Original Article

Effectiveness of Nursing Interventions in Preventing Pressure Ulcers among Immobile Stroke Patients

Abstract

Background: Individuals with physical disabilities are more likely to develop pressure ulcers due to restricted mobility and diminished sensation. Stroke is the most prevalent medical diagnosis associated with pressure injuries. Pressure ulcer (PU) is a common complication associated with strokes. Timely recognition and implementation of preventive measures are essential in preventing the development of pressure ulcers. This study aimed to explore the effectiveness of nursing interventions in preventing pressure ulcers among immobile stroke patients. **Materials and Methods:** A simple random sampling technique was used to recruit 128 patients; 64 patients were assigned to the control group and 64 to the intervention group. Patients were recruited from the neurological ward at Rizgary Teaching Hospital, Erbil City, Kurdistan region of Iraq, and from the intensive care unit (ICU) at the East Emergency Hospital. Data collection tools included the Braden scale, a risk assessment tool for PUs, and a structured questionnaire. The Chi-square test, logistic regression, and an independent sample *t*-test were used to analyze the data. The significant level was set as a $p < 0.05$. **Results:** Heart diseases, diabetes mellitus, smoking, advanced age, and friction and shear were the main risk factors for PUs development among immobile stroke patients. The nursing educational interventional program was highly effective in reducing the incidence of PUs among immobile stroke patients ($t = 4.130$, $p < 0.001$). **Conclusions:** Appropriate nursing interventions and patient education can significantly reduce the incidence of PUs as well as prolong the development of PUs among immobile stroke patients.

Keywords: *Evidence-based nursing, pressure ulcers, prevention, stroke*

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Introduction

Individuals with physical disabilities are more likely to develop pressure ulcers (PUs) due to restricted mobility and diminished sensation, underlying medical conditions, such as multiple sclerosis, cerebral palsy, and hemiplegia, and other neurological conditions, such as stroke put patients at higher risks for developing PU.[1] Stroke is the most prevalent medical diagnosis associated with pressure injuries (PIs). This finding highlights the critical relationship between neurological conditions, particularly stroke, and the development of PIs. Patients who have experienced a stroke and have PUs showed a higher mortality rate than stroke patients without PUs.[2]

Pressure ulcers, often known as pressure sores or bedsores, are localized injuries to the skin and underlying tissue that occurs when there is prolonged pressure is applied to the skin. These injuries typically develop over bony areas of the body, such as the heels, sacrum, elbows, and hips, where the skin is in direct contact with a surface like a bed or chair.[3] The prevalence of PUs among stroke patients in two UK hospitals is 28%.[4] Understanding the prevalence rates of PUs is crucial for assessing the severity of the issue, designing preventive measures, and facilitating the use of healthcare resources. This would serve as baseline data to assess the quality of care delivered by healthcare providers in clinical areas.[5] It is estimated that about 2.5 million people in the United States develop PUs annually.[6] In the United States, approximately 60,000 deaths per year are associated with complications due to PUs. PUs impact patients and their families socially, economically, and psychologically. Treatment costs are more than twice the prevention costs. The daily costs for the treatment of PUs per patient vary in all health settings ranging from €2.65 to €87.57.[7]

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Timely recognition and intervention are essential in preventing the development of PUs. Healthcare providers must regularly assess at-risk patients and implement preventive measures, such as repositioning the patient, pressure relief, and appropriate wound care. Providing education and interventions for patients and caregivers about skincare and early detection is crucial in reducing the incidence and severity of PUs, ultimately leading to improved patient outcomes and quality of life.[8] Prevention involves maintaining and enhancing tissue tolerance and implementing proper offloading strategies. Prevention strategies include proper skincare (keeping the skin clean and dry), sufficient nourishment and hydration, establishing turning schedules, pressure-relieving cushions, and the application of support surfaces.[9]

To the authors' knowledge, there is a lack of studies on preventing PUs among immobile stroke patients. This study aimed to reduce the incidence of PUs among immobile stroke patients This study aimed to explore the effectiveness of nursing interventions in preventing pressure ulcers among immobile stroke patients at Rizgary Teaching Hospital, Erbil City, Kurdistan region of Iraq.

Materials and Methods

A randomized control trial study design was used to explore the effectiveness of nursing education and interventions in preventing PUs among immobile stroke patients. The study was conducted from September 1, 2024 to June 3, 2025 at Rizgary Teaching Hospital (neurology ward) and East Emergency Hospital (intensive care unit). Clinical trial registration number: NCT06981962. The sample population included immobile stroke patients seeking care at two public hospitals in Erbil city (Rizgary Teaching Hospital and East Emergency Hospital). The inclusion criteria included both genders (males and females), age: ≥18 years, Braden scale score ≤ 12, patients who being able to communicate, providing written informed consent, not being part of any other study, and not receiving any information regarding preventing PUs. A simple random sampling technique was used to recruit 128 patients [Figure 1], who were admitted to the neurology ward or the intensive care unit to assess the effectiveness of nursing interventions on preventing PUs among immobile stroke patients. The researcher randomly selected 128.

In this study, to collect the necessary data, the Braden scale was used as a pressure ulcer risk assessment tool.[10] It comprises of six subscales: sensory perception, activity, mobility, nutrition, moisture, and friction and shear. Each subscale is scored from 1 to 4 with the overall total score ranging from 6 to 23 (highest). A lower total score indicates a higher the risk of developing pressure ulcers.[11,12] The researcher developed the questionnaire according to the extensive literature search, and it consisted of two parts. Part I was divided into two sections. Section A included sociodemographic characteristics of the patient, and Section B included the patient's clinical characteristics and anthropometric measurements. Part II was divided into three sections. Section A consists of risk factors associated with pressure ulcers, Section B comprises patients' skin characteristics, and Section C comprises of frequency of pressure ulcer development after intervention. The control group received daily routine care. The program was given to the patients over two days in the hospital using face-to-face interview. In the first day, education was given to the patients, while in the second day of the program, demonstration was shown to the patients. The educational interventional program and demonstration that was given to the patients was consisted of proper positioning, frequent change of patients' posture to limit or decrease pressure

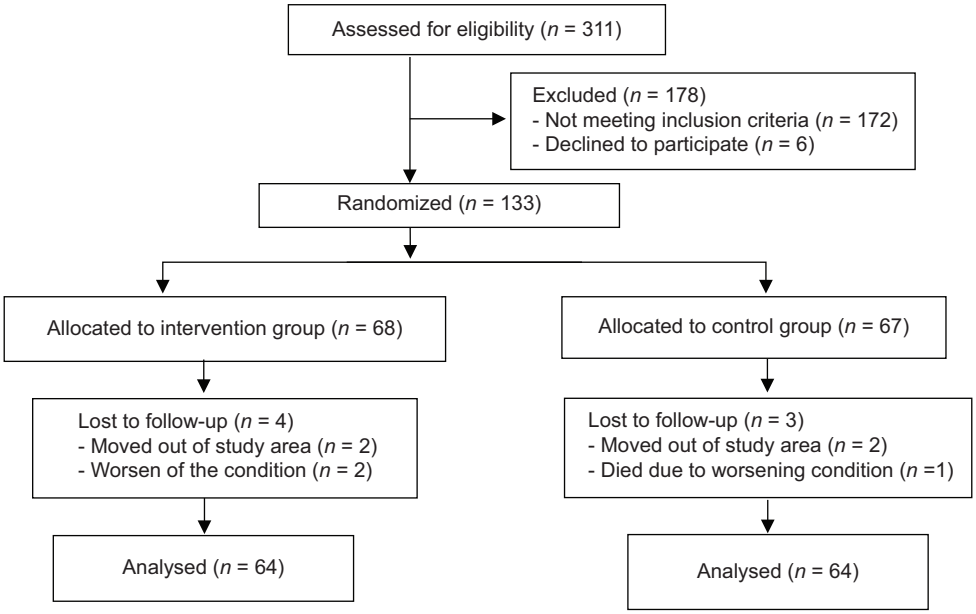

Figure 1: Sample selection of the study participants

over the skin, and skincare, such as maintaining adequate hydration, keeping skin clean, preventing excessive dryness of skin, preventing message over bony prominence, and controlling moisture.

Data were analyzed using IBM SPSS (Statistical Package for Social Science) version 23. Frequency and percentage were used to describe patients' sociodemographic and skin characteristics and data related to pressure ulcers. The Chi-square test determined the relationship between developing PUs and categorical variables. Logistic regression describes independent variables (risk factors) and dependent variables (pressure ulcer). An independent sample *t*-test was used to compare and determine the significant difference between the means of the two groups (intervention and control groups). Significant level was set at $P < 0.05$.

The prevention of the PU development (PU incidence) was the primary outcome. The main outcomes of the nursing interventions program on the prevention of PUs had been evaluated by the researcher. During the first and second home visits, patients' skin was assessed for the development of PUs. A patient who moved from a high and very high-risk Braden scale score (≤12) to stage-one PU and above is considered as the occurrence of a PU event.

Ethical considerations

Ethical approval for this study was obtained from the ethical committee (No. 2462 on September 1, 2024) at the College of Nursing/Hawler Medical University. Before collecting the data, verbal and written informed consent were obtained from all participants. The study's purpose, benefits, and risks were explained in detail to the patients. Participants were informed that their participation was voluntary and they had right to leave or withdraw from the study at any point they wanted without an obligation to continue and without explaining the reason for leaving the study. Finally, the participants were assured that the information and data collected will be kept confidential and used for the study's purposes only.

Results

Table 1 shows the comparison between sociodemographic characteristics of the study participants (64 in the intervention and 64 in the control groups). There was no statistically significant difference between the two groups in all sociodemographic characteristics as $p > 0.05$. This means that both groups are nearly equal in their sociodemographic characteristics. Most of the patients were aged between 55 and 64 years (45.31% of intervention and 48.44% of control groups). The majority of them (62.50%) were male in both groups. The highest percentage of intervention and control groups were married (98.44% and 90.63%, respectively). Regarding the educational level (45.31%) of both groups was illiterate. Approximately three-quarter of intervention and control groups (70.31%

Table 1: Comparison between sociodemographic characteristics of the study participants

Sociodemographic characteristics		Intervention group (*n*=64) F (%)	Control group (*n*=64) F (%)	*p*
Age group/ years	45–54 yrs.	16 (25.00)	16 (25.00)	0.810
	55–64 yrs.	29 (45.31)	31 (48.44)	
	65–73 yrs.	19 (29.69)	17 (26.56)	
Gender	Male	40 (62.50)	40 (62.50)	1.000
	Female	24 (37.50)	24 (37.50)	
Marital status	Single	1 (1.56)	6 (9.37)	0.061
	Married	63 (98.44)	58 (90.63)	
Educational level	Illiterate	29 (45.31)	29 (45.31)	1.000
	Primary school	27 (42.19)	27 (42.19)	
	High school	4 (6.25)	4 (6.25)	
	Technical diploma and college graduate	4 (6.25)	4 (6.25)	
Economic status	Sufficient	2 (3.13)	1(1.56)	0.488
	Barely sufficient	17 (26.56)	15 (23.44)	
	Insufficient	45 (70.31)	48 (75.00)	
Area of residence	Urban	63 (98.44)	62 (96.88)	0.563
	Rural	1 (1.56)	2 (3.12)	
Duration of hospitalization	1–3 days	43 (67.19)	38 (59.38)	0.507
	4–5 days	21 (32.81)	26 (40.62)	
Smoking	Smoker	23 (35.94)	26 (40.62)	0.783
	Nonsmoker	35 (54.69)	31 (48.44)	
	Ex-smoker	6 (9.37)	7 (10.94)	
Cigarettes per day	0–20 Cigarettes	46 (71.88)	39 (60.94)	0.209
	21–40 Cigarettes	16 (25.00)	22 (34.38)	
	41–60 Cigarettes	2 (3.12)	3 (4.68)	

and 75.00%, respectively) had insufficient economic status. Almost all study participants (98.44 of intervention and 96.88 of control groups) lived in urban areas. Most of the intervention group (67.19%) and the control group (59.38%) were hospitalized for 1–3 days. More than half (54.69%) of the intervention group and 48.44% of the control group were nonsmokers. Nearly three-quarter (71.88%) of the intervention group and (60.94%) of the control group smoked 0–20 cigarettes per day.

Table 2 shows skin characteristics of the study participants. Most patients' skin color in the intervention and control groups (82.81% and 76.56%, respectively) was pallor. The majority (73.44% and 67.19%, respectively) of patients' skin turgor in the intervention and control groups was impaired. Both groups (60.94% and 65.62%, respectively) had impaired tissue perfusion. Most of the patients (71.88%) in the intervention group had dry skin. However, 54.69% of the participants in the control group had dry skin. Regarding the skin, the temperature (62.50% and 59.38%, respectively) of both groups had warm skin.

Table 2: Patients' skin characteristics

Skin characteristics		Intervention group (*n*=64) F (%)	Control group (*n*=64) F (%)	*p*
Color	Normal	11 (17.19)	15 (23.44)	0.383
	Pallor	53 (82.81)	49 (76.56)	
Turgor	Normal	17 (26.56)	21(32.81)	0.562
	Impaired	47 (73.44)	43 (67.19)	
Tissue perfusion	Normal	25 (39.06)	22 (34.38)	0.359
	Impaired	39 (60.94)	42 (65.62)	
Moisture	Dry	46 (71.88)	35 (54.69)	0.451
	Moist	14 (21.87)	27 (42.19)	
	Wet	4 (6.25)	2 (3.12)	
Temperature	Normal	15 (23.44)	16 (25.00)	0.415
	Warmth	40 (62.50)	38 (59.38)	
	Coolness	9 (14.06)	10 (15.62)	

Table 3 shows information regarding pressure ulcer formation during the first follow-up (10 days post-discharge) and the second follow-up (21 days post-discharge) for both groups. No patients developed PU at the first follow-up in the intervention group. Only one patient (1.56%) developed one PU at the second follow-up in the intervention group. In the control group, there were 16 patients (25.00%) who developed PUs. Twelve patients (18.75%) developed PUs at the first follow-up and 4 (6.25%) developed PUs in the second follow-up.

Table 4 shows the relationship between the sociodemographic characteristics of the patients and developed pressure ulcers. In the intervention group, there was no relationship between sociodemographic characteristics with developed PUs as $p > 0.05$. In the control group, there were statistically significant differences between developed PUs with age group ($x^2 = 10.60$, $p = 0.005$), developed PUs with level of education ($x^2 = 5.41$, $p = 0.011$), developed PUs with area of residence ($x^2 = 6.19$, $p = 0.013$), developed PUs

Table 3: Frequency of pressure ulcer development after intervention

Variables		Intervention group Second follow-up After 21 days (*n*=64) F (%)	Control group First follow-up After 10 days (*n*=64) F (%)	Control group Second follow-up After 21 days (*n*=64) F (%)
Number of PUs*	One	1 (1.56)	9 (14.06)	4 (6.25)
	Two		3 (4.69)	
Location	Sacrum		8 (12.50)	1 (1.56)
	Heel			2 (3.12)
	Buttocks	1 (1.56)	1 (1.56)	1 (1.56)
	Sacrum and hell		2 (3.1)	
	Sacrum and buttocks		1 (1.56)	
Stages	Stage I		4 (6.25)	1 (1.56)
	Stage II	1 (1.56)	6 (9.38)	3 (4.69)
	Stage III		2 (3.12)	
Exposed tissue	Epidermis		4 (6.25)	1 (1.56)
	Epidermis and dermis	1 (1.56)	6 (9.38)	3 (4.69)
	Epidermis, dermis, and fat tissue		2 (3.12)	
Exudate	None	1 (1.56)	9 (14.06)	4 (6.25)
	Mild		1 (1.56)	
	Moderate		2 (3.12)	
Odor	Present		2 (3.12)	
	Absent	1 (1.56)	10 (15.62)	4 (6.25)
Total		1	12	4
		16		

*Pressure ulcers

with duration of hospitalization ($x^2 = 6.18$, $p = 0.013$), and developed PUs with smoking status ($x^2 = 8.51$, $p = 0.014$).

Table 5 shows the risk factors of pressure ulcer development associated with immobile stroke patients. All the risk factors are: heart diseases (OR = 3.000, CI = 1.023 to 8.802, *p*-value = 0.043), diabetes mellitus (OR = 5.549, CI = 1.696 to 18.150, *p*-value = 0.005), advanced age (OR = 4.551, CI = 1.576 to 13.144, *p*-value = 0.005), smoking (OR = 2.689, CI = 1.059 to 6.829, *p*-value = 0.038), and friction and shear (OR = 23.333, CI = 5.013 to 108.601, *p*-value = <0.001).

Table 6 shows the comparison between intervention and control groups regarding pressure ulcer development. There were highly statistically significant differences between intervention and control groups about the development of PUs ($t = 4.13$, $p < 0.001$). This means that the nursing interventional program was highly effective in reducing the incidence of PUs among immobile stroke patients.

Discussion

The present study aimed to explore the effectiveness of nursing interventions in preventing pressure ulcers among immobile stroke patients. Patients with extended periods of bed rest, limb paralysis, and issues like urinary and fecal incontinence significantly elevate the risk of developing PUs in many stroke patients. PUs heighten patient discomfort, leading to extended hospital stays and financially burdening families. Consequently, there is a pressing need for effective clinical strategies to prevent and mitigate the incidence of PUs in those affected by stroke.[13]

Based on this study's results, there were no statistically significant differences between any sociodemographic

Table 4: Association between sociodemographic characteristics of the patients and developed pressure ulcers (intervention and control groups)

Variables		Intervention group (*n*=1)			Control group (*n*=16)		
		F (%)	*X^2	*p*	F (%)	X^2	*p*
Age group/years	45-54		1.23	0.542	1 (6.25)	10.60	0.005
	55-64	1 (100.0)			4 (25.00)		
	65-73				11 (68.75)		
Gender	Male	1 (100.0)	0.61	0.435	11 (68.75)	0.36	0.551
	Female				5 (31.25)		
Marital status	Married	1 (100.0)	0.16	0.899	16 (100.0)	2.21	0.323
Educational level	Illiterate	1 (100.0)	1.23	0.747	11 (68.75)	5.41	0.011
	Primary school				4 (25.00)		
	High school				1 (6.25)		
Economic status	Sufficient		0.43	0.807	1 (6.25)	3.20	0.316
	Barely sufficient				3 (18.75)		
	Insufficient	1 (100.0)			12 (75.00)		
Area of residence	Urban	1 (100.0)	0.02	0.899	14 (87.50)	6.19	0.013
	Rural				2 (12.50)		
Duration of hospitalization	1–3 days	1 (100.0)	0.28	0.594	6 (37.50)	6.18	0.013
	4–5 days				10 (62.50)		
Smoking status	Smoker	1 (100.0)	1.81	0.404	12(75.00)	8.51	0.014
	Nonsmoker				3 (18.75)		
	Ex-smoker				1 (6.25)		
**BMI	Normal weight		0.57	0.903	2 (12.50)	1.76	0.041
	Over weight	1 (100.0)			9 (56.25)		
	Obese				4 (25.00)		
	Extremely obese				1 (6.25)		

*Chi-square test. **Body mass index. Level of significant=*p*<0.05

Table 5: Risk factors of pressure ulcers development associated with immobile stroke patients

Risk factors associated with PUs development	Standard error	*p*	Odds ratio	Confidence interval 95%	
				Lower	Upper
Heart diseases	0.55	0.043	3.00	1.02	8.80
Diabetes mellitus	0.61	0.005	5.55	1.70	18.15
Advanced age	0.79	0.005	4.55	1.58	13.14
Smoking	0.48	0.038	2.69	1.06	6.83
Friction and shear	0.79	<0.001	23.33	5.01	108.60

Level of significant=*p*<0.05

Table 6: Comparison between intervention group and control group regarding pressure ulcer formation after intervention (post-test)

Group—Post-test	*n*	Number of PUs* F (%)	Mean	**(SD)	*t*	*p*
Post-intervention group	64	1 (1.56)	0.98	0.13	4.13	$p<0.001$
Post-control group	64	16 (25.10)	0.75	0.44		

*Pressure ulcer. **Standard deviation. Level of significant=$p<0.05$

characteristics and the PU development in the intervention group. However, in the control group, most PUs developed among patients during the first follow-up session during the first 10 days after discharge. This finding is consistent with the study by Pachá, Faria,[14] which stated that approximately 60% of the PUs were developed during first two weeks after hospitalization. Also, this study revealed no statistically significant association between developing PUs and gender ($p > 0.05$). This result is in agreement with the study by Aghazadeh, Lotfi,[15] who found no relationship between sex and incidence of PUs. However, this finding is not in line with the study conducted by Lichterfeld-Kottner, Lahmann,[16] who declared that the difference between male and female in developing PUs was minor.

The current study demonstrated that the PU development was strongly associated with the duration of the hospitalization. The longer duration of hospitalization had significant effects on the PU development. This result is in agreement with the studies conducted by Nadukkandiyil, Syamala[17] in Qatar, and Koivunen, Hjerppe[18] in Finland. Patients who spend extended periods in the hospital often face unstable conditions that can negatively impact their overall health, potentially increasing their risk for PUs. This may occur because the primary illness necessitating their admission usually demands more attention than any secondary health concerns, leading to inadequate interventions for those additional issues. Therefore, it is crucial to have regular follow-ups and monitoring for patients with prolonged hospital stays to identify and prevent these complications.[19]

This study revealed a significant association between smoking status and the PU development ($p = 0.038$,). It demonstrated that patients who were smokers were 2.69 times more at risk of developing PUs than patients who are nonsmokers. This finding is consistent with the study conducted by Beriso, Zemene[19] in Northwest Ethiopia, which stated that smokers were 7.46 times more likely to develop PUs than nonsmokers. These results are also supported by the study conducted by de Azevedo Macena, da Costa Silva[20] in Brazil, which demonstrated a significant relationship between smoking and the PU development. This is because long-term nicotine addiction often results in years of cigarette use, which can lead to serious cardiorespiratory issues. These respiratory problems contribute to inadequate oxygen delivery to tissues and reduced blood flow, creating conditions that allow PUs to develop in areas with insufficient oxygen.[21]

This study also revealed that patients with friction and shear were 23.33 times more likely to develop PUs than those without friction and shear ($p = < 0.001$). This result is consistent with the study conducted by Akram, Samdani,[22] who explained that patients experiencing issues with friction and shear were 5.7 times more likely to develop PUs compared to those who did not show any problems with friction and shear. This could be due to skin sliding over a support surface like a bed or wheelchair if they cannot keep their body upright, leading to skin necrosis, irritation, and blood vessel damage, which causes PUs to develop.

This study showed a highly statistically significant difference between age groups and the development of PUs ($p = 0.005$). The study also showed that advanced age (above 64 years old) was 4.55 times at risk of developing PUs compared to those below 64. The findings of the present study were consistent with a study conducted by Aghazadeh, Lotfi[15] that indicated that advancing age significantly influences the occurrence of PUs, and noted that approximately 90% of PUs were reported in patients above 60 years of age. The main reason for this problem was linked to decreased mobility and activity levels, and decreased subcutaneous fat layer among older people.

The study results showed that patients with heart disease and diabetes mellitus were 3.00 times and 5.55 times, respectively, more vulnerable to developing PUs than those without. The findings were supported by Wang and Chen.[23]

The study results showed the effectiveness of nursing educational interventional program in reducing the incidence of PUs among immobile stroke patients ($t = 4.13$, $p < 0.001$). This result is supported by Gao and Wang,[24] which stated that proper nursing interventions reduce the incidence of PUs and prolong the time to develop while enhancing patients' satisfaction and overall quality of life.

The study was conducted in a single setting and involved a relatively short intervention period of three weeks. These factors were identified as limitations, as they may restrict the generalizability of the findings.

Conclusion

Appropriate nursing interventions and patient education can significantly reduce the incidence of PUs and prolong the time of development among immobile stroke patients. Promoting evidence-based nursing interventions is

recommended for patients with immobility and stroke, to prevent the PU development.

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Conflicts of interest

Nothing to declare.

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