

Effect of Pressure Ulcer Prevention Program on Nurses' Performance and Orthopedic Patients' Outcomes

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Abstract:

Background: Pressure ulcers in orthopedic patients are a major health concern with greater expectations of their development. It should be monitored in all admitted patients with a high risk for developing it. Orthopedic nursing staff must be aware with procedures required to avoid and minimize its incidence. **Aim of this study:** To evaluate the effect of pressure ulcer prevention program on nurses' performance and orthopedic patients' outcomes. **Method:** Quasi-experimental design was used to carry out the study. Sample of thirty-six nurses and eighty patients were recruited from orthopedic departments at South Valley University Hospital. **Tools:** Four tools included as follow a structured interview questionnaire; nurses' pressure ulcer preventive practices observational checklist, comprehensive skin assessment tool, and Braden Scale were utilized to assemble data. **Results:** The study showed that nurses' knowledge and practices were significantly improved towards pressure ulcer prevention after program implementation when compared to preprogram. Furthermore, there was a statistically significant difference in patient outcomes between the study and control groups ($p < 0.05$). **Conclusion:** The pressure ulcer prevention program has improved both nurses' performance and patients' outcomes. **Recommendation:** Providing continuing educational and training programs for nurses caring of orthopedic patients in order to strengthen their knowledge and practice related prevention of pressure ulcer.

Keywords: Pressure Ulcer, Prevention Program, Nurses' Performance, Patients' Outcome.

Introduction:

Pressure ulcers (PU) are lesions or damages of skin layers or underlying tissue caused by continuous pressure, contact and shear force or a mixture of all, they typically develop above a prominence of bone and can result in tissue death. The effect of pressure-induced skin damage ranges from persistent erythema on undamaged skin to serious ulcers that spreading to the bones. Ulcers represent a major cost on both the patient, and health care system (Munoz, 2021; Nadukkandiyil et al., 2021).

Previous studies have linked the following factors increase risk to the development of a pressure ulcer as immobility, malnutrition, hemodynamic instability, incontinence, spinal cord injury (SCI), fractures

and/or major orthopedic procedure, reduced level of consciousness, advanced age, dehydration, decrease tissue perfusion, and chronic illness including bed rest (De Meyer et al., 2019).

Pressure ulcers are found in all sectors of health care, but are most prevalence in hospitals. However, recent statistics revealed that the prevalence of PU varies depending on the area of care and that patients in critical care units, orthopedic and medical units being at a higher risk of getting pressure ulcers. Immobilized orthopedic patients admitted to the hospital are more prone to developing PU as a result of changes associated with limited movement that enhance the skin's breakdown. (Bereded et al., 2018; Saleh et al., 2019; Beeckman et al., 2021).

Occurrence of PU has a substantial impact on the patients including decreased quality of life, increased length of hospital stays, pain/ discomfort, and mortality rate. Pressure ulcers prevention necessitates collaboration among different disciplines, to preserve integrity of the patient's skin and avoid possible complications. Prevention begins with identification of high-risk patients, through skin assessment, using various measures taking care of surfaces, maintain position change, performing exercise, and maintain nutritional status (Turja-Rostedt et al., 2018; Dalvand et al., 2018; Yousef et al., 2019).

Nurses' practices for PU prevention were unreliable because nurses gave this topic a very low priority level due to their lack knowledge about the severe consequence of PU complications. Pressure ulcer prevention is essential part of nursing practice for all patients who are potential for developing a PU. Pressure ulcers are becoming a global problem for all health care professionals as their treatment is associated with high costs and complications. Protective measures should be initiated promptly as a patient is admitted and those at risk for developing PU (Amir et al., 2017; Mitchell, 2018).

Significance of the study:

Pressure ulcers are a serious health issue that places a significant social and economic impact both nationally and worldwide. Pressure ulcers still one of the biggest health concerns worldwide. For every 1,000,000 patients who develop pressure ulcers, 65,000 die as a result of complications representing a major health burden worldwide (Team et al., 2019).

Although, pressure ulcers are avoidable consequence, it is a large and costly concern for health-care systems. Between 2016 and 2018, hospital acquired complications including pressure ulcer among increased fourfold in hospitalized patients (Özyürek et al., 2016; Al Mutairi et al., 2020). The care management of PU is considered a public health concern that extends in the hospital stay from 4 to 30 days, increases cost and negatively affects the patient's quality of life. Pressure ulcers are

considered to be a result of poor-quality care (Morel et al., 2019 & Gaspar et al., 2019).

Furthermore, complications from pressure ulcers can be fetal and life threatening. Therefore, nurses play a crucial role in assessing of patients' needs, inform the care plan and also delivering standardized care to patients, which means nurses are a desperate situation. There is a need for continuous training to prevent and manage pressure ulcers (Kısacık and Sönmez., 2020). However, PU prevention has long been concerning to nurses and one of their primary responsibilities. It is still difficult for nurses to prevent PU and their prevalence is considered a poor nursing care (Blenman and Marks-Maran 2017). Furthermore, there are scanty research that to evaluate the effect of pressure ulcer prevention program on nurses' performance and orthopedic patients' outcome.

Aim of the study:

This study aimed to evaluate the effect of pressure ulcer prevention program on nurses' performance and orthopedic patients' outcomes.

Research Hypotheses:

H1: Nurses' knowledge and practice scores could be improved post pressure ulcer prevention program implementation compared to pre-program.

H2: Significant statistical differences in patients' outcomes could be found between study group and control group after implementation of the pressure ulcer prevention program.

Operational definition:

In this study, patient outcomes refer to a patient who progressed from a high and very high-risk Braden score (≤ 12) to a low risk Braden score. First-stage PU that progress second-stage or more PU or more are considered the beginning of a pressure ulcer event. Patients who have experienced more than one PU progression (in a distinct anatomical region) after a week.

Subjects and method:**Research design:**

Quasi experimental research design was utilized to conduct this study.

Setting:

This study was performed at the orthopedic departments at South Valley University Hospital in Egypt. Orthopedic departments are located on the "Fifth floor" with each department containing 35 bed which including 16 nurses for the male department and 20 nurses for the female department.

Subjects:

Participating nurses: Convenience sample which composed of all available nurses who were working in the orthopedic departments at the start of the study who accepted to participate in the present study (total nurses = 36).

Participating patients: A purposive sample of 80 bedridden adult orthopedic patients of both sex with ages ranged from 20 to 60 years, and who were hospitalized to previous mentioned health care settings. They were split into two equal groups. The first group consists of 40 patients who received only routine hospital care only (control group). The second group consists of 40 patients who received the nursing care after completing of the pressure ulcer prevention program (study group).

The following were the inclusion criteria for the recruited sample: patients who were recently hospitalized in the first 24 hours, had no pressure ulcers at time of admission, those with major orthopedic injuries that need a longer stay in the orthopedic department, and the patients accepted to takes part in this study. The exclusion criteria: Patients with cognitive impairments were unable to comprehend and cooperate. Also, those with any disorders that may affect on their skin.

The sample size was calculated using data from the literature (**Gaballah and Salah El-Deen, 2021**). Considering a significance

level of 5% and a study power of 80% and using the following formula:

$$n = \frac{(Z\alpha/2 + Z\beta)^2 \times 2(SD)^2}{d^2}$$

Where, SD = standard deviation from the previous study; $Z\alpha/2$, for 5% this is 1.96; $Z\beta$, for 80% this is 0.84 and d, for the expected difference. Therefore:

$$n = \frac{(1.96 + 0.84)^2 \times 2(2.1)^2}{(1.33)^2} = 39.1$$

According to the above formula, the required sample size is 40 in each group

Tools of data collection:

Four data collection tools were used for this study as follows:

Tool (I): Structured interview questionnaire: that was divided into two sections:

Section (1): Demographic characteristics of the studied nurses: It was designed and evaluated by the researchers based on recent relevant literature (**Moore & Patton, 2019**) & (**Ali, 2019**); included age, gender, marital status, clinical experience years, and attending pressure ulcers prevention training courses and educational level (qualifications).

Section (2): Pressure Ulcer Knowledge Test (PUKT): It was adopted from (**Manderlier et al., 2017**) to measure the studied nurses' knowledge of PU. It contains twenty-six multiple choice questions organized into six items: Etiology and development (six questions), observation and classification (five questions), assessment of risk (two questions), nutrition (one question), preventive strategies to decrease the amount of pressure (seven questions), and preventive strategies to decrease the duration of pressure (five questions). There are four answer options for each question, with the fourth option is "I don't know".

Scoring system: It was determined as follows: The total score ranges from 0 to 26. Each question received one score for each correct answer and zero for the wrong and I don't know answer. The total knowledge score was 26 score s. The original tool didn't have a cut-off score for satisfied knowledge, so the researchers converted the overall score into a percentage and chose a mean cut-off score of 80 or more for this questionnaire or more reflecting satisfactory knowledge, depending on a previous research in China (Jiang & Lommel, 2020).

Tool (II): Nurses' pressure ulcer preventive practices observational checklist: It was adopted from (Islam, 2010): This observation checklist includes 22 items that related to pressure sores preventive guidelines. This checklist uses a three-point Likert scoring system, with values 1 to 3 score, 1= (never), 2= (sometimes), and 3= (always). The observational checklist includes factors that contribute to the occurrence of pressure ulcers, assessment of the risk factors, PUs preventive measures such as skin care, as well as adequate nutrition to preserve healthy skin, management of mechanical loads, and instructions provided by nurses to families regarding PUs prevention. A possible response varied from 22 to 66 score. These responses were then converted into a percentage.

Scoring system: It was determined as follows: The overall score was converted into percentage and classified as follow: $\geq 85\%$ deemed competent practice; however, $< 85\%$ deemed incompetent practice.

Tool (III): Comprehensive skin assessment tool:

The researchers designed this tool after reviewing the relevant recent literatures (Patricia et al., 2017; & Linton et al., 2017). It was divided into three sections, as follows:

Section (1): Personal data of the studied patients: It was comprised age, gender, marital status, education level and occupation.

Section (2): Patient clinical data: It was concerned with fracture related data as type of orthopedic injury, type of fracture, treatment

modalities, body mass index (BMI) and activities of daily living.

Section (3): Pressure ulcer assessment: It was adapted from (Edsberg et al., 2016) which was included assessing pressure ulcer characteristics, including presence of pressure ulcers, stages, number of developed pressure ulcers and common sites.

Tool (IV): Braden Risk Assessment Scale: This tool was designed by (Bergstrom et al., 1987). It was used to assess the patients' risk level for developing a pressure ulcer. It is a rating scale containing six categories: Skin moisture, sensory perception, mobility, nutrition, activity and friction/shear. Each subscale was scored from 1 to 4, with a score 4 representing no problem, and a score of 1 representing a substantial problem. Only the friction and shear categories received a score of 1 to 3.

Scoring system: It was calculated as follows: Scores for each category are summed to get overall score between 6 to 23 score. The lower the values the higher risk. An overall score of 15 to18 denotes mild risk, an overall score of 13 to14 denotes moderate risk, an overall of 10 to12 denotes high risk and an overall score ≤ 9 denotes extremely high risk.

Pilot study:

To confirm the applicability and relevance of the study tools, a pilot study was performed with eight patients (10%) of all patients and four nurses (10%) of all nurses in the orthopedic departments, to estimate the time required to complete the study tools and to recognize any probable barriers that may interfere collection of data. The created tools were modified according to the results. Patients and nurses who took part in the pilot study weren't included in the entire study.

Content validity:

The content validity was established for completeness, relevance, clarity, ambiguity and simplicity by a panel of five experts from the Department of Medical Surgical Nursing, Faculty of Nursing, South Valley and Helwan

University (two professors and three assistant professors) and necessary changes were made.

Tools reliability:

The reliability of the tools was checked using Cronbach's Alpha. The reliability coefficient for **Tool (I) Section (2)** was (0.72), **Tool (II)** was (0.77), **Tool (III) Section (3)** was (0.82) and **Tool (IV)** was (0.84).

Ethical consideration:

The Ethical Research Committee of South Valley University's Faculty of Nursing approved the study. In addition, the Director of the Orthopedic Departments at South Valley University Hospital provided formal approval to conduct the study after illustrating the study's goal and significance. As well as, emphasizing the confidentiality of the data collected, each nurse and patient included in the study gave their consent. The researchers stressed that involvement in the study was totally voluntary and that every participant had the option to withdraw at any moment. All data obtained was utilized for the aim of the study and were handled in complete confidentiality.

Field work:

The study was taking place from the start of May to the end of October 2023. The researchers collected data three days a week during the morning shift, from 9 a.m. until 2 p.m. and afternoon shift from 2 p.m. until 8 p.m.

Data were gathered in the following order:

The assessment phase:

For nurses: Researchers met the available three times a week. On average, four to five nurses were met per day to gather the data using tools mentioned above. Before collection of the data, the researchers welcomed the nurses, explained the study's aim as well expected outcomes, and obtained their written agreement to participate in this study. Researchers then assessed the studied nurses'

knowledge and practice level regarding preventing PUs among bedridden orthopedic patients using a pressure ulcer knowledge test and nurses' pressure ulcer preventive practices observational checklist. This interview lasted around 25 and 35 minutes. Each nurse was observed while providing care of bedridden orthopedic patients regarding pressure ulcer prevention.

For patients: The researchers met the patients for gathering baseline data, from the profiles of patients were taken for both groups using tool III (section I and II). The researchers then used the IV tool to assess the patients' level of risk for developing a PU.

Implementation phase:

The PU prevention program was established response to the nursing needs and requirements identified in the assessment phase. In this study, the recommendations of the National Pressure Ulcer Advisory Panel (2019), for PU prevention were utilized to construct the PU prevention program. The researchers also created the teaching materials and the media (videos, handouts & photos). The schedule of training sessions was organized depending on time available, numbers of nurses in the shift, the content of the booklet, and available resources, then the nurses were split into small groups (8 groups) depending on their shift to conduct the training sessions, with each group consisting of four or five nurses. Each group took one week. They take into account the use of the Arabic as a language appropriate to the nursing staff's level. Reinforcement and motivation through training sessions are intended through training sessions to improve cooperation in this study.

The entire number of sessions for each group of the nurses investigated in this study was four, including two sessions for the theoretical portion, and two sessions for the practical portion. The theoretical portion was included information about the skin structure and physiology, the definition, causes, risk factors, signs / symptoms, stages, common locations and complications of PUs. The practical portion was included assessment of

risk, skin and nutrition, raising the head of the bed $\leq 30^\circ$, care of the skin, positioning, turning and moving, pressure relief, and range of motion exercises. The session lasted 30 to 45 minutes, with 10 minutes set aside for questions and feedback. Each session began with a review on the prior session as well as the learning objectives of the new issues. Based on the studied nurses' requirements feedback and teaching were provided to confirm their understanding. Each nurse taken a printed copy of the booklet which served as a teaching method used for the theoretical part, while practical teaching methods which included demonstrations and re-demonstrations, videos, posters, and handouts as media.

Evaluation phase:

The studied nurses' knowledge and practices were reassessed immediately and then post three months of program implementation. The researchers reviewed all patients in the study and control groups using section III of tool III (Pressure ulcer assessment) after one week to evaluate the incidence of PU. Moreover, all the patients were also evaluated using tool IV (Braden risk assessment scale) at 3rd, 5th and 7th day of the pressure ulcer prevention program implementation.

Statistical analysis:

Before further statistical analysis, the data were checked for homogeneity and normality and using the Shapiro test. Mean and standard deviation (Mean, SD) were used to describe continuous variables, whereas number and percentage were used to describe categorical variables. To compare categorical data, the chi-square test was utilized, whereas the independent t-test and paired sample t-test was used to examine continuous variables $p < 0.05$ was used to establish statistical significance. Pearson Correlation was also utilized to demonstrate the relationships between variables. The IBM SPSS version 25.0 was used for all analysis.

Result:

Table (1): Shows that 55.6% of the studied nurses are less than 30 years old with a

Mean \pm SD is 30.58 ± 7.69 . As well, 72.2% were females and married. Additionally, 58.3% of them had less than 10 years of clinical experience with a Mean \pm SD of 8.11 ± 6.47 . Moreover, 77.8% of them had not attending previous pressure ulcers prevention training courses.

Figure (1): Illustrates that, the secondary school nursing diploma accounted for the largest percentage at 50.0%. A technical institute diploma was held by 39.0% of them, while 11.0% had a bachelor's degree in nursing.

Table (2): Shows that there is improvement in the mean knowledge scores of the studied nurses in all items in the post and follow-up phase as compared to the preprogram phase with a highly statistically significant difference between them. The total level knowledge Mean \pm SD 12.33 ± 4.97 , 20.77 ± 2.58 and 19.25 ± 3.08 at the pre, immediately post, and three months after program implementation respectively.

Figure (2): Represents that 5.6% of the studied nurses had satisfactory knowledge before the implementation of the program, which reached 88.9% and 80.6% immediately post and three months after the implementation of the program, respectively.

Table (3): Represents that 19.4% of the studied nurses had competent practice pre-program implementation, which reached 86.1% and 77.8% immediately post and after three months after the implementation of the program, respectively, with a highly statistically significant difference between them. The total level of practice was also improvement at Mean \pm SD was 32.25 ± 10.31 , 51.80 ± 9.17 and 46.47 ± 10.23 at pre, immediately post, and three months after the implementation of the program, respectively.

Table (4): Clarifies that there was a statistically significant positive correlation between the overall nurses' knowledge and their practices before, immediately post, and three months after the program implementation with a p-value of ≤ 0.05 .

Table (5): Shows that 42.5% of the patients in the study group and 40.0% of the patients in the control group were between the ages of (35- 50) years old with a mean \pm SD of 44.86 ± 12.31 and 46.90 ± 10.02 respectively. Regarding to gender, 57.5% of the study group and 52.5% of the control group were males. Concerning the marital status, it was cleared that 62.5% of the study group and, 60.0% of the control group were married. In respect of patients' educational level, it was found that 42.5% of the study group and 47.5% of the control group had a secondary school education. In terms patients' occupations, it is clear that, 67.5% of the study group and 55.0 % of the control group were work. The differences in personal data between both groups were not statistically significant.

Table (6): Represents that the type of orthopedic injury 35.0% of the study group had femoral head fracture. While 37.5% of the control group had hip fracture. Regarding treatment modalities 42.5% and 47.5% of the study and the control group were undergoing open reduction and internal fixation respectively. The Mean \pm SD of BMI in kg/m² is 27.78 ± 3.94 and 28.09 ± 4.54 in the study group and control group respectively. As well,

Table (1): Frequency and percentage distribution of the studied nurses according to their demographic characteristics (N= 36).

Items	N	%
Age (Years)		
<30	20.0	55.6
30+	16	44.4
Mean \pmSD	30.58 \pm 7.69	
Gender		
Male	10	27.8
Female	26	72.2
Marital status		
Single	9	25.0
Married	26	72.2
Divorced	1	2.8
Clinical experience years		
<10	21	58.3
10+	15	41.7
Mean \pmSD	8.11 \pm 6.47	
Attending previous pressure ulcers prevention training courses		
Yes	8	22.2
No	28	77.8

80.0% and 77.5 % of both study and control groups respectively were dependent during activities of daily living. There were no statistically significant differences between both groups in all items of medical data.

Table (7): Reveals that there was no a statistically significant difference between the study and control groups in the level of risk for pressure ulcer on admission with Mean \pm SD is 11.05 ± 2.75 , and 10.80 ± 2.57 , but there was a highly statistically significant difference in the level of risk for pressure ulcer between both groups at 3rd day, 5th day, and one week with Mean \pm SD is 12.65 ± 2.69 , and 10.60 ± 2.69 ; 13.95 ± 2.53 , and 11.75 ± 1.97 ; 16.67 ± 2.34 , and 12.02 ± 3.01 and 17.20 ± 2.19 , and 13.75 ± 3.29 in the study group and control group respectively.

Table (8): Demonstrates that there was a highly statistically significant difference between the study and control groups regarding presence of pressure ulcers at $P= 0.001^*$. Also, there was a statistical significance difference between the study and control group in relation to pressure ulcer stages (stage two), number of developed pressure ulcers (one and three ulcers) and common sites (multi-site) at $P < 0.05$.

Figure (1): Frequency and percentage distribution of the studied nurses according to educational level (qualifications) (N= 36)

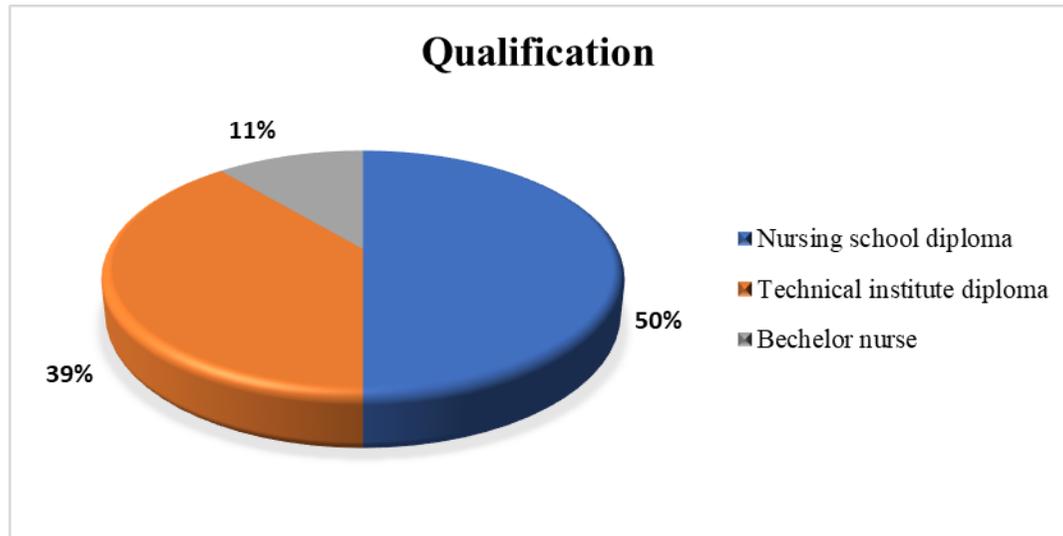


Table (2): Mean knowledge score of the studied nurses throughout the study period (N=36)

Items	Pre	Immediately post	Follow-up (after three months)	Kruskal Wallis test	P
	Mean ±SD	Mean ±SD	Mean ±SD		
Etiology and development	2.83±1.66	4.75±0.069	4.38±0.90	31.63	<0.001*
Classifications and observation	2.36±1.29	3.69±0.82	3.44±1.02	22.45	<0.001*
Risk assessment	1.02±0.50	1.88±0.31	1.69±0.46	45.83	<0.001
Nutrition	0.66±0.47	0.94±0.23	0.88±0.31	11.09	0.004*
Preventive strategies to decrease amount of pressure/ shear	3.06±1.55	5.36±1.09	4.94±1.41	34.84	<0.001*
Preventive strategies to decrease duration of pressure/shear	2.13±0.86	4.14±0.93	3.88±1.14	48.68	<0.001*
Total level of knowledge	12.33±4.97	20.77±2.58	19.25±3.08	50.55	<0.001*

(*) Statistically significant at p < 0.05

Figure (2): Total knowledge score of the studied nurses throughout the study period (N=36)

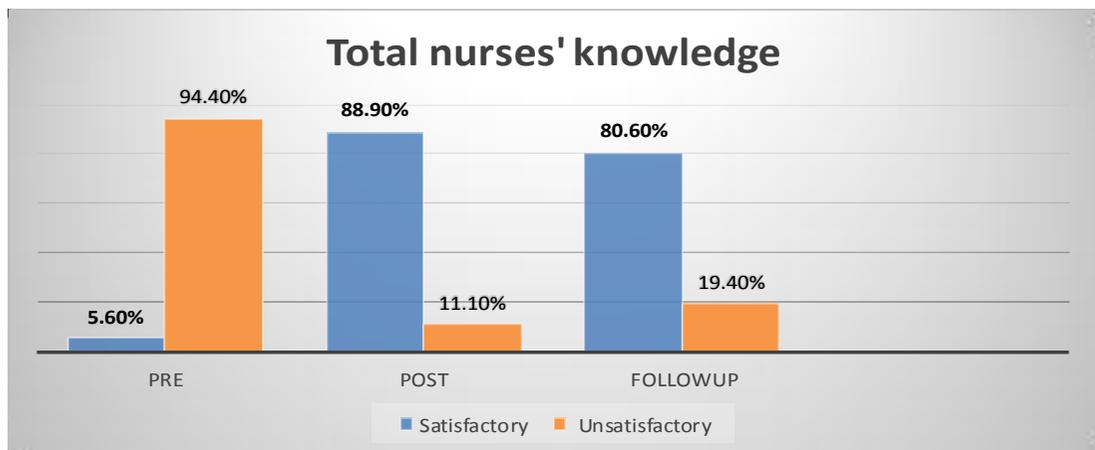


Table (3): Total practice score of the studied nurses throughout the study period (N=36)

Items	Pre		Immediately post		Follow up (after three months)		χ^2 (P)	χ^2 (P)
	N	%	N	%	N	%	Pre-post	Pre-FU
Competence ≥ 85	7	19.4	31	86.1	28	77.8	32.09	24.51
Incompetence < 85	29	80.6	5	13.9	8	22.2	(<0.001*)	(<0.001*)
Mean \pm SD	32.25 \pm 10.31		51.80 \pm 9.17		46.47 \pm 10.23		H=27.10	(<0.001*)

(*) Statistically significant at $p < 0.05$; (H) Kruskal Wallis test

Table (4): Correlation between total knowledge score and total practice score of the studied nurses throughout the study period (N=36)

	Total knowledge score					
	Pre		Immediately post		FU (after three months)	
	r	p	r	p	r	p
Total practice score	0.386*	0.020	0.495**	0.002	0.444**	0.007

Table (5): Frequency and percentage distribution of both study and control groups regarding to their personal data (N=80)

Items	Study group (N=40)		Control group (N=40)		Chi-Square / Fisher's Exact Test	
	N	%	N	%	χ^2	P
Age (Years)						
20– 25	4	10.0	6	15.0	2.701	0.437
25 – 35	11	27.5	6	15.0		
35 – 50	17	42.5	16	40.0		
50 – 60	8	20.0	12	30.0		
Mean \pm SD	44.86 \pm 12.31		46.90 \pm 10.02		t=0.8.12	0.420
Gender						
Male	23	57.5	21	52.5	0.202	0.653
Female	17	42.5	19	47.5		
Marital status						
Single	8	20.0	11	27.5		
Married	25	62.5	24	60.0	0.827	0.664
Widow	7	17.5	5	12.5		
Level of education						
Reading and writing	8	20.0	9	22.5	0.503	0.839
Secondary education	17	42.5	19	47.5		
Have university degree	15	37.5	12	30.0		
Occupation						
Work	27	67.5	22	55.0	1.317	0.231
Not work	13	32.5	18	45.0		

Table (6): Frequency and percentage distribution of both study and control groups regarding to their medical data (N=80)

Items	Medical data	Study group (N=40)		Control group (N=40)		Chi-Square / Fisher's Exact Test	
		N	%	N	%	χ^2	P
Types of orthopedic injury	Hip fracture	12	30.0	15	37.5	2.855	0.610
	Pelvic fracture	4	10.0	7	17.5		
	Femoral head fracture	14	35.0	13	32.5		
	Multiple trauma	8	20.0	4	10		
	Vertebral fracture	2	5.0	1	2.5		
Treatment modalities	Open reduction and internal fixation	17	42.5	19	47.5	0.829	0.904
	External fixation	11	27.5	12	30.0		
	Spinal brace	2	5.0	1	2.5		
	Traction	10	25.0	8	20.0		
Body mass index (BMI)	Normal weight (18.5-24.9)	14	35.0	12	30.0	1.259	0.564
	Overweight (25.0 – 29.9)	20	50.0	18	45.0		
	Obesity (30 and above)	6	15.0	10	25.0		
	Mean \pmSD	27.78\pm3.94	28.09\pm4.54	t=0.365	0.716		
Activities of daily living	Dependent	32	80.0	31	77.5	0.075	0.775
	Needs support	8	20.0	9	22.5		

Table (7): Frequency and percentage distribution of both study and control groups regarding to their level of risk for pressure ulcer (N=80)

Items	Risk for pressure ulcer	Study group (N=40)		Control group (N=40)		Chi-Square / Fisher's Exact Test	
		N	%	N	%	χ^2	P
On admission	Extremely risk (<9)	9	22.5	11	27.5	0.791	0.893
	High risk (10-12)	21	52.5	20	50.0		
	Moderate risk (13-14)	7	17.5	5	12.5		
	Mild risk (15-18)	3	7.5	4	10.0		
	Mean \pmSD	11.05\pm2.75	10.80\pm2.57	0.419	0.676		
3 rd day	Extremely risk (<9)	3	7.5	12	30.0	15.91	0.001*
	High risk (10-12)	14	35.0	21	52.5		
	Moderate risk (13-14)	11	27.5	2	5.0		
	Mild risk (15-18)	12	30.0	5	12.5		
	Mean \pmSD	12.65\pm2.69	10.60\pm2.69	3.19	0.002*		
5 th day	Extremely risk (<9)	0	0.0	1	2.5	12.86	0.003*
	High risk (10-12)	10	25.0	20	50.0		
	Moderate risk (13-14)	11	27.5	14	35.0		
	Mild risk (15-18)	19	47.5	5	12.5		
	Mean \pmSD	13.95\pm2.53	11.75\pm1.97	4.33	<0.0001*		
One week	Extremely risk (<9)	0	0.0	8	20.0	41.23	<0.0001*
	High risk (10-12)	0	0.0	14	35.0		
	Moderate risk (13-14)	10	25.0	13	32.5		
	Mild risk (15-18)	21	52.5	5	12.5		
	No risk (19-23)	9	22.5	0	0.0		
	Mean \pmSD	16.67\pm2.34	12.02\pm3.01	7.69	<0.0001*		

Table (8): Frequency and percentage distribution of both study and control groups regarding to their characteristics of development pressure ulcers (N=80)

Items	Characteristics of development pressure ulcers	Study group (N=40)		Control group (N=40)		Chi-Square / Fisher's Exact Test	
		N	%	N	%	χ^2	P
Presence of pressure ulcers	Yes	5	12.5	18	45.0	10.33	0.001*
	No	35	87.5	22	55.0		
Stage	Stage one	3	7.5	6	15.0	1.127	0.288
	Stage two	2	5.0	9	22.5	5.165	0.02*
	Stage three	0	0.0	3	7.5	3.117	0.077
Number of developed pressure ulcers	One	1	2.5	7	17.5	5.0	0.02*
	Two	4	7.5	5	12.5	0.125	0.723
	Three	0	2.5	6	15.0	6.01	0.02*
Common sites	Scapula	1	2.5	3	7.5	1.053	0.305
	Sacrum	4	5.0	6	15.0	0.457	0.499
	Heel	0	0.0	2	5.0	2.051	0.152
	Multi-site	0	0.0	7	17.5	7.671	0.006*

Discussion:

Pressure ulcers continue to be the primary complication of extended hospital stays, particularly for older patients. PUs is frequently used as performance indicators to assess the standard of treatment and the general health of the patient. Although, a collaborative health team effort plays important role in the pressure ulcers prevention, nurses still the cornerstone in this area. Numerous studies have shown that treating pressure ulcers early on benefits both the patients and the healthcare system. For this reason, educating healthcare professionals is essential to both preventing and treating pressure ulcers (Awad, and Hewi, 2020). So, this study aimed to evaluate the effect of pressure ulcer prevention program on nurses' performance and orthopedic patients' outcomes.

According to the study's findings, most of the nurses under investigation were under 30 years old. Perhaps as a result of the majority of the nurses being recent grads. This result is in line with the studies by Hefnawy and Abd El-Monem, (2017), in Saudi Arabia, and Abou El Enein and Zaghoul, (2011), in Egypt, which indicated the same age distribution of nurses in their studies. Also, this finding was consistent with Mohamed & Weheida (2015), who stated that nearly majority of the nurses had less than 30 years of experience.

Conversely, though the findings contradicted with those of Ebi et al., (2019), who discovered that most nurses on the field were between 38- 47 years old. According to the researchers' perspective, this outcome due to the fact that most of the middle-aged research participants' nurses in orthopedic departments were capable of providing good care for patients who were immobilized, rather than being novices to the nursing field.

Regarding gender, the majority of nurses under the study were female. This research aligns with Ali (2019), who showed that the most was comprised of females. In addition, this result agreed with Hassan (2018), who revealed that women made up the bulk of the nurses under study. Researchers suggest that this outcome could be because women finished the majority of nursing education prior to men becoming involved in the field. Men have just recently become involved in nursing education.

Concerning the educational level (qualifications) among the nurses examined, half of them possessing a nursing school diploma. The search was incongruent with Awali et al., (2018), who stated that the majority of research participants held a bachelor's degree in nursing.

In terms of clinical experience years, most of the nurses under study have fewer than

ten years of clinical experience in orthopedic departments. The aforementioned findings agree with **Gaballah & El-Deen, (2021)**, in a published study who reported that among the nurses who took part; half had five to ten years of experience. The findings of this study were also corroborated with **Bayoumi, and Bassuni, (2017)**, who noted found that over half of nurses had between four and seven years of experience overall, but just under a quarter had between one and three years of experience.

This finding contradicted with **Lotfi et al., (2019)**, who observed in their study that nearly one-third of them had more than 14 years of experience. From the researchers' standpoint, these findings imply that prior to the implementation of the pressure ulcer prevention programme, staff nurses' knowledge and practice regarding the management of pressure ulcers was insufficient.

In relation to attending previous pressure ulcer prevention training courses, according to the current inquiry, over three quarters of didn't take any courses on pressure ulcer prevention. A shortage of nursing personnel and work stress, in the opinion of the researchers, may have contributed to this conclusion by making it difficult for the nurses under the study to take time off work for training. This outcome was conforming to **Ingwu et al., (2019)**; they found that nearly all of the nurses in their research did not participate in pressure ulcer prevention training for patients with orthopedic conditions. Furthermore, **Lotfi et al. (2019)**; discovered a similar outcome, indicating that most of the nurses who took part in the study had no prior experience with pressure ulcers.

Concerning nurses' total knowledge level, the current study showed that a marked improvement in studied nurses' knowledge about pressure ulcer following the implementation of prevention program with a highly statistically significant difference between pre, immediately post and three months after program implementation. This result illustrates how the preventative program has improved nurses' knowledge. This supports the theory that the nurses' lack of access to educational opportunities contributed to their ignorance and implies that satisfying the nurses'

information needs will close this knowledge gap. A successful strategy to raise nurses' knowledge about pressure ulcers includes session reinforcement, the use of different media, such as a colorful booklet and a laptop, to promote clarity and understanding, and the taking of feedback throughout each time frame.

This result was in line with what was found by **Kathirvel et al., (2021)**, who discovered statistically significant improvements in knowledge about PU management and prevention. In addition, this result was confirmed by the work of **Awali et al., (2018)**, who demonstrated that, as compared to the pretest, nurses' knowledge grew and stayed high throughout the study period for expanding the findings. This conclusion was confirmed by **Baron et al., (2016)**, they state that after the educational intervention, the study group's mean knowledge score was higher than the control group's mean knowledge score. On the contrary, the discovery is disagreement with **Zeb et al., (2015)**, they found that, even in the absence of the program's implementation, the majority of nurses have solid knowledge.

Concerning the nurses' level of practice under examination, the present search determined that significantly improved in nurses' level of practice after conducting PU prevention program. These results were consistent with **Sabaq & Mohamed (2018)**, who discovered a highly statistically significant improvement in nurses' compliance with most risk assessment, skin inspection, shifting positions, and nutrition items immediately after program intervention. These results concur with those of **Awali et al. (2018)**; they claimed that nurses' level of practice in the following areas considerably increased following the implementation of an educational intervention concerning PU prevention: assessment of the patient upon entrance, the time period of the patient's turn, skin protection throughout the transfer, and elevated bed

Regarding the correlation between the studied nurses' knowledge and practice level, the result showed a statistically significant positive correlation between total nurses' knowledge and practice in the pre, immediately post and after three months after program

implementation. This finding suggested that the practice may be quickly enhanced, especially if it were connected to an appropriate source of scientific knowledge. This finding was congruent with **Sabaq & Mohamed (2018)**; **Hashad & Hassan (2018)**; **Mohamed & Weheida (2015)**, who reported similar outcomes in their studies. Also, this finding is in same line with **Trueman & Whitehead (2010)**, who demonstrated that staff nurses needed to maintain and attain a high level of knowledge and practice. In order to be good in their practice, nurses must gain information prior to joining the field.

Regarding to patients' sociodemographic characteristics, the ongoing research found that, about half of the studied patients in the study and control groups were males, with means age were of 44.86 ± 12.31 in study group and 46.90 ± 10.02 in the control groups, married additionally had diploma degree in nursing and had work. Our findings were in harmony with **Mayhob & Amin, (2021)**, they discovered that approximately half of the patients in the intervention and control groups were males; with mean age were 60 ± 6.2 and 60.35 ± 5.21 in both the study and control groups respectively. Furthermore, this finding is in accordance with a research conducted by **Kathirvel et al., (2021)**, who stated that men constituted the majority of the patients.

The end outcome in agreement with **Soliman et al., (2022)**, who demonstrated that almost half of the patients had intermediate training. The end result was contradicted with **Kathirvel et al., (2021)**, who demonstrated that nearly fifty percent of patients have a high graduated educational level. From the researchers' perspective, this might be because the study was carried out in a government hospital that treats a lot of patients with low education levels and socioeconomic background.

In terms of medical history, the current studying noted that, one third of examined patients in the study group had a femoral head bone fracture, although almost one-third of the participants in the control group experienced hip fractures. This conclusion has been proven by **Mayhob and Amin, (2021)**, they verified

that less than one-third of the study group's patients and half of the control group's patients were hospitalized with severe orthopedic injuries.

Regarding body mass index, the present inquiry revealed that in both the study and control groups, approximately fifty percent of the patients under investigation were overweight; with a mean \pm SD weight was 27.78 ± 3.94 and 28.09 ± 4.54 kg respectively. This discovery was contradicted with **Alizadeh et al., (2021)**, they indicated that mean weight of 66.76 ± 10.60 kg.

This research discovered that there was no a statistically significant difference between the study and control groups regarding risk level of developing pressure ulcers upon admission. Further, there was a highly statistically significant difference regarding risk level of developing pressure ulcers between both groups at 3rd day, 5th day, and one week after the implementation of prevention program. The result was consistent with **Mahmoud & Omran (2022)**; they discovered revealed on the seventh day after the recommendations were applied, there was a slight chance that any of the patients in the study group would develop a pressure ulcer. Conversely, more than fifty percent of the control group was at high or extremely high risk of getting pressure ulcers. The finding also matching with **Mohamed and Ibraheem, (2019)**, they discovered that, after two weeks, nearly third and quarter of the study group had mild and moderate risk, respectively, whereas more than a third of the control and study groups were at higher risk when they enrolled.

Concerning stage of pressure ulcers, current study stated that, there was present a highly statistically significant difference between the study and control groups regarding presence of pressure ulcers. Also, there was a statistical significance difference between the study and control group in relation to pressure ulcer stages (stage two), number of developed pressure ulcer, and common sites (multi-site). These findings are supported by **Mayhob & Amin, (2021)**, noted that, during the first two or even four days of using the bundle of care, half of the patients in the intervention group

acquired grade one pressure ulcers, but none of them developed grade three pressure ulcers. Also, found that, after four days of receiving usual nursing care, less than three quarters of the patients in the control group had grade three pressure ulcers. These findings were corresponding with **Mao and Zhu (2021)**, they mentioned that, pressure ulcer grading might be improved by using care bundle items, the effectiveness of care and patients' quality of life.

Conclusion:

It has been demonstrated that implementing a pressure ulcer prevention program improves nurses' performance statistically significantly compared to not implementing the program. The study hypotheses were further reinforced by the fact that patients' outcomes statistically significantly improved in the study group as compared to the control group.

Recommendations:

- Offering ongoing education and training program to nurses who care for patients with orthopedic conditions so they may improve their knowledge and practice with pressure ulcer prevention.

- The first line of defense against pressure ulcers is teach nurses how to utilize the Braden scale to assess patients' pressure ulcer risk.

- Further studies are needed to assess barriers for implementing pressure ulcer prevention measures.

- Repeat the research with a large sample in various hospital departments in order to extrapolate the findings.

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