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Effectiveness of Nursing Intervention Program on Prevention of Acquired Pressure Ulcers among Hospitalized Elderly Patients

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Abstract

Background: One of the most prevalent issues among elderly patients in hospitals is pressure ulcers (PU), which place a great strain on the elderly as well as the society. **Aim:** Evaluate the effectiveness of nursing intervention program on prevention of acquired pressure ulcers among hospitalized elderly patients. **Method:** A quasi-experimental (study and control groups) design was used on a purposive sample of 84 elderly patients (42 for each group) selected from the medical and orthopedic departments at Mansoura University hospital (MUH), Egypt. Data were collected using**;** demographic & medical data structured interview schedule, Braden risk assessment scale, European pressure ulcer advisory panel classification, and elderly patients' knowledge towards pressure ulcers prevention instrument. **Results**: The mean age of the study and control groups was 64.26 ± 4.26 and 65.64 ± 4.65 years respectively. For all the demographic data, there was no statistically significant difference between both groups. The study group shows overall improvement (decrease risk for developing pressure ulcers) throughout the implementation phases of the nursing intervention program, while the control group shows overall worsening. There was a statistically significant improvement in the study group compared to control group regarding knowledge and grades of developed pressure ulcers (P=0.001). While, the independent predictors of developing pressure ulcers among the study group were still higher in elderly who aged from 70 year and more, had hospital stay more than two weeks, being obesity, smoking, and those with diabetes and stroke. **Conclusion**: The nursing intervention program is successful in raising awareness and preventing older patients' pressure ulcers from developing in hospitals. **Recommendation**: Application of a nursing intervention program as a highly recommended approach to prevent pressure ulcers in immobilized and hospitalized elderly patients.

Keywords: Nursing intervention, prevention of acquired pressure ulcers, and hospitalized elderly patients.

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Introduction

As people age, their bodies undergo significant changes, increasing their susceptibility to diseases and injuries. Thus older persons are more than twice as likely to require hospitalization compared to those in middle age , with about 17% of those 65 years of age and above requiring hospitalization at least once a year [(1)]. Hospital-acquired

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pressure ulcers were one of the top five most common causes of unfavorable patient outcomes, despite scientific and technical advancements. Elderly patients in hospitals frequently develop pressure ulcers (PUs) due to changes in their skin's structure, decreased mobility, altered cognitive patterns, and a higher prevalence of degenerative diseases [(2)].

Pressure ulcers serve as a standard of the quality of care. The incidence of it varies between 0.4% and 12% in acute care settings and 2.2% to 23.9% in long-term care settings, whereas the prevalence rates vary from 8.8 to 53.2% in chronic care settings and between 12–18% in acute care settings [(3)]. Over 2.5 million people in healthcare facilities experience pressure ulcers annually, and more than 60,000 of these patients dying as a result [(4)]. Approximately, two thirds of pressure ulcer cases are documented in older adults (60–80 years of age) [(5)].

Pressure ulcers are described as "localized injury to the skin and underlying tissue usually over a bony prominence as a result of pressure, or pressure in combination with shear and friction" by the National Pressure Ulcer Advisory Panel (2018). Many variables, such as ageing skin, comorbidities, poor nutrition, friction, shear, and dampness, typically contribute to this condition. Since the sacrum and heel are the two bones where hospital-acquired pressure ulcers most frequently occur, treating them poses the most clinical issues. [(6,7)].

Pressure ulcers can be classified into four stages according to their severity. Intact skin with non-blanch able redness (stage 1), partial thickness loss of dermis (stage 2), complete thickness tissue loss (stage 3), and loss of complete thickness tissue with exposed bone, tendon, or muscles (stage 4) [(8)].

In addition to the physical problems that, pressure ulcers causes to elderly, it also has a terrible financial impact on health care systems [(7)]. Pressure ulcers negatively affect a patient's quality of life due to pain, discomfort, depression, suffering, diminished body image, prolonged healing, decreased mobility, loss of independence, increased risk of infection and sepsis, unnecessary surgeries, and longer hospital stays. It's linked to higher morbidity and mortality in addition to the physical limitations and psychological effects. The treatment becomes more costly if the ulcer progress, further worsening the state of elderly patients [(5)]. A mortality risk of patients with pressure ulcers is 2 to 6 times higher than those patients without it. Most notably, every year complications from pressure ulcers result in deaths of about 60,000 patients [(9)].

Prevention techniques for hospital-acquired pressure ulcers vary and include risk assessment and appropriate preventive care planning depending on the results of the risk assessment [(8)]. It is possible to prevent pressure injuries during a hospital stay by identifying high-risk patients early on and putting preventative measures in place. Patients may have pressure ulcers over bony prominences if preventive measures are not taken. Improving health in the elderly population requires a major focus on PU prevention. People can be empowered to actively participate in health promotion through

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education. Development risk and education programs should empower patients to participate in self-management techniques targeted at achieving optimal treatment management and promoting adherence to preventive methods in order to support patients in their self-management for post-stroke (PU) [10].

The best way to prevent nearly 95% of pressure ulcers, according to empirical research, is to use multicomponent therapies. A risk assessment, support surfaces, patient repositioning, mobilization, friction elimination, nutritional support, and moisture management are among the most common multicomponent therapies **[9].** Therefore, the purpose of this study was to assess the effectiveness of nursing intervention program on prevention of acquired pressure ulcers among hospitalized elderly patients.

Study significance

Pressure ulcer development is a prevalent health issue among geriatric people, and it is most likely to occur during hospital stays. Thus, a range of adverse health outcomes that affect a patient's quality of life, morbidity, and death, are associated with pressure ulcers development. Pressure ulcer growth can cause pain and suffering, lead to social isolation, interfere with functional rehabilitation, and result in an extended hospital stay if problems such as infection, which can lead to sepsis and even death, arise. Apart from the aforementioned medical issues, there are significant and fluctuating financial ramifications as well [9,11]. Nevertheless, if at-risk hospitalized elderly persons are recognized early and preventive measures are taken, pressure ulcers are still mostly a preventable health issue[12,13]. .

The study's aim:

Evaluate the effectiveness of nursing intervention program on prevention of acquired pressure ulcers among hospitalized elderly patients.

Research Hypothesis:

Elderly patients who exposed to nursing intervention program for prevention of pressure ulcers would not develop it.

Subjects and Method

1- **Research Design:** A quasi-experimental design (study & control groups) was used in this study.

II-Setting:

The study was carried out in the medical and orthopaedic departments at Mansoura University Hospital (MUH), Egypt. As many of the immobilized patients in this context would match the inclusion and exclusion criteria of the study sample and would require a hospital stay of at least 14 days, the researchers chose this setting for their study.

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III- Subjects:

Based on the following inclusion criteria, a purposive sample of 84 eligible patients of both sexes were chosen from the previously mentioned setting: Elderly patients 60 years of age and older who are able to understand and communicate and willing to participate in the study voluntarily, patients who have been admitted to the hospital for little more than 24 hours and appear with serious orthopaedic or medical problems allowing them to remain in the hospital for at least 14 days.

Elderly patients who suffer from any terminally ill diseases or who admitted with any degree of pressure sores from homes were excluded from the study.

Sample size calculation:

Research software (https://clincalc.com) was used to establish the sample size for a study on nursing interventions for reducing pressure ulcers in hospitalized geriatric patients. Based on the results of a similar previous study (14), which found that 90% of study group compared to 30% of control group didn't have any stage of pressure ulcer two weeks after nursing interventions were implemented. With an error probability of $\alpha = 0.05$ and a power $(1-\beta) = 0.80$. 76 elderly patients make up the sample size, plus an additional 10% due to dropouts. So, final size of sample required is 84 elderly patients (42 in study group, and 42 in control group).

IV- Tools:

To collect the necessary data four tools were used:

Tool I: Demographic & Medical Data Structured Interview Schedule: This tool consists of three parts:

Part I: Demographic Data: Such as age, gender, educational level, marital status, and occupation before retirement.

Part II: Medical Data: Such as, medical diagnosis on admission, length of hospital stay, medical history and other comorbidities.

Part III: Pressure Ulcer Development Risk Factors: such as body mass index, number of showers per week, type of soap used, amount of fluid intake/ day, type of mattress, use lifting devices, and use of pillows or foam wedges.

Tool II: Braden Risk Assessment Scale: Developed to enhance early identification of patients at risk for pressure ulcers, this scale was adopted from Bergstrom et al. (15) and Moore & Patton (16). It is used to evaluate the existence of risk factors for the development of pressure ulcers. The assessment of sensory perception, skin texture, activity, mobility, friction, shear, and nutritional status is reflected in its six subscales.

Scoring system

The Braden scale is used to evaluate older people. Three points are assigned to skin exposure to friction and shear pressures, while four points are assigned to the remaining five categories. A higher number denotes a lower risk of pressure ulcers. The total score goes from 6 to 23. Patients are categorized as very high risk (score <9), high risk (score

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10-12), moderate risk (score 13-14), low risk (score 15-18), and no risk (score 19-23) based on the Braden Scale.

Tool III: European Pressure Ulcer Advisory Panel (EPUAP) classification;
This scale was adopted in 1999 by the European Pressure Ulcer Advisory Panel (EPUAP) [8]. It used to assess grades of bed sores. The grading system for pressure ulcer classification including; Grade I: Intact skin with non-blanch able redness, Grade II: Partial thickness loss of dermis presenting as a shallow open ulcer with a red, pink wound bed, without slough. May also present as an intact or open/ruptured serum-filled or serosanguinous filled blister, Grade III: Full thickness tissue loss. Subcutaneous fat may be visible, but bone, tendon or muscle are not exposed, may include undermining and tunneling and Grade IV: Full thickness tissue loss with exposed bone, tendon or muscle. The incidence of bedsore and its grades will be investigated by observation [17].

Tool IV: Elderly patients' knowledge towards pressure ulcers prevention instrument: This tool was adopted from **Wilborn and Dassen[18] and Shanley et al., [19]**, it used to assess the elderly patients' knowledge towards pressure ulcers and its prevention impact of pressure ulcers prevention program. This tool consists of about 30 questions. Where correct answers will be coded as 1, and incorrect or missing answers as 0.These scores will summed to produce a total knowledge score for statistical exploration and analysis and had a maximum potential range of 30. Individual question items, which will composed of multiple-choice questions designed to assess patient knowledge of best practice. Elderly patients' feedback will be collected at the program ended.

V- Process of data collection:

Phase I: Preparation Phase

- During this phase, efforts were made to secure approval from the hospital for the data collection process. In order to get the hospital director's consent, Faculty of Nursing official letter had to be submitted. The patients' diagnoses were then confirmed by the researchers in the orthopaedic and medical departments to make sure they fulfilled the criteria for inclusion. After that, the researchers met with the supervisors, staff nurses, and nursing directors in the assigned departments to explain the study goals and methodology and to ask for their assistance as needed.
- The researchers created tool II (demographic and health-related data structured interview schedule) and tool IV (Elderly patients' knowledge towards pressure ulcers prevention instrument) after the relevant literature was reviewed.
- The researchers translated tool II (Braden Risk Assessment Scale) ,and tool III(European Pressure Ulcer Advisory Panel (EPUAP) into Arabic. An expert in the English language from the English Department, Faculty of Education, and Mansoura University employed back translation to confirm the accuracy of the tool translation.
- After conducting a review of the current literature the researchers developed an educational booklet in plain Arabic that included information about pressure ulcers

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and preventive methods ([10,1,20,21]). The content validity of the program booklet was checked by the faculty members who confirmed its clarity and comprehensiveness. It given to every elderly patient participated in the research

- Methods of teaching: A variety of instructional methods were determined, including demonstrations, and visual aids such as PowerPoint, videos and posters, were used. Handouts and booklets were distributed.

- The content validity of the tools were evaluated by five jury experts and university professors specializing in gerontological nursing and medical surgical nursing. The study tools, in their judgment, were clear and practicable, and no changes were suggested. The tools' reliability for internal consistency was statistically examined using Cronbach's alpha coefficient, which revealed that tool II was 0.95 and tool III was 0.84, and tool IV was 0.86 indicating that the tools were very reliable.
- The researchers perform a pilot study on 10% (8) elderly from the medical and orthopedic departments at Mansoura University hospital to test the applicability, feasibility, and completeness of the study tools and to estimate the time needed to complete it. Based on finding, no modifications were made as the tools were clear, understandable, and objective.

Phase II: Operational phase

- In order to directly notify the head nurses in each relevant department of newly admitted patients who fit the inclusion criteria within 24 hours of admission, the researchers collaborated with them to schedule intervention sessions. Notifying the head nurses of the designated admission day for patients with significant orthopaedic or medical issues assisted in facilitating this communication. Additionally, the researchers ensured daily confirmation with the head nurse to maintain consistency in the process.
- Subsequently, the researchers proceeded to have one-on-one meetings with every study group patient. They obtained their agreement to participate by thoroughly explaining the study goals and methods used to gather information. The researchers then used tools I, II, III, and IV to evaluate patient demographic and medical information, pressure ulcer development risk factors, stages of the ulcer, and patient knowledge of pressure ulcer prevention.
- The researchers initiated the intervention sessions individually for every elderly patient as soon as they identified risk factors for pressure ulcers. Every patient was assured that this care would be given throughout each shift, especially in the morning and afternoon, with night shifts being handled by family members under the direction of nurses.
- The demographic and medical data of the patients in the control group were evaluated by the researchers, along with the assessment of the patients' being aware of pressure ulcer prevention, the stages of pressure ulcer development, and any risk factors for pressure ulcers. This assessment was conducted using tools 1, II, III, and IV. Subsequently, the researchers informed the assigned nurses for the control group patients, allowing them to commence routine nursing care in accordance with the hospital policy.

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The nursing intervention program: It contained of 6 sessions and was presented over a period of two weeks, 3 sessions per week as follows:

• First session

The session provided an overview of the program and discussed the importance of skin health, highlighting potential risks to skin integrity. It also touched upon the definition of pressure ulcers and identified individuals who are susceptible to developing them.

• Second session

This session centered on skincare, specifically emphasizing the importance of inspecting the skin and understanding where, when, and what to look for. It offered practical advice on maintaining healthy skin, including the recommendation to change positions every hour. Towards the end of the session, the elderly patients were presented with various soap alternatives and moisturizers. Samples of each were provided for them to try.

• Third session

Keep moving (this session was focused on ways to prevent PU). It further demonstrated methods of safe sitting, turning movement and how to avoid pressure ulcers while lying in bed. Place pillows or dressings between the skin surfaces and over bony prominences. Activity sheet to complete, also over the following week for our elderly patients

• Fourth session

During this session, the main topic was nutrition and how it impacts overall health. The discussion emphasized the importance of ensuring that elderly patients consume enough fluids (6 to 8 cups) on a daily basis, either orally or through IV infusions if necessary. The food pyramid was briefly introduced, along with examples of serving sizes from each level. Additionally, hospital meals that meet all of the participants' dietary criteria were given..

• Fifth session

The topics of this lesson included the reasons of incontinence in older individuals as well as skin hygiene. There are also product samples available that may be used to clean the skin and shield it from the effects of incontinence. Upon bony prominences, keep the skin clean, dry, and apply lubricating lotion once a day.

• Sixth session

This is a summary session designed to highlight the key points made in each presentation as well as the pertinent activities related to each session, like activity sheets, diet diaries, and skin care items that the elderly patients can test, like moisturizer and soap alternatives.

Phase III: Evaluation phase:

- The researchers notified the senior nurse and the nursing staff in each ward that a daily visit would take place during the morning and afternoon shifts. During the implementation phase, one of the researchers would determine whether the elderly patients in the study and control groups experienced pressure ulcer development. This evaluation was to continue until elderly patients were released. Likewise, for each group of elderly patients, assigned family members and nurses would conduct the same evaluation at night.

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- All elderly patients in both groups were evaluated on four occasions using tools II. Also, on two occasions using tool III for assessing stages of pressure ulcers, and tool IV for assessing elderly patients' knowledge towards pressure ulcers prevention before and immediately after implementation of the intervention sessions**.**
- The period of data collection was five months, starting on November 1, 2023, and ending on March 31, 2024.

Ethical considerations:

Mansoura University's Faculty of Nursing research ethics committee accepted the conduct of the current study and assigned it reference number 0557. The purpose of the study was explained to elderly patients, who were then asked to sign a written consent form. Anonymity, privacy, confidentiality, and the option to withdraw at any time were guaranteed.

Statistical analysis:

Data were organized, tabulated, and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 22, SPSS Inc. Chicago, IL, USA). It was agreed that normalcy was assumed. As a result, categorical data were described using frequency and percentage. Continuous variables were represented by the mean and standard deviation. Two group comparisons of demographic and medical data at baseline were performed using Chi-square test, and Monte Carlo test. The Student t test is used to compare the means of two groups, whereas the Analysis of Variance (ANOVA) test is used to compare the means of more than two groups. The 95% confidence intervals for crude odds ratios (CORs) were computed. In order to determine the independent pressure ulcer predictors, bivariate analysis revealed significant relationships that were then put into a multivariate logistic regression model. Graphing was done with Microsoft Excel to visualize the data. A significance level of 0.05 or less was established.

Study limitations:

Two weeks beforehand, four elderly patients (from both groups) either left the hospital or withdrew. To maintain the sample size, they were then replaced by additional patients who fulfilled the study criteria.

Results

Table (1) Shows that, there were 42 elderly patients in each group,. The mean age of study group is 64.26 ± 4.26 years compared to 65.64 ± 4.65 years in the control group. Males constituted 71.4% and 64.3% of the elderly in the study and control groups respectively. About the marital status and level of education 71.4% and 78.6% of elderly in both groups were married respectively, and 61.9% of the studied elderly had a secondary level of education compared to 52.4% of the control groups respectively. Concerning work before retirement and income, 69.0% of the study group's elderly

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patients and 54.8% of the control group indicated that they have enough income. In any of the demographic data there was no statistically significant difference between the two groups.

Table (1): Demographic data of the elderly patients in the study and control groups

Demographic data	Study group		Control group		Test of significance
	N (42)	(%)	N (42)	(%)	
Age					
60 - 70 years	35	83.3	34	81.0	$\chi 2$ =0.081 (0.776)
70 year and more	7	16.7	8	19.0	
Mean ± SD	64.26± 4.26		65.64± 4.65		t= 0.392 (0.697)
Sex					
Male	30	71.4	27	64.3	$\chi 2$ =0.491 (0.483)
Female	12	28.6	15	35.7	
Marital status					
Married	30	71.4	33	78.6	$\chi 2$ = 0.571 (0.450)
Unmarried	12	28.6	9	21.4	
Educational level					
Read and write	6	14.3	11	26.2	$\chi 2$ = 1.915 (0.590)
Primary	5	11.9	4	9.5	
Secondary	26	61.9	22	52.4	
University	5	11.9	5	11.9	
Income					
Not enough	13	31.0	19	45.2	$\chi 2$ = 1.817 (0.187)
Enough	29	69.0	23	54.8	

(*) Statistically significant at p ≤0.05, χ^2 = chi square, t: student t test

Table (2) reveals that, In the study group, 76.2% of the elderly patients reported having hypertension, while in the control group, 81.0% had the same. Similarly, 71.4% of elderly patients in the study group, reported having diabetes mellitus, while the control group's percentages were 78.6% and 69.0%, respectively. 47.6% and 50.0% of the study and control groups, respectively, reported having a stroke. 40.5% of the study group and 42.9% of the control group reported having musculoskeletal disorders, respectively. The two groups' medical histories did not differ in a way that was statistically significant. As respect to further risk factors that might be involved in the development of, pressure ulcers, hospital stay for more than two weeks was reported by 78.6% in the study group compared to 66.7% in the control group. Compared to 69.0% in the control group, 83.3% of the study group had been found to be overweight. Having one shower per week, using ordinary soap, using ordinary mattress, and consuming only 3 to 5 cups of fluid per day were reported by 88.1%, 64.3%, 61.9 and 78.6% in the study group compared to 88.1%, 71.4%, 64.3%, and 83.3% in the control group respectively. Regarding the risk factors

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linked to the development of pressure ulcers, there was no statistically significant difference between the two groups.

Table (2): Factors that may lead to pressure ulcers for the elderly patients at the hospital in the study and control groups

Risk factors	Study group		Control group		Test of significance
	N (42)	(%)	N (42)	(%)	
Chronic diseases					
Hypertension	32	76.2	34	81.0	$\chi 2 = 0.283$ (0.595)
Diabetes Mellitus	30	71.4	33	78.6	$\chi 2 = 0.571$ (0.450)
Heart disease	30	71.4	29	69.0	$\chi 2 = 0.057$ (0.811)
Stroke	20	47.6	21	50.0	$\chi 2 = 0.048$ (0.827)
Musculoskeletal disorders	18	42.9	17	40.5	$\chi 2 = 0.049$ (0.825)
Respiratory	10	23.8	12	28.6	$\chi 2 = 0.246$ (0.620)
Liver disease	8	19.0	6	14.3	$\chi 2 = 0.343$ (0.558)
Duration of hospital stay					
Two weeks	9	21.4	14	33.3	$\chi 2 = 1.497$ (0.224)
More than two weeks	33	78.6	28	66.7	
BMI					
25 – 29.9 (overweight)	35	83.3	29	69.0	$\chi 2 = 2.363$ (0.124)
4-30 and more (obesity)	7	16.7	13	31.0	
Number of showers per week					
Once	37	88.1	37	88.1	$\chi 2 = 0.000$ (0.1000)
Twice	5	11.9	5	11.9	
Type of soap					
Ordinary soap	27	64.3	30	71.4	MC = 0.632 (0.729)
Cream soap	11	26.2	8	19.0	
Antiseptic soap	4	9.5	4	9.5	
Type of mattress					
Air mattress	7	16.7	4	9.5	MC = 1.059 (0.787)
Latex mattress	1	2.4	1	2.4	
Mattress containing foam materials	8	19.0	10	23.8	
Ordinary mattress	26	61.9	27	64.3	
Amount of fluids					
3 – 5 cups	33	78.6	35	83.3	$\chi 2 = 0.309$ (0.578)
6 – 8 cups	9	21.4	7	16.7	
Smoking					
Yes	18	42.9	20	47.6	$\chi 2 = 0.192$ (0.661)
No	24	57.1	22	52.4	

(*) Statistically significant at $p \leq 0.05$, χ^2 = chi square, MC: Monte Carlo test

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According to Table (3), prior to the implementation of the nursing intervention program, 61.9% of the study group had a mild risk of developing pressure ulcers, followed by 11.9% with a moderate risk. In contrast, 59.5% of the control group had a mild risk of developing pressure ulcers, followed by 9.5% with a moderate risk. On the 4th day of the nursing intervention program, there was no changes concerning the study group, compared to the control group 50.0% of them had a mild risk of pressure ulcer development followed by 21.4% with moderate risk.

After 1st week of the nursing intervention program implementation, 47.6% of the study group had a mild risk of pressure ulcer development and 45.2% with no risk. Compared to 42.9% of the control group had a mild risk of pressure ulcer development and 28.6% with moderate risk. After the 2nd week of the nursing intervention program, 69.0% of the study group had no risk of pressure ulcer development compared to 38.1% of the control group had a mild risk of pressure ulcer development and 33.3% with moderate risk. **(The study group shows overall improvement throughout the nursing intervention program implementation while the control group shows overall worsening).**

Table (3): Predicting pressure ulcers risk among elderly patients in the study and control groups using Braden throughout the nursing intervention program implementation

Braden scale for predicting pressure ulcer risk		Study group		Control group		Test of significance
		N (42)	(%)	N (42)	(%)	
Pre	No risk	11	26.2	13	31.0	$\chi2 = 0.297$ (0.862)
	Mild risk	26	61.9	25	59.5	
	Moderate risk	5	11.9	4	9.5	
	High risk	0	0.0	0	0.0	
4th day	No risk	11	26.2	10	23.8	$\chi2 = 3.722$ (0.293)
	Mild risk	26	61.9	21	50.0	
	Moderate risk	5	11.9	9	21.4	
	High risk	0	0.0	2	4.8	
1st week	No risk	19	45.2	8	19.0	$\chi2 = 13.987$ (0.003)**
	Mild risk	20	47.6	18	42.9	
	Moderate risk	3	7.1	12	28.6	
	High risk	0	0.0	4	9.5	
2nd week	No risk	29	69.0	6	14.3	$\chi2 = 0.063$ (0. 969)
	Mild risk	13	31.0	16	38.1	
	Moderate risk	0	0.0	14	33.3	
	High risk	0	0.0	6	14.3	

Table (4) shows that, the majority of the study group 88.1% did not develop pressure ulcers post the implementation of nursing intervention program and only 11.9%

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of them had stage I, compared to 40.5% of the control group had stage I pressure ulcers followed by 14.3% of them had stage II and 9.5% had stage III pressure ulcers post nursing intervention program implementation. Furthermore, there was a statistically significant difference (P=0.001) in the grades of pressure ulcer development between the two groups.

Table 4: Stages of pressure ulcers after nursing intervention program implementation among the study and control groups

EPUAP classification	Study group		Control group		Test of significance	
	N	%	N	%	$\chi 2$	P
No	37	88.1	15	35.7	25.853	(<0.001) **
Stage I	5	11.9	17	40.5		
Stage II	0	0.0	6	14.3		
Stage III	0	0.0	4	9.5		

Figure (1) indicates that, before the implementation of the nursing intervention program, no statistically significant difference was found in, the mean score of knowledge regarding the prevention of pressure ulcers between the study and control groups. On the other hand, the study group's mean knowledge score significantly improved after the nursing intervention program was implemented in comparison to the control group (P=0.001).

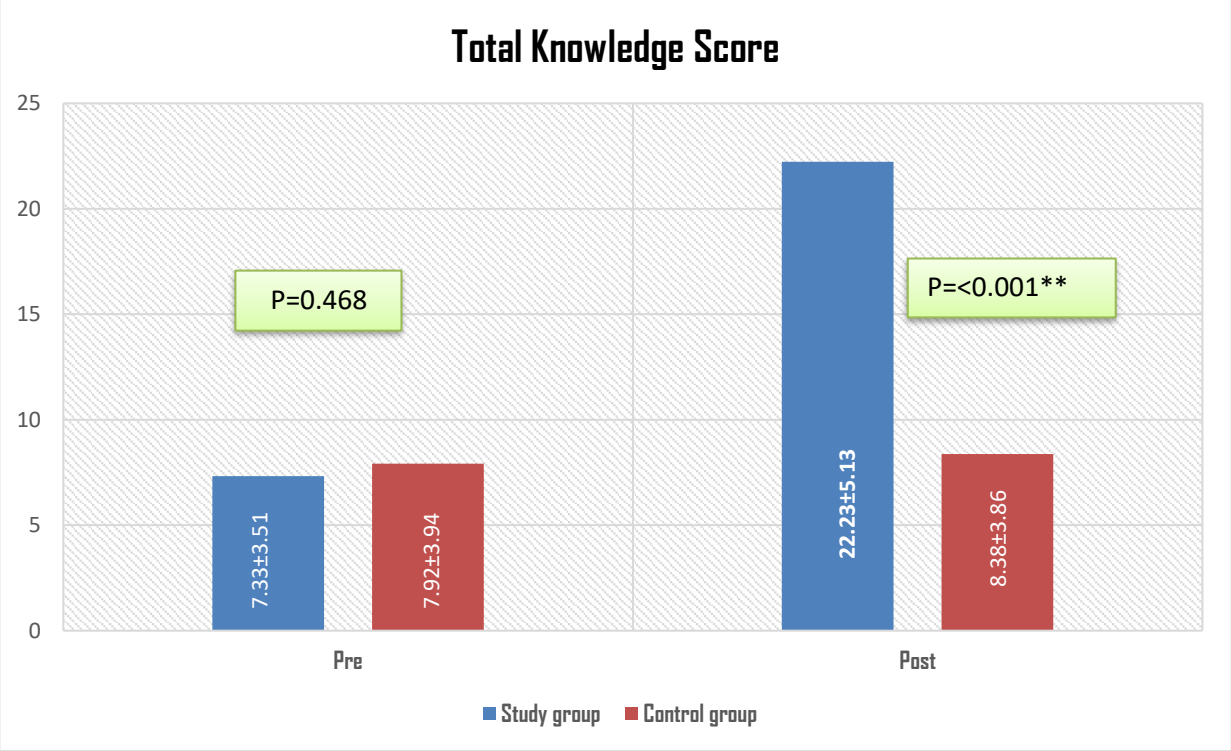

Figure 1: Elderly patients' knowledge towards pressure ulcers prevention pre and post the nursing intervention program implementation among the study and control groups

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Table (5): Indicates that among the study group, the independent predictors of developing pressure ulcers were still higher in the elderly patients who were 70 years of age or older, had hospital stay more than two weeks, being obesity, smoking, and who suffering from diabetes and stroke (COR= 1.5, 3.2, 2.1, 3.1, 4.9 and 9.4 respectively).

Table 5: Predicting factors for developing pressure ulcers after the nursing intervention program implementation in the study group

Demographic data	Risk for PU		P value	COR (95%CI)	AOR (95%CI)
	N	(%)			
Overall	13	31.0			
Age					
60 - 70 years	8	22.9	0.011*	1	1
70 year and	5	71.4		1.5(0.973-2.352)*	8.438 (1.367-52.062)
Duration of hospital stay					
Two weeks	4	12.1	<0.001**	1	
More than two weeks	9	100.0		3.2(1.438-7.345)	
BMI					
Overweight	6	17.1	<0.001**	1	
obesity	7	100.0		2.1(1.204-3.898)	
Smoking					
No	3	12.5	0.003**	1	1
Yes	10	55.6		3.1 (1.134-8.681)	0.114 (0.025-0.526)
Suffering from Diabetes					
No	1	8.3	0.045*	1	1
Yes	12	40.0		4.9(0.709-34.306)	7.333 (0.834-64.454)
Suffering from stroke					
No	1	4.5	<0.001**	1	1
Yes	12	60.0		9.4(1.413-62.715)	31.500 (3.502-83.300)

COR=Crude odds ratio, AOR=Adjusted odds ratio, CI= Confidence Interval
* & ** Significant at P≤0.05 & ≤0.001; respectively

Table (6) Notifies that, there was a statistically significant relation between each of educational level, work before retirement and enough income of the study group and their knowledge about pressure ulcer prevention. In which females, elderly patients who had higher education with enough income had higher mean score of knowledge about pressure ulcer prevention after the implementation of nursing intervention program.

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Table 6: Relation between demographic data of the elderly patients and their knowledge about pressure ulcer prevention after the nursing intervention program implementation in the study group

Demographic data	Post total Knowledge	Test of significance
	Mean ± SD	
Age		
60 less than 70 years	23.71± 3.54	t =0.830 (0.412)
70 year and more	21.94± 5.39	
Sex		
Male	21.73±5.72	t =1.007 (0.320)
Female	23.50±3.09	
Marital status		
Married	16.04± 9.11	F= 1.160 (0.324)
Unmarried	15.06± 8.08	
Educational level		
Read and write	14.00±8.22	F = 9.289 (<0.001)**
Primary	20.00±3.59	
Secondary	23.67±3.69	
University	25.00±.000	
Income		
Not enough	21.21±5.65	t = 2.115 (0.05)*
Enough	24.54±2.7	

Discussion

Pressure ulcers persevere as one of the serious hospital acquired problem particularly for elderly patients. Nevertheless, nursing interventions, such as early warning sign identification, skin dryness maintenance, and emphasis on early ambulation of elderly patients to avoid pressure on bony prominences and improve circulation, play a crucial role in preventing the creation of pressure ulcers despite mounting evidence and guidelines for their prevention. For this reason, educating the hospitalized elderly patients is crucial for both preventing and managing pressure ulcers [20,21].

Accordingly, this study aimed to evaluate the effectiveness of nursing intervention program on prevention of acquired pressure ulcers among hospitalized elderly patients. The current results found no statistically significant differences in the demographics of the study and control groups. This was corroborated by **Boonchoo et al., (2019)** [22], who reported that it

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is crucial to ensure that the groups are equal before the experiment starts in order to prevent bias based on a variable known to effect outcomes, like age, sex. Furthermore, the study group's mean age was 64.26 ± 4.26 years while that of control group was 65.64 ± 4.65 years, the percentage of male was more in the study group (71.4%) compared with control group (64.3%). Secondary level of education was the most prevailing educational level among the study and control groups (61.9% and 52.4% respectively). This could be explained by age-related changes, particularly to the skin, where thinner cell layers, less vascularization, more proliferating cells, and slower healing times make the skin more delicate and more prone to pressure ulcers. These findings agree with studies done in Egypt, by **Mayhob and Amin (2021)** [23] who revealed that the mean age in both the intervention and control groups were 60 ± 6.2 and 60.35±5.21 respectively and in Iran by **Razi-Chafi, (2023)** [24] who found that the mean age of the studied patients was 69.54 ± 9.33 years.

A longer length of stay is an established risk factor for acquired pressure ulcers because patients with longer length of stay generally experience higher severity of diseases, along with increased duration of exposure compared to patients with shorter length of stay [25]. As regards the current study's findings, hospital stay for more than two weeks was reported by 78.6% in the study group compared to 66.7% in the control group. This can be the result of persistent pressure on body parts, which can reduce blood flow to tissues - a blood supply necessary for cells to receive oxygen and other nutrients. Without these essential nutrients, the skin and surrounding tissues suffer damage and may eventually die, hastening the development of pressure ulcers. The same finding was found in the study done in Korea by **Han et al., (2020)** [26] and in Finland by **Tervo-Heikkinen et al., (2022)** [27] who observed that there was strong association between length of hospital stay and pressure ulcer development.

A crucial first step in clinical practice and preventative nurse interventions is identifying patients who are at risk of developing pressure ulcers early on [20]. So, in the present study, before implementation of the nursing intervention program 61.9% of the study group had mild risk of pressure ulcer development followed by (11.9%) with moderate risk compared to 59.5% of the control group had a mild risk of pressure ulcer

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development followed by 9.5% with moderate risk. On the 4th day of the nursing intervention program, there were no changes concerning the study group, compared to the control group 50.0% of them had a mild risk of pressure ulcer development followed by 21.4% with moderate risk.

This finding may be justified by the constant presence of researchers in all shifts, alternating with nurses in the department. In addition to most of the study sample were young old, married and secondary educated, which helped elders and encouraged them to understand and follow instructions presented in the intervention and apply it frequently through the day. In the same line another studies done in Egypt by **Ibrahim & Mokhtar, (2020)** [28]; **Sayed & Sliman, (2021)** [29] revealed that most of the patients under study had mild risks, and that this percentage decreased following the implementation of nursing training.

Additionally, the current study revealed that, the study group shows overall improvement throughout the application of the nursing intervention program while the control group shows overall worsening regarding pressure ulcers risk. This finding may be justified by many reasons, the program's impact includes regular elderly position changes every two hours, which lessen pressure, friction, and shear damage. It also minimizes the effects of prolonged pressure on bony prominences, which keeps the area supplied with enough oxygen and nutrients and prevents tissue death. Additionally, maintaining clean and dry skin can reduce the likelihood of developing pressure ulcers. Moreover, to avoid skin damage around bone prominences, made massage and apply cream on a daily basis.

These findings in agreement with another studies performed at Saudi Arabia by **Al Mutair et al., (2020)** [7]; at Egypt by **Sayed et al., (2022)** [30] and at Iran by **Khodayari et al., (2024)** [31] who noticed that, when the program had been implemented into place, the risk of pressure ulcers was statistically significant decreased than it was before. Besides, the current study indicated that between the two groups, there was a statistically significant difference in the grades of formed pressure ulcers. As, 88.1% of the study group didn't develop pressure ulcers after the nursing intervention program was implemented, and only 11.9% of them had stage I, while

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40.5% of the control group developed stage I pressure ulcers after the nursing intervention program was implemented.

Also, this findings match with study done in Egypt by **Ibrahim & Mokhtar (2020)** [28] who noted that there was a statistically significant difference in the development of pressure ulcers before, during, and after three months. In this regard, **Mobed et al.,(2022)** [32] in a study was performed at Egypt highlighted that following intervention, a statistically significant difference was reported in the mean and standard deviation of pressure ulcer development between the study and control groups.

In addition, the current study presented that the mean score of knowledge of the study group regarding prevention of pressure ulcers development was higher and significantly improved in contrast to the control group after nursing intervention program implementation as a statistically significant difference between the two groups (P=0.001). This can be justified by the fact that majority of the sample completed a 2nd school and university education that helps older people see their own talents in a new light and gain control over the risk factors for the problem. In addition to continuous and restrict supervision from the researchers along the period of intervention program implementation. This result was accordance with studies conducted in Egypt by **Awad & Hewi (2020)** [33] who stated that the average post-test knowledge score for pressure ulcers (26.92 ± 1.40) was considerably higher than the pre-test score (10.68 ± 4.05) among the subjects (P < 0.001).

The same opinion was found in another studies performed in Australia by **Deakin et al., (2020)** [34] and in Baghdad by **Noor & Hassan, (2021)** [35] who clarified that there was statistical significant improvement in knowledge level of the studied subjects regarding prevention of pressure ulcers occurrence after intervention compared to before intervention (P=<0.001). This result was consistent with a study performed in Nigeria by **Gbadamosi et al., (2023)** [36] stated that the knowledge level regarding pressure ulcers improved in intervention group 13.97 ± 0.892 after intervention application compared to control group 11.90 ± 1.716 at (P<0.001) .

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According the results of the current study, the research hypothesis was proved as hospitalized elderly patients enrolled in the study group showed a meaningful improvement in prevention of acquired pressure ulcers than those in the control group.

Conclusion

The present study assumed that this program of nursing intervention had a notable beneficial impact on enhancing the information of elderly patients, which in turn decreased the frequency and severity of pressure ulcers that the elderly acquired in hospitals.

Recommendations

- Implementation of a nursing intervention program as a highly recommended approach to prevent pressure ulcers in immobilized and hospitalized elderly patients.
- Ongoing training about pressure ulcer prevention for hospitalized elderly patients should be designed and conducted regularly.
-Development of different pressure ulcer protocols focused on high risk elderly as obese old old with multiple comorbidities, and who with prolonged hospital stay.
- Establishing of protocols for hospital acquired pressure ulcers prevention in partnership with nursing stuff, and elderly patient's caregivers.

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Declaration of Competing Interest

The researchers declare that their interests are not in odds with one another. Upon a reasonable request, the corresponding author will provide all information needed, including statistics.

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