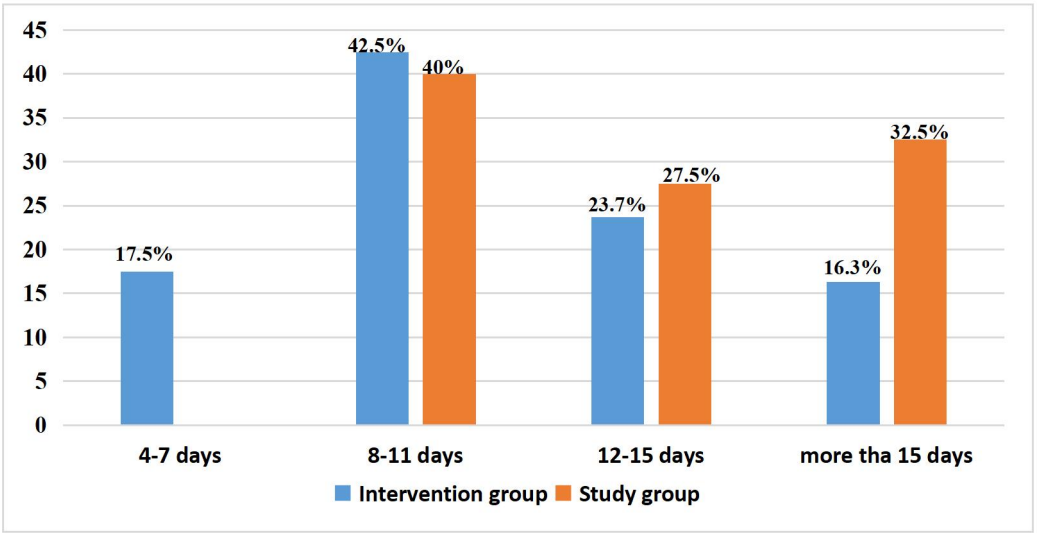

Figure (2): Hospitalization Period for the Patients in Intervention and Control Groups

Table (2): Frequency and Percentage of Pressure Ulcer Risk Factors among the Patients in Intervention and Control Groups (n= 40 each)

Items	Intervention group		Control group		Chi Square
	No.	%	No.	%	
Sensory perception					
Completely limited	27	67.5	1	2.5	0.947
Very limited	4	10	9	22.5	
Slightly limited	3	7.5	1	2.5	
No impairment	6	15	29	72.5	
Moisture					
Constantly moist	14	35	4	10	0.354
Often moist	14	35	13	32.5	
Occasionally moist	7	17.5	18	45	
Rarely moist	5	12.5	5	12.5	
Activity					
Bed ridden	27	67.5	16	40	0.747
Site on a chair most of the time	7	17.5	22	55	
Walks occasionally	6	15	2	5	
Walks frequently	0	0	-	-	
Mobility					
Completely immobile	27	67.5	23	57.5	0.738
Very limited	5	12.5	17	42.5	
Slightly limited	2	5	-	-	
No limitations	6	15	-	-	
Nutrition					
Very poor	18	45	1	2.5	0.373
Probably inadequate	17	42.5	29	72.5	
Adequate	0	0	2	5	
Excellent	5	12.5	8	20	
Friction and shear					
Problem	32	80	36	90	0.238
Potential problem	5	12.5	4	10	
No apparent problem	3	7.5	-	-	

Table (3): Assessment of Nurses' Commitment regarding Implementing Care Bundle Elements and Routine Care for Pressure Ulcer Prevention in Intervention and Control Groups (n=40)

Nursing interventions to be done	Intervention group				Control group				Chi-Square
	Done		Not Done		Done		Not Done		
	No.	%	No.	%	No.	%	No.	%	
Risk assessment	32	80	4	10	27	67.5	13	32.5	0.144
Skin inspection and care	38	95	2	5	18	45	22	55	0.109
Change patient position	37	92.5	3	7.5	40	100	0	0	0
Nutritional status	37	92.5	3	7.5	0	0	40	100	0
Educational instructions	37	92.5	3	7.5	0	0	40	100	0

Table 4: Comparison between Intervention and Control Groups Regarding Site, and Grade of Developed Pressure Ulcers

Items	Intervention group (n= 40)				Control group (n= 40)				Chi-Square
	After 2 days		After 4 days		After 2 days		After 4 days		
	No.	%	No.	%	No.	%	No.	%	
Status of developed pressure ulcers after implementing intervention									
Did not develop pressure ulcers	16	40	21	52.5	3	7.5	2	5	0.95
Developed pressure ulcers	24	60	19	47.5	37	92.5	38	95	0.71
Grade									
Grade I	21	52.5	13	32.5	6	15	5	12.5	0.37
Grade II	2	5	6	15	20	50	5	12.5	
Grade III	-	-	-	-	11	27.5	28	70	
Number of developed pressure ulcers									
1	14	35	11	27.5	17	42.5	18	45	0.64
2	5	12.5	7	17.5	4	10	4	10	
3	5	12.5	1	2.5	16	40	16	40	

Table (5): Relation between Patients' Demographic Data and Pressure Ulcer Grades

Items	Intervention group (n= 40)			Control group (n= 40)			Chi-Square	
	After 4 days			After 4 days			Intervention group (n= 40)	Control group (n= 40)
	0	G1	G2	0	G1	G2		
Gender								
Male	9	8	5	11	7	3	0.181	0.988
Female	12	5	1	10	6	3		
Age (in years)								
35 - < 45	0	1	0	0	1	0		
45 - < 55	5	1	0	5	1	0	0.661	0.651
55 - < 65	9	7	3	11	7	3		
65 +	5	5	3	2	1	1		
Educational Level								
Read & write	14	8	3	11	8	1	0.632	0.349
Intermediate	5	5	2	5	1	2		
Above intermediate	2	0	1	5	4	3		
Occupation								
Self employed	13	8	2	10	7	1	0.430	0.299
Retired	8	5	4	11	6	5		
Marital Status								
Married	10	6	1	15	8	3	0.380	0.594
Widow	11	7	5	6	5	3		

Table (6): Relation between Patients' Demographic Data and (Hospitalization Period).

Items	Intervention group (n= 40)				Control group (n= 40)				Chi-Square	
	Hospitalization Period				Hospitalization Period				Intervention group (n= 40)	Control group (n= 40)
	4-7	8-11	12-15	More than 15	4-7	8-11	12-15	More than 15		
Gender										
Male	7	8	7	0	0	7	7	7	0.138	0.519
Female	8	9	1	0	0	9	4	6		
Age (in years)										
35 - < 45	0	0	1	0	0	2	0	0		
45 - < 55	5	0	1	0	0	2	1	0	0.150	0.205
55 - < 65	9	7	5	0	0	11	7	13		
65 +	0	10	1	0	0	1	3	0		
Educational Level										
Read & write	11	12	2	0	0	10	2	8		0.100
Intermediate	3	3	6	0	0	4	2	2	0.489	
Above intermediate	1	2	0	0	0	2	7	3		
Occupation										
Self employed	10	11	2	0	0	9	2	7	0.301	0.227
Retired	5	6	6	0	0	7	9	6		
Marital Status										
Married	8	8	1	0	0	12	4	10	0.475	0.96
Widow	7	9	7	0	0	4	7	3		

Discussion

Pressure ulcers remain a serious problem in the hospitals, and this is considered as a significant health problem, that is affecting both patients and the health care system. Developed pressure ulcers in the hospitals are hospital acquired problems. Regardless of growing evidence and directives for pressure ulcer prevention, implementation of preventative strategies is suboptimal, and one of these preventive strategies is a care bundle which is considered as the most organized set of interventions that encourages compliance with its elements to prevent pressure ulcers development and improve provision of quality of care.

In the current study, around half percent of the studied patients in intervention and control groups were males. With regard to the age in both the intervention and control groups the patients' mean age were 60 ± 6.2 and 60.35 ± 5.21 respectively. Meanwhile, the current study results

reported that the patients' diagnosis on admission was as follows, less than one third of the patients in intervention group and half percent of the patients in control group was admitted with major orthopedic problems. Concerning the length of hospital stay, the findings of this study reveals that, more than two fifths of the patients in intervention and control groups respectively stayed in the hospital from eight to eleven days.

The present study stated that, slightly more than two thirds of the patients in intervention group had complete limited sensory perception as a risk factor for developing pressure ulcers; meanwhile, the minority of the control group has the same risk factor. Moreover, slightly more than one third of the patients in both groups had another risk factor that might lead to development of pressure ulcers as being most of the time had moisture. Concerning performing activities as one action that could prevent development of pressure ulcers, this study reported that, more than two thirds of the patients in intervention group were not able to perform any activity, while more than one third of the patients in control group had the same risk factor.

All these are considered as significant risk factors for developing pressure ulcers, because all of them lead to poor circulation or irritation in the skin surface that makes the skin very fragile and easily develop pressure ulcers specially if there is no movement and with severe limitation of performing physical activities. This finding is supported by ***Alderden et al. (2017)*** who highlighted that, limited mobility and physical activities lead to pressure injuries, lack of skin perfusion, and shear, friction all these were identified as possible risk factors for pressure ulcers development.

In the present study the majority of the patients in the intervention group were provided nursing care bundle elements as risk assessment, skin inspection and care, changing patient position, nutritional status assessment and educational instructions. However, slightly more than two thirds of the patients in the control group had risk assessment and slightly more than one third of them were provided by skin inspection and care, and all of them changed their position and all of these were done as routine nursing care that did not include provision of nutritional status assessment and educational instructions. This finding was due to that the intervention group was provided by a care bundle elements set that considered as the most organized and approved steps for preventing pressure ulcers development. Meanwhile, for the control group, the nurses might only aware by routine nursing care; therefore, they did not do nutritional assessment status or educational instructions.

These findings are in the same line with ***Lecko (2018), and Getie et al. (2020)***, who stated that nutritional assessment is crucial to maintain good nutritional status as it plays a key role in keeping skin integrity, and poor nutritional status is a risk factor in the development of pressure ulcers. Assessing patients' nutrition status, including their ability to eat and drink, should therefore form part of holistic care in pressure ulcer prevention and management. Moreover, in a very recent study ***Floyd et al. (2021)*** stated that, educational interventions are not only necessary for implementing care bundles but also for improving diagnostic accuracy and reducing misclassifications with pressure ulcers risk assessment. Similarly, educational interventions are essential to reliably identify and classify pressure ulcers to assess the accuracy of clinical definitions and classification systems.

The current study reported that, two fifths of the patients in intervention group did not develop pressure ulcers after two days from implementing care bundle, and after four days around half of them did not develop pressure ulcers. With regard to the control group the majority of them developed pressure ulcers after two and four days from implementing routine nursing care. This might be attributed to that; care bundle includes intervention for elements that might have a significant effect on preventing development of pressure ulcers. These findings are supported by ***Zhang et al. (2021)*** who recently proved that, the use of the care bundle elements reduces the incidence and the number of pressure ulcers as well their severity.

Concerning pressure ulcers grading, this present study stated that, half of the patients in intervention group developed grade one pressure ulcers, while none of them developed grade three pressure ulcers in the first two or even after four days from implementing care bundle. With regard to the patients in control group, the current study reported that, less than three quarter of them

developed grade three pressure ulcers after four days from providing routine nursing care. This might happen because care bundle has several intervention steps that covered interventions for all possible risk factors that might lead to pressure ulcers development, and it is approved that implementing care bundle elements has its evidence based that reduce pressure ulcers. These findings are supported by ***Mao and Zhu (2021),*** who sated that; care bundle could reduce the grade of pressure ulcers, which is beneficial to recovery and rehabilitation. Similarly, ***Tilmazer, and Tuzer (2019***) reported that, care bundle is a set of nursing interventions, each part of which has been proven in clinical practice to improve patient outcomes. In addition, care bundle introduce new nursing concepts and develop targeted nursing interventions that are custom-made to patients with pressure ulcers, which contribute to the improvement of quality of life.

With regard to the number of developed pressure ulcers, this current study results revealed that, slightly more than one third of the patients in intervention group developed one pressure ulcers after two days, while, minorities of them developed two and three ulcers after two and four days. In relation to the number of pressure ulcers developed in the control group, this study finding stated that, an equal percentage of two fifths of them developed three ulcers after two and four days from implementing routine nursing care. This might be due to that the interventions that are done through implementing care bundle elements are handling all the risk factors that may lead to pressure development. These results congruent with ***Mao and Zhu (2021),*** who stated that in a very recent study it was reported that, implementing care bundle elements could improve grading of pressure ulcers, enhance care efficacy and improve patient's quality of life.

With regard to relation between patients' demographic data and grades of developed pressure ulcers and length of hospital stay in intervention and control groups, this study proved that, there is no association between patients' demographic data in both groups and grades of developed pressure ulcers and length of hospital stay. This finding is against ***Gedamu, et al; (2014)*** stated that, as the age of the patient and length of stay in hospital increased the development of pressure ulcer.

Conclusion

The prevention of pressure ulcers is a constant challenge. From the current study results, concluded that, implementing care bundle elements had significant positive effect on reducing development and grading of pressure ulcers.

Recommendations

Based on the results of this study, the following recommendations are suggested:

- Implementing nursing care bundle is considered as one of the best practice that is recommended to prevent pressure ulcers development among all immobilized patients.
- Increasing nurses' awareness of performing nutritional status assessment and educational instructions for the patients who have risk for developing pressure ulcers.
- This study needs to be repeated on a wider scale to include all departments with a larger sample of patients.

Limitations

This study presented some limitations that included the small sample size and the selection of, only one setting. These limitations did not allow the investigators to make generalizations of the results.

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