

# Pressure Injury Care Program Effects on Nurses' Performance and Patients' Pressure Injury Wound Healing Outcomes

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**Abstract** Pressure Injury (PI) is a major health problem which imposes a considerable social and economic burden nationally and globally. **Aim of the study** was to investigate the effect of PI care program on nurse's performance and patients' pressure injury wound healing outcomes. **Study design** was a quasi-experimental control group using pre-post and follow up design. **Sample** of thirty nurses and fifty patients were allocated in the current study in two medical units at one of the general hospitals in Ismailia City. **Tools:** Six tools included nurses' demographic data sheet, pressure injury knowledge questionnaire, and pressure injury care observational checklist, patients' demographic and medical profile data sheet, The Braden Scale, and patients' pressure injury wound healing outcomes were used to collect data. **Results:** The study revealed that nurses' knowledge and practices, were significantly improved towards PI care post program implementation when compared to preprogram. Moreover, there was a significant improvement in PI wound healing among patients cared with nurses after receiving the educational program compared with patients who received care before the program. **Conclusion:** The PI educational program could improve nurses' performance as well as PI wound healing among cared patients. **Recommendation:** Endorse the educational program for pressure injury care in the nurses' orientation program plus continuous in-service education.

**Keywords:** pressure injury, care program, nursing performance, wound healing

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## 1. Introduction

Pressure injury (PI) is defined as 'localized damage to the skin and/or underlying soft tissue over the bony prominence areas or under a medical or other device which resulted from intense pressure or pressure with shear [1,2]. Factors that may affect the tolerance of soft tissue to pressure and shear include microclimate, nutritional status, degree of tissue perfusion, presence of comorbid conditions, and the condition of the soft tissue itself [3]. Disabled patients who have impaired moving or positioning are especially vulnerable to the development of PI due to prolonged exposure to pressure over body tissue [2,4].

Management of PI starts from detecting high-risk patients, systematic examination of skin, using bed and chair support surfaces, changing posture, mobility, proper dressing and nutritional support [6]. Pressure injury is an

index of nursing care quality, and management of PI is one of the main nursing tasks as nurses are in direct contact with patients [7]. Nursing interventions for pressure injury wound aim to reduce the magnitude and duration of mechanical load such as pressure or shear forces and performing exercise, or aimed to enhance tissue tolerance, for example by improving nutritional status, and application of skin care products [2].

However, the review of literature suggests that nurses' knowledge on PI care is limited and that this lack of knowledge can negatively influence their performance [8]. Moreover, different studies reported different results about nurses' level of performance regarding PI management that ranged from 28% to 74% considering the importance of improving nurses' knowledge on PI management [9]. Overall, the availability and quality of evidence to make recommendations for nurses' knowledge and practices regarding pressure injury management are weak. So that, further researches are necessary [2].

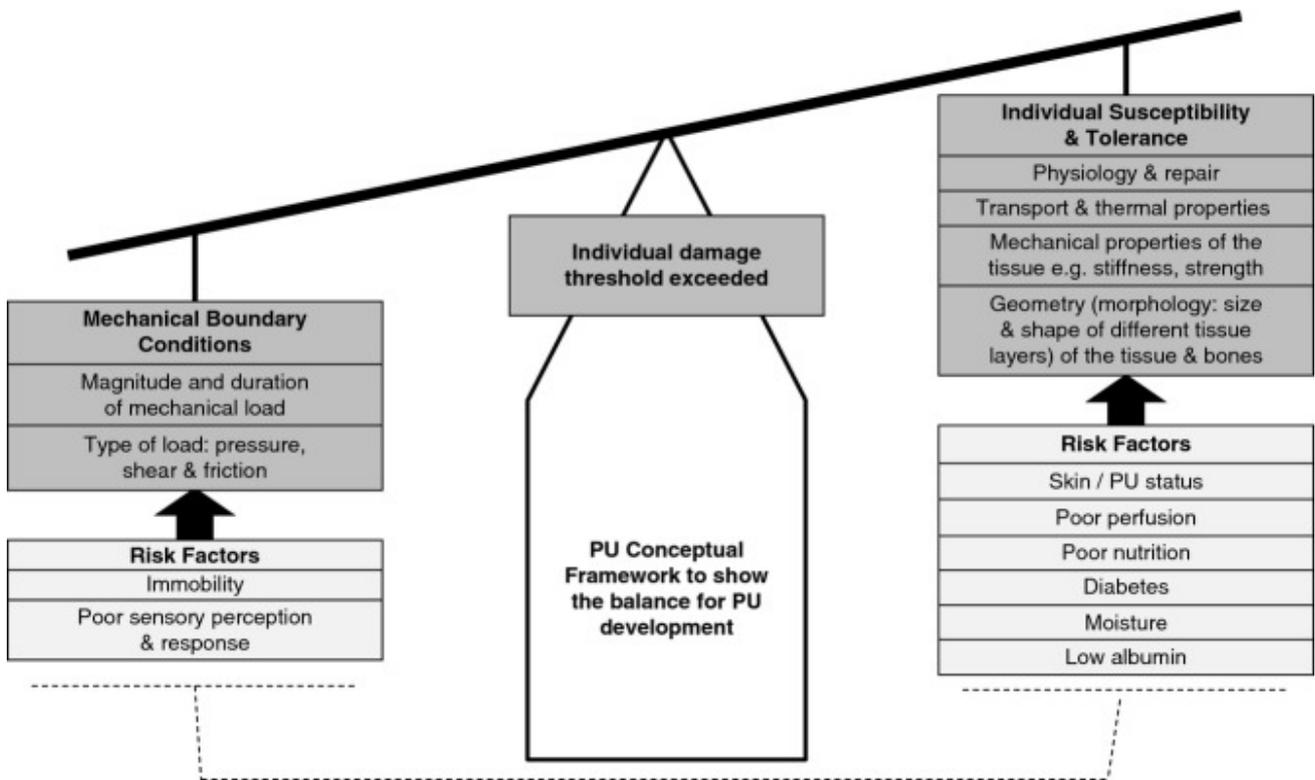


Diagram 1. The Coleman Conceptual Model of Pressure Injury Etiology [5]

### 1.1. Significance of the Study

Pressure injury is a major health problem which imposes a considerable social and economic burden nationally and globally [4,10,11]. Although, PI is a preventable complication, it is a major and serious problem facing health care systems [12,13]. There was 4-fold increase of hospital acquired complications including PI in inpatients between 2016 and 2018 [14,15]. Care management of PI encountered as a public health issue which increases in the hospital stay from 4 to 30 days and cost [16], affect negatively the patient's quality of life [17]. Pressure injuries are viewed as an outcome for poor-quality nursing care [11,18].

Moreover, pressure injury complications can be catastrophic and life threatening, so, nurses play an important role in assessment of patients' needs, informing the patients about the plan of care and also providing standardized patients' care, this mean that nurses are in dire need of continuous training on how to prevent and treat pressure injury [1]. Furthermore, there are scanty researches that examine the effect of nursing program on patients' pressure injury healing outcomes. Therefore, the present study was delivered with hope that the obtained findings will contribute to the health care experts, nursing practice, as well as patients' outcome.

## 2. Subject and Methods

### 2.1. Aim of the Study

The aim of present study was to investigate the effect of PI care program on nurse's performance as well as patients' pressure injury wound healing outcomes.

### 2.2. Research Hypotheses

Three hypotheses were formulated to be tested as follows:

H<sub>1</sub>: Nurses will have significantly higher knowledge scores about pressure injury care post-program implementation when compared to pre-program.

H<sub>2</sub>: Nurses will have significantly higher practice score about pressure injury care post-program implementation when compared to pre-program.

H<sub>3</sub>: Patients cared after the program implementation (study group) will have significantly improved pressure injury wound healing outcomes compared to the patients cared before the program implementation (control group).

### 2.3. Study Design

A quasi-experimental control group using pre-post and follow up design was utilized in the current study. This design estimated the causal impact of an intervention (educational program) on the dependent variables (nurses' level of knowledge and practices and patients' wound healing) [19].

### 2.4. Participants & Setting

This study was conducted at two medical units in one of the general hospitals, in Ismailia City, Egypt. A sample of thirty-seven nurses was eligible for the current study. The Nurses' inclusion criteria include all nurses working in the selected medical units and agreed to participate in the current study. Four nurses withdrew from the study due to birth leave or frequent work leave, and other three were excluded from the final study sample because they were included in the pilot study.

Additionally, patients who fulfilled the inclusion criteria were eligible for this study as the following criteria: 1) Adult male and female, (2) patients not experienced any stage of PI within last 24 hours, (3) had on Braden scale score  $\leq 13$  (indicating moderate to very high risk to PI), and (4) agreed to participate in the current study either by himself/herself or by the guardian. Exclusion criteria include patients admitted for observation, psychiatric reasons, and rehabilitation. The sample size was determined using the following equation [20].

$$n = \frac{\left( \frac{z_{\alpha} + z_{\beta}}{2} \right)^2 (P_1(1-P) + P_2(1-P_2))}{(P_1 - P_2)^2}$$

n= sample size

Z  $\alpha/2$  = the value for a type I error of 5%.

Z  $\beta$  = the value for a type II error of 20%.

P1 = proportion of patients who received proper nursing PI care and developed PI = 32%.

P2 = Prevalence of patients who didn't receive proper nursing PI care and developed PI = 45%.

$P_1 - P_2$  = effect size.

The calculated sample size is 25 patients, therefore, a convenient sample composed of 25 patients before program application and 25 patients after program applications were required.

## 2.5. Tools for Data Collection

To assess the effectiveness of educational intervention on nurses' performance, one tool was utilized. The validity and reliability of these tools were revised by a panel in medical surgical nursing, and then a pilot study was done. The tool involved the following parts:

1. Nurse's Demographic Data sheet: It was developed by researchers, it covered data related to nurse's age, gender, educational level...etc.
2. Pressure injury knowledge questionnaire [21]: it was used to assess nurse's knowledge regarding management of the pressure injury. It consisted of seventy-five questions regarding anatomy and physiology of the skin, definition, risk factors, causes, signs and symptoms, sites, stages, complications and nursing care for pressure injury. Correct answers had score "1" and incorrect scored with "0" with possible total scores ranged from 0 to 75. Reliability of the tool was assessed using Cronbach's Alpha that was 0.79.
3. Pressure injury care observational checklist [21]: it assesses nurse's practices in details regarding management of PI. It consisted of 120 items regarding assessment of PI, nutritional instructions, skin moisture and tissue perfusion, measures to prevent friction and shear, dressing application, patient's positioning and finally range of motion exercises. Its items had two responses, either done scored "1" or not done scored "0" with possible total scores ranged from 0 to 120. Reliability of the tool was measured using Cronbach's Alpha that was 0.81.

4. Patients' demographic and medical profile data sheet: This tool was developed by the researchers, it involved two parts. Part I covered patient's personal data as age, gender marital status and occupation. Part II covered information related to level of consciousness, level of dependency, type of incontinence and past medical history.
5. The Braden Scale for Predicting Pressure Injury Risk was developed in 1987 by Barbara Braden and Nancy Bergstrom. The purpose of the scale is to assess a patient's risk of developing a pressure injury by examining six criteria: Sensory perception, Moisture, Activity, Mobility, Nutrition and Friction and Shear, with possible total score of 23 points, with a lower score meaning a higher risk of developing a pressure injury and vice versa. The Braden Scale assessment score scale: very high risk: total score 9 or less, high risk with score 10-12, moderate risk with score 13-14, mild risk with score 15-18, no risk with score 19-23. Correlation Coefficients for Braden scale sum scores were 0.90 [22].
6. Patient's pressure injury wound healing outcomes tool: It was developed by The National Pressure Injury Advisory Panel [3,23]. The Tool was used to monitor and measure healing of pressure injury. It consists of two parts. The first part is skin inspection that had seven items included the site of pressure, depth, color of skin, skin temperature, moisture, texture, stage of injury, as well as signs and symptoms of dehydration. It had possible scores ranged from 0 to 24. The second part is Pressure Injury Ulcer for Healing (PIUH), it consisted of three items to monitor change in pressure ulcer status over time (length, width, and amount of exudate and tissue type), with possible total score ranged from 0-13. Patient's pressure injury wound healing outcomes measured through summation of the two parts scores with possible total scores ranged from 0 to 37 with lower score which indicates better outcome. Reliability of the tool was measured using Cronbach's Alpha that was 0.88.

## 2.6. Pilot Study

A pilot study was conducted on five patients and three nurses (10%), who met the inclusion criteria in order to ensure objectivity and clarity of the tools, estimate the time needed for data collection tools, and feasibility of the study. Required modifications were performed on the tools' final version. The pilot study sample was excluded from the actual study sample and the results of the pilot study proved that the research was feasible.

## 2.7. Ethical Considerations

Ethical approval was obtained from the Institutional Review Board- Faculty of Nursing, Port-Said University. Official permission to perform the study was obtained from hospital administrators. The aim and significance of the current research were explained for each nurse and each patient. As well, patients were informed that they

have the right to refuse participation or withdraw from the study whenever they want without any harm. Anonymity and confidentiality were secured by data coding. Moreover, patients were informed that these data will not be reused in another study without their permission. Written informed consent was obtained from the patients who agreed to participate.

## 2.8. Procedure

The study was conducted through the following three phases; pre-program phase, program implementation phase, and post-program phase. The data collection was conducted from the beginning of March 2019 to the end of April 2020.

### I. Pre-program phase:

An official permission was granted from the appropriate authoritative personnel. In this phase, the researchers selected two inpatient medical units. The potential nurses who agreed to participate in the study were interviewed individually as well as patients who are conscious to explain the nature and the benefit of the current study, and those who are semi or unconscious patients, the researchers met the guardian member. Then, the researchers obtained consent from those who agreed to participate in the study.

Furthermore, nurses' demographic characteristics, knowledge and practices were assessed as well as patients' outcomes were measured. These were performed as follows: nurses' knowledge was assessed using the pressure injury knowledge questionnaire, it is a self-administered, and the time consumed to fulfill the questionnaire was about 30-40 minutes. Additionally, the nurses' performance regarding care of pressure injury was observed by the researchers using pressure injury care observational checklist during actual clinical care practices as well as nurses' notes were revised in that shift in order to pick up any nursing intervention that was done for the potential patients regarding pressure injury. Nurses were observed for 3 different shifts and the mean scores of the three readings were taken.

Synchronously, all the patients in the selected units were assessed in order to pick up patients who met the inclusion criteria and had moderate to very high risk for PI (score  $\leq 13$ ) on the Braden scale as they were followed up until discharge, and among those, patients who developed pressure injury were included in the current study (control group) and followed up for 5 consecutive weeks using patients' pressure injury wound healing outcomes tool, also demographic and medical related variables were assessed during initial assessment. This phase continued until the number of patients required for this study was complete (25 patients), it took about five months.

### II. The program implementation phase:

The educational program was developed based on the identified needs and demands of nurses collected in the preprogram phase. The PI educational program has been developed guided by the National Pressure Ulcer Advisory Panel (NPUAP) and European Pressure Ulcer Advisory Panel (EPUP) by [24,25] guidelines for PI

prevention and treatment were used in this study. The program includes information related to anatomy and physiology of skin, definition, risk factors, causes, signs, symptoms, most common sites, stages, diagnostic studies, complications and nursing role of PI as well as range of motion exercises, positioning and turning in bed, applying of transparent dressing and nurses' practices regarding pressure injury prevention. Each nurse was planned for 4 sessions (2 session/ week), 3 sessions regarding the application of related knowledge as well as demonstration and re-demonstration of the related skills, while the fourth session was a debriefing session. Each session included one group of the studied nurses; each group contained four to five nurses.

### III. Post-program phase:

In this phase nurses' knowledge and practices were reassessed immediately after delivering the program and then after one month of the program implementation in order to measure the retained related knowledge and practices. Nurses' knowledge was assessed using the pressure injury knowledge questionnaire, while, the nurses' performance was measured by observing the nurses for 3 different shifts and the mean scores of the three readings were taken using pressure injury care observational checklist. Moreover, all the patients in the selected units were also assessed and those who met inclusion criteria and had score  $\leq 13$  on Braden scale were followed up until discharge and from those who developed PI were included in the current study (study group) and followed up for 5 consecutive weeks, using the patients' pressure injury wound healing outcomes tool. Furthermore, matching of the patients post program with the pre-program was performed, the matching was done based on demographic characteristics as well as medical profile. This phase took about seven months.

## 2.9. Data Analysis

The collected data were analyzed by personal computer using Statistical Package for the Social Science (SPSS) program, version 21. Descriptive statistics containing frequency distribution, percentage, means, and standard deviations were utilized, while t-test and Chi square as inferential statistics were utilized to compare results pre and post program. Level of significance was adopted at  $p \leq 0.05$ , while highly significant level was set at  $p \leq 0.001$ .

## 3. Results

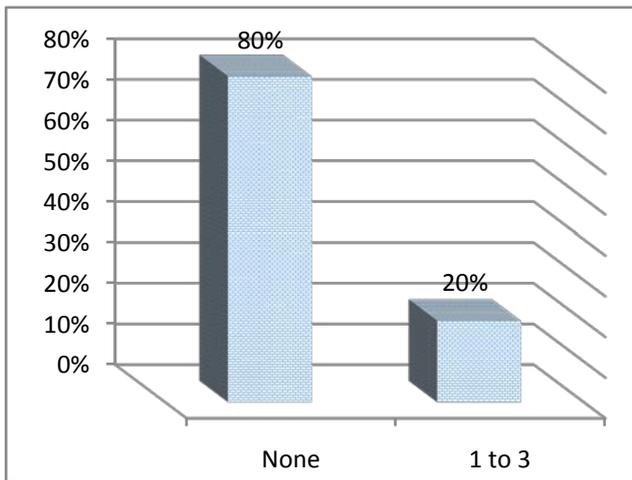
Results of the study were presented into 2 sections as follows: Section (1) is pertinent to nursing related variables as nursing demographic variables, as well as comparison of mean knowledge and practice scores of nurses before and after nursing intervention. Section (2) is concerned with patients' related variables, as demographic and medical related variables, as well as comparison of total pressure injury healing outcomes mean scores between patients cared after the program implementation (study group) and patients cared before the program implementation (control group) throughout the study period.

**Section (1): Nurses' related variables**

**Table 4. Frequency and Percentage Distribution of the Demographic Data of Nurses (N=30)**

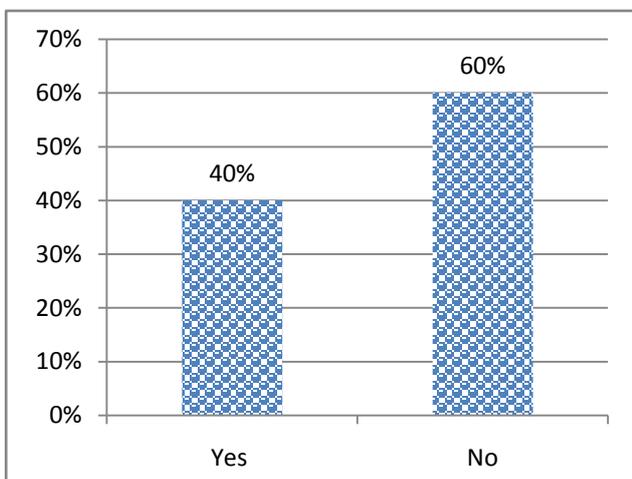
Variables	Frequency	Percentage
<b>Age</b>		
18- < 25	23	76.7
25- < 30	5	16.6
≥ 30	2	6.7
<b>Gender</b>		
Male	12	40
Female	18	60
<b>Educational level</b>		
Diploma	13	43.3
Institute	15	50
Faculty	2	6.7
<b>Years of experience</b>		
< 5	12	40
5- < 10	15	50
≥10	3	10

Table 1 shows that, 76.7% of the studied nurses had age ranged between 18 to less than 25 years, 60 % were female. Regarding educational level, 50% of the nurses graduated from the Institute of Nursing, with 50% of them had 5 to less than 10 years' experience in nursing field.



**Figure 2.** Percentage Distribution of the Number of Nurses Who Received Training Courses about Pressure Injury (N=30).

Figure 2 illustrates that 80% of the nurses didn't receive any training courses regarding to pressure injury care.



**Figure 3.** Percentage Distribution of Presence of Nursing Care Guideline of Pressure Injury (N=30)

Figure 3 represents that 60% of the studied nurses had no nursing care guidelines in relation to pressure injury in their units.

**Table 2. Comparison of Mean Knowledge Scores of Nurses Pre, Post and at Follow Up Program Implementation (N=30)**

Study periods	Mean ± SD	t-test	p-value
Pre-program	44 ± 5.5	23.352	0.000**
Post-program	68.3 ± 2.1		
Pre-program	44 ± 5.5	20.859	0.000**
Follow up	65.7 ± 4.7		
Post-program	68.3 ± 2.1	2.851	0.008*
Follow up	65.7 ± 4.7		

\*Result is significant at p-value ≤ 0.05, \*\*Result is highly significant at p-value ≤ 0.001.

Regarding nurses' knowledge, Table 2 indicates that there were highly statistically significant differences between pre and post program implementation (t-test = 23.352, p-value= 0.000), also between pre-program and follow up (t-test= 20.859, p-value= 0.000), As well, there was a statistically significant difference between post-program and follow up evaluation (t-test= 2.851, p-value= 0.008).

**Table 3. Comparison of Mean Practice Scores of Nurses Pre, Post and at Follow Up Program Implementation (N=30)**

Study periods	Mean ± SD	t-test	p-value
Pre-program	67.1 ± 15.2	13.405	0.000**
Post-program	108.6 ± 12.9		
Pre-program	67.1 ± 15.2	8.903	0.000**
Follow up	96.1 ± 16.9		
Post-program	108.6 ± 12.9	8.292	0.000**
Follow up	96.1 ± 16.9		

\*Result is significant at p-value ≤ 0.05, \*\*Result is highly significant at p-value ≤ 0.001.

Table 3 reveals that there were highly statistically significant differences between nurses' mean practice scores pre-program and post-program (t-test= 13.405, p-value= 0.000), also between pre-program and follow up (t-test= 8.903, p-value= 0.000), and finally between post-program and follow up evaluation (t-test= 8.292, p-value= 0.000).

**Section (2): Patients' related variables**

**Table 4. Frequency and Percentage Distribution of the Patients' Demographic Data among those cared post-program (study group) against patients cared pre-program (control group) (N=50)**

Variables	Study Group (n=25)		Control Group (n=25)		χ <sup>2</sup>	p-value
	No.	%	No.	%		
<b>Age</b>					1.2	0.834
18- < 30	1	4	2	8		
30- < 45	4	16	4	16		
45- < 60	8	32	5	20		
≥ 60	12	48	14	56		
<b>Marital status</b>					0.432	0.640
Married	14	56	13	52		
Not married	11	44	12	48		
<b>Occupation</b>					0.610	0.504
Working	11	44	8	32		
Not working	14	56	17	68		

Result is significant at p-value ≤ 0.05.

Table 4 demonstrates that 48% of the study group and 56% of the control group had age equal or more than 60 years. Additionally, 56% and 52% of the study and control groups respectively were married, with 56% of the study group and 68% of the control group had are not working. Furthermore, there were no statistically significant differences between study and control groups regarding all demographic variables.

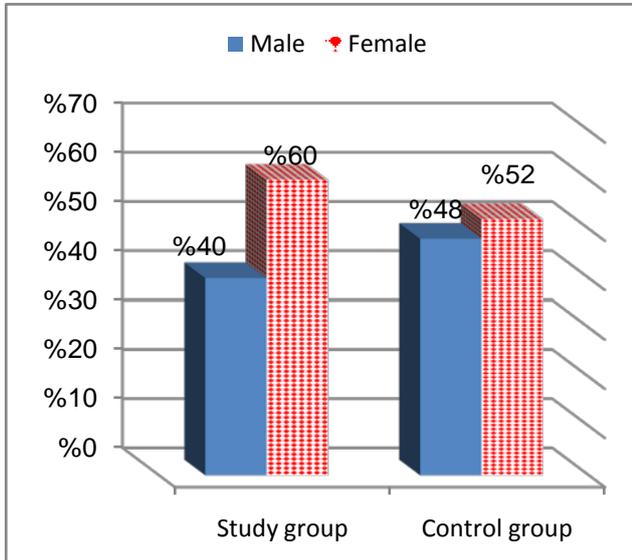


Figure 4. Percentage Distribution of the Patients' Gender among the Study and Control Groups (N= 50).

Regarding gender, 60% of the study group and 52% of the control group were female with no statistically significant difference between both groups ( $\chi^2 = 0.81$ , p-value= 0.498).

Table 5. Frequency and Percentage Distribution of the Patients' Medical Profile among the Study and Control Groups (N=50)

Variables	Study group (n=25)		Control group (n=25)		$\chi^2$	p-value
	No.	%	No.	%		
<b>Level of consciousness</b>					1.014	0.791
Fully conscious	7	28	9	36		
Semi-conscious	12	48	10	40		
Unconscious	6	24	6	24		
<b>Level of dependence</b>					1.044	0.792
Independent	1	4	0	0		
Partially dependent	6	24	6	24		
Totally dependent	18	72	19	76		
<b>Incontinence</b>					0.845	0.631
Urine	4	16	6	24		
Stool	4	16	5	20		
Both	17	68	14	56		

Result is significant at p-value  $\leq 0.05$ .

Table 5 shows that 48% and 40% of the study and control groups respectively were semi-conscious. Regarding level of dependency, 72% of the study group and 76% of the control group were totally dependent. With reference to incontinence, 68% of the study group and 56% of the control group had both urinary and stool incontinence. Additionally, there were no statistically significant differences between the study and control groups regarding all medical profile variables.

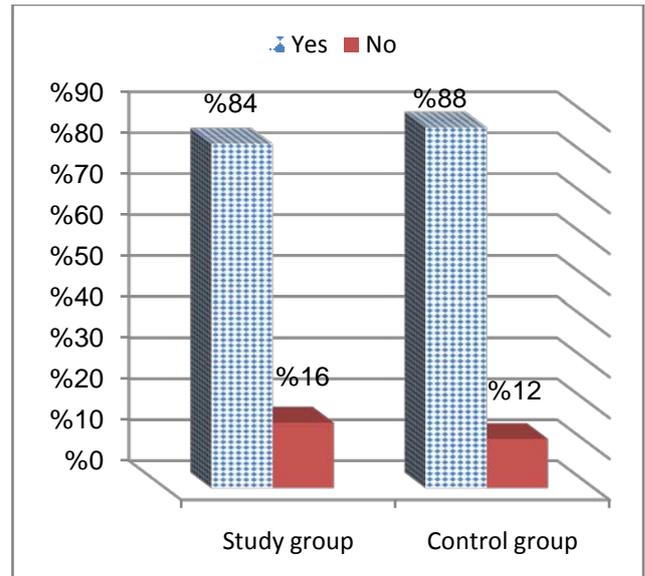


Figure 5. Percentage Distribution Regarding Presence of Past Medical History among the Study and Control Groups (N= 50).

Figure 5 represents that 84% of the study group and 88% of the control group had past medical history with no statistically significant difference between both groups ( $\chi^2 = 0.165$ , p-value= 0.809).

Table 6. Comparison of Patients' Pressure Injury Wound Healing Outcomes Mean Scores among The Study and Control Groups Throughout the Study Period (N= 50)

Study Periods	Mean $\pm$ SD		t-test	p-value
	Study Group (n=25)	Control Group (n=25)		
1 <sup>st</sup> week	18.7 + 2.6	21.3 + 1.5	5.004	0.000**
2 <sup>nd</sup> week	17.6 + 1.9	26.4 + 3.8	10.276	0.000**
3 <sup>rd</sup> week	14.4 + 1.6	27.8 + 3.8	14.629	0.000**
4 <sup>th</sup> week	10 + 1.5	28.4 + 3.7	26.466	0.000**
5 <sup>th</sup> week	9.4 + 1.2	29 + 3.4	30.662	0.000**

\*Result is significant at p-value  $\leq 0.05$ , \*\*Result is highly significant at p-value  $\leq 0.001$ .

Regarding patients' pressure injury wound healing outcomes mean score, table (6) shows that there were highly statistically significant differences between the study and control groups by the end of the 1<sup>st</sup> week of assessment (t-test= 5.004, p-value= 0.000), the 2<sup>nd</sup> week (t-test= 10.276, p-value= 0.000), the 3<sup>rd</sup> week (t-test= 14.629, p-value= 0.000), the 4<sup>th</sup> assessment week (t-test= 26.466, p-value= 0.000), as well as the 5<sup>th</sup> week of assessment (t-test= 30.662, p-value= 0.000).

## 4. Discussion

Pressure injuries are one of the most important management issues for medical institutions. In the US, for instance, PI was added to the list of "never events," which ended reimbursement for the extra cost of care for stages 3 and 4 PIs documented during a patient's hospital stay [26]. Ultimately, the prevention, early detection, and proper treatment of PI are important issues for patients, nurses, and medical institutions [27]. Professional knowledge and management skills regarding PI are necessary for nursing staff. Results from the present study were presented in two

main sections in which section (I) described nursing related variables and Section (II) is concerned with patients' related variables.

### Section (I): Nursing related variables

The current study results showed that about three fourth of the studied nurses were under 25 years old, three fifth were females and the majority of the sample had less than ten years of experience. These results are consistent with those of Mohamed and Weheida [28], who studied the effects of implementing an educational program about PI control on nurses' knowledge and safety of immobilized patients and found that most of the nurses aged less than thirty years and the majority of them had clinical experience less than 10 years. Moreover, half of the studied nurses graduated from the Institute of Nursing which was different from a study done by Köse and G. Öztunç [29] who reported that half of the studied nurses were Bachelor's degree holders.

The results of the current study showed that the majority of the studied nurses had not received training courses about pressure injury and three fifth had no nursing care guidelines in relation to pressure injury in their units. This may be attributed to deficiency in teaching courses as paying efforts to train the staff on such problems. This result is similar to that of Sengul and Karadag [30] who found that about two-thirds of the nurses had not received in-service training related to PIs and Ursavaş and İşeri [12] who found that the majority of the nurses didn't receive education about PI. In this regard, Habiballah [7], concluded that having more experience and receiving training on PI were most influential factors which affect nurses' attitude towards PI prevention.

Regarding to nurses' knowledge, the current study results revealed that studied nurses had mean knowledge scores slightly more than half of the total knowledge scores in pre-program period. Similarly, Coyer et al. [31] assessed the ICU nurses' knowledge and Kim and Lee [32] conducted a study on long term facility nurses and concluded that nurses have a moderate level of knowledge about PI prevention. However, much lower level of knowledge among the subjected nurses were reported by several authors [1,12,28,29,33,34,35]. Furthermore, [30] concluded that general level of knowledge of inpatient units' nurses in preventing PIs are extremely insufficient regarding PI prevention, risk assessment, and decreasing the amount or duration of pressure.

Concerning post-program results, there were highly statistically significant increases in the nurses' level of knowledge immediately after program intervention and at follow-up when compared to pre-program. Therefore, the first study hypothesis was empirically justified. These results confirm the effectiveness of the educational intervention, and the sustainability of the increase in the knowledge even after one month of the program may be attributed to the preparation and training of the staff to launch the 1<sup>st</sup> stage of the universal health insurance system. In this respect, Ursavaş and İşeri [12] concluded that nurses who received education program reported highly significant level of knowledge. The current study result was not similar to what Park et al. [26] reported that post education knowledge level of participants significantly improved right after intervention, but effects

significantly decreased or disappeared as time passed and the participants are to revert to their pre-education baseline. So, regular educational programs, continuous feedback after education, and follow-up are necessary.

Regarding nurses' level of practice, the present study results showed that the mean nurses practice scores were approximately equal to half of the total practice scores in the pre-program indicating that the studied nurses experienced low level of practices in the pre-program which could be related to differences in perceptions of the priority of nursing care provided to the patients, workload, longtime shifts as the majority of nurses worked for 12 hours/day, and insufficient managerial attention to train nurses. Similar finding was reported by Mwebaza et al. [36], who found that few of the inpatient unit nurses applied pressure relieving devices on their wards and give low priority for PI care practices. As well, in the study conducted by Coyer et al. [31], although, the ICU nurses were having a moderate to high levels of knowledge but they were confronted with a lot of barriers to implement appropriate and timely PI care strategies. Moreover, several authors [11,37], and [38] found that inpatient unit nurses had inadequate level of PI care practices and Kim and Lee [32] reported that only a small number of nurses changed the PI prevention care plan when PIs develop in patients.

The present study results revealed that there were highly statistically significant differences between the pre and post intervention, which reflect the effectiveness of the educational program and emphasize that the second study hypothesis was empirically confirmed. These may have resulted from the practice training and likely from the daily care provided to the patient in the wards. These results are congruent with those of Rn et al. [39], who concluded that evidence-based PI prevention program reduced the development of the PI and improved the skill performance of the nursing.

However, Cogan et al. [40], reported that there is no evidence of the effectiveness of behavioral or educational interventions in preventing the occurrence of pressure ulcers in adults with spinal cord injury and emphasized that clinical guidelines are the best available evidence for PI prevention and should remain the foundation of a prevention program.

### Section (II): Patients' related variables

The current study results revealed that about half of both the study and control groups had age equal or more than 60 years, female, married and had no work. Regarding to medical profile, about half of both groups were semi-conscious, while approximately three fourth of the sample were totally dependent, also, more than half of the study and control groups had urine and stool incontinence, and the majority of the studied patients had past medical history. Furthermore, there were no statistically significant difference between the study and control groups regarding to all demographic and medical related variables which indicated that the two groups are matched.

Pressure injury wounds have opposing effects, such as pain, infection, increased hospital length of stay and treatment costs, reduced quality of life, and increased mortality [41,42]. As well, it is the most expensive of

medical errors that occur among elderly, which specifically increased the workload of nurses [43]. In PI wound management the ultimate goal is wound closure [44]. In this study, significant improvements in PI wound status and wound healing process in patients cared post-program implementation (study group) compared with those cared pre-program (control group) throughout the five weeks of PI wound healing assessment which indicates the effectiveness of the educational program provided to the nurses and its positive impact on wound healing outcomes, therefore the third research hypothesis was supported. In the same line with the current study results, Elmansy et al. [21] evaluated the effect of pressure ulcer guidelines on nurses' performance and patients' outcomes and found a statistically significant improvement in PI wound healing after three weeks of care among their studied patients.

However, Stern et al. [45] conducted a pragmatic cluster randomized stepped wedge trial by multidisciplinary team versus usual care for the treatment of stage II PI patients in long term care facilities and worked biweekly as a remote support team for a skin and wound care expertise nurses who visited and educated nursing staff weekly at bedside and in group sessions and didn't found statistically significant differences in PI wound healing between the control and intervention groups which justified by the authors to the use the virtual and short time communication between the nurses and trainers and suggested longer period of implementation, conduct face to face advanced practice nurse support, rather than remote approaches, and more involvement of the nurses in the training. All of these suggestions were taken in the researchers' consideration during the conduction of this study to get the accurate effects for educational program implementation on the nurses' performance and PI wound healing outcomes.

## 5. Conclusion

In conclusion; the study results supported the three suggested research hypotheses as the PI educational program was an influential tool to improve the quality of patient care by keeping the nurses abreast of current knowledge and evidenced based practices on PI care, and reduced the patients suffering by improving patients' pressure injury wound healing outcomes.

## 6. Recommendations

Based on the study results, the following recommendations are suggested

- Endorse the educational program for pressure injury care in the orientation program for nurses.
- Continuous in-service education regarding pressure injury care is required
- Replicate the study on a larger probability sample in different settings for generalizing the findings.

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