Effect of Nursing Training on Identification, Prevention and Management of Pressure Ulcer among Stroke Patients and Its Outcomes

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Abstract

Background: Pressure ulcer represent a significant burden to the patient, family and healthcare organization. **Aim:** To assess the effect of nursing training on identification, prevention and management of pressure ulcer among stroke patients and its outcomes**. Methods:** a quasi-experimental stud pre posttest assessment. A convenience sample of 40 nurses were voluntarily participate in the study. **Setting:** The study carried out at neurological units (A and B) at Mansoura University Hospital. **Tools:** Interview Questionnaire Sheet, The Pieper Zulkowski-Pressure Ulcer Knowledge Test (PZPUKT), Facility Assessment Checklist, Moore & Price attitude scale, Socio-demographic and medical clinical base line data for patients and Braden Scale. **Result:** The result revealed a positive association between pressure ulcer educational protocol prevention and nurses' knowledge, attitude and practice to ward pressure ulcer prevention. The pretest result indicated that nurses' knowledge and practice were low, nurse's attitude was negative. However, the mean percentage of all posttest showed a significant increase in nurses' knowledge, attitude and practice. In addition to decreases pressure ulcer risk level among the patients with stroke. **Conclusion:** The result of current study indicates the important of ongoing nurses' education regarding pressure ulcer prevention and decrease the pressure ulcer risk level among patients **Recommendation:** developing a continuous training program to improve nurses' knowledge, attitude and practice toward pressure ulcer prevention.
Keywords: Nursing Training, Identification, Prevention, Management, Pressure Ulcer, Stroke and Outcomes**.**

Introduction

According to National Pressure Ulcer Advisory Panel (NPUAP) the pressure injury or pressure ulcer can be defined as localized injury to the skin or tissue caused by suppression of soft tissue between protruding bone and the outer surface for a long period of time **(Hsieh et al., 2020).**Additionally; PU is a wound on the skin and/or underlying tissue, usually caused by a bony protrusion, as a result of pressure or combination of pressure with shear and/or friction force **(Kottner et al., 2018).**

As well as, International Organization of Pressure Ulcer Advisory Panel (NPUAP) defined it as the local injury of the skin or the underlying tissues that occurs around a bony prominence as a result of the pressure or composition of the pressure and the slipping forces of friction (**Alvarez et al., 2016).**

According to the National Pressure Ulcer Advisory Panel (NPUAP), Pressure ulcers are skin wounds on bony prominent areas resulting from prolonged pressure on the skin. Pressure ulcer causes painful conditions, takes a long time to heal and is often a precursor to life-threatening complications such as skin and bone infections. Circulation is

stopped when blood flow slows or ceases between the bone and the bed or wheelchair surface in the enclosed region. The skin may die in as little as half a day when the tissue is deprived of oxygen and nutrients, although the evidence may not be apparent for days or even weeks **(Mervis & Phillips, 2019).**

Pressure ulcer (PU) represents a significant burden to the patient, family and healthcare organization. It has a great impact on quality of life physically, psychologically and socially leading to pain, increase a length of hospitalization and rehabilitation. PU had been recognized as one of most physically and financial debilitating complication in the 20th century, that affect all age group in both hospital and community setting. However, the risk increases in elder individual, immobilized and patient with neurological deficit. Despite, availability of all resources needed to prevent PUs; it reminds one of the health issues affecting many health care organizations **(Awali et al., 2018).**

Pressure ulcers are a top priority risk problem for long term care (LTC). Patients, confined to beds and wheelchairs, require nursing interventions for repositioning to help prevent pressure ulcers. Likewise, patients who experience a loss of bladder or bowel control can develop macerated skin that is more susceptible to the effects of friction damage if moisture issues are not treated. Dehydration and inadequate nutrition and poor sensory perception are also risk factors for pressure ulcer development **(Rodrigues et al., 2016).**

Preventing pressure ulcers is one of the biggest health problems in terms of reducing patient damage. Pressure ulcer control requires both sores prevention and treatment. Nurse's practices toward pressure ulcer prevention were not reliable because nurses prioritized it very low level that is because of their inadequate knowledge about the serious consequence of pressure ulcer complications. Nurses poor knowledge and skills in pressure ulcer prevention contributes significantly to the development or worsening of pressure ulcers and this is may be lead to more complications, Therefore, nurses require regular training and education in this area of practice. Furthermore nurses good knowledge regarding pressure ulcer prevention not only can improve the quality of nursing care but also within this reduce the patients duration of hospital stay and the number of patients suffering from this painful condition**(De Meyer et al., 2019).**

Significance of the study:

PUs complications lead to 60,000 deaths yearly in the USA and around 2.5 million patients will develop PUs annually in the United States **(Awali et al., 2018).** The high prevalence rate of PU reflects the quality of care. Therefore, a numbers of strategies had been used to reduce PU rate and improve patient quality of care such as- education of health care member, availability of PU guidelines and equipment used to reduce PU(Lu et al., 2020). Most of PUs are preventable through using PU guideline, which can be correctly identify population at risk (Mäkinen et al., 2020).

Every year, approximately 186,617 patients develop new acute ulcers. Also, 60,000 people have died as a result of global pressure ulcer complications **(Berihu et al., 2020).** Pressure ulcers have been known as a disease agent for decades. Pressure sores have been discovered in Egyptian mummies, some of which are over 5,000 years old. Pressure ulcers are accountable

for 2% of preventable deaths **(Lofor & Odiase, 2020).**

Aim of the study:

Aims: assess the effect of nursing training on identification, prevention and management of pressure ulcer among stroke patients and its outcomes**.**

Subjects and Methods

Research hypotheses:

H1: nurses' level of knowledge, practice, and attitude regarding identification, prevention and management of pressure ulcer will improve post implementation of the nursing training.

H2: Patients' outcomes improve after implementation of nursing training for nurses.

Subjects and methods:

Study design:

A quasi experimental study design with pre and post assessments was used in this study to fulfill the aims of this study.

Study setting:

This study was carried out at the Medical Neurological Units (A and B) at Mansoura University Hospital in Egypt.

Subjects:

Convenience sampling was adopted. All registered nurses were recruited from those nurses working at neurological units (A and B) at Mansoura University Hospital. In addition, all stroke patients who were admitted to these units were included in the study; they were hospitalized for more than week. Assess bed sores that develop among patients assessed before the implementation of the program and compared with another group of 50, age- and sex- matched patients after program implementation.

By considering the response distribution among them as 50 % (to obtain the largest sample size, the margin of error as 5% and confidence level as 95%; the calculated sample size was 132 using Epi-info software (version 7), for sample size calculation.

Tools of data collection:

Four tools were used for data collection they accomplished after reviewing the recent relevant literatures:-

Tool (I): Interview Questionnaire Sheet:

The interview questionnaire sheet was designed and tested by the researcher then used prior to implementation of the program to measure the exact level of knowledge of nurses about pressure ulcer. The same tool was used immediately after the implementation of the program (immediate post -test), in addition to three months late to evaluate the gain in knowledge after the intervention. The questionnaire consists of two parts as following:

Part I: Demographic characteristics questionnaire:

Demographic data of the recruited nurses in the study (40 nurses) including age, gender, marital status, level of education, years of experience, source of knowledge regarding pressure ulcer…….. etc.

Tool (II): The Pieper Zulkowski-Pressure Ulcer Knowledge Test

(PZPUKT): (Pieper and Zulkowski, 2014)

The Pieper Zulkowski-Pressure Ulcer Knowledge Test contains 72 items, used to measure three domains: prevention (28 items), staging (20 items), and assessment (24 items), in the true-false-don't know format assessing prevention/risk, staging, and description knowledge.

Scoring system:

The level of knowledge was judged according to McDonald‟s standard of learning outcome which classify the level of knowledge into five categories as follow **(McDonald, 2016)**90%-100% showed a very high level of knowledge, 80%-89, showed a high level of knowledge, 70%-79, showed a moderate level of knowledge, 60%-69, showed a low level of knowledge, And a percentage below 60% showed a very low level of knowledge.

Tool (III): Facility Assessment Checklist:

The nursing practices regarding pressure ulcer were measured using "Facility Assessment Checklist" a public and validated tool with 29 items developed by Partners of Rhode Island to determine if the facility has a process for developing and implementing a pressure ulcer care plan for patients who have been found to be at risk or who have a pressure ulcer and to identify areas that need improvement". This tool originally consisted of multiple-choice questions with "Yes", "no", "responsible person" and "comment" as options but after adaptation, only "yes" or "no" remained as options. After correction of the participants‟ copies (questionnaires), the obtained marks out of 29 was put on hundred and then mean score, percentage were provided.

Scoring system:

The McDonald‟s standard of learning outcome was used to interpret the level of practice as either low or high as follow (McDonald, 2016): A percentage of 60% indicated a very low level of practices, A percentage of 60%-69, indicated a low level of practices , A percentage of 70%-79, indicated a moderate level of practices, A percentage of 80%-89, indicated a high level of practices, A percentage of 90%-100% indicated a very high-level of practices.

Tool (IV): Moore & Price attitude scale (Moore& Price, 2004).

The Moore & Price (2004) pressure injury attitude tool was developed to assess and examine the attitudes of nurses toward pressure injuries. The questionnaire consists of 28 questions divided into 4 sections: Prevention, behaviors, barriers, and details of practice.

Scoring system:

Prevention consists of 11 items in a five item Likert scale format ranging from "strongly disagree" (1 point) to "strongly agree" (5 points), with a score range of 11 to 55 points. The behavior section consists of eight items, two of which may not be answered based on prior item responses. Each item has 5 point scoring system ranging from strongly agree to strongly disagree." Here, "strongly disagree" = 5 points, "disagree" = 4points, "Neither agree nor disagree"=3 points, Agree=2 points and "Strongly agree"=1point. For the questions number 1, 6, 7, and 11 the scoring is reversed whereby, "strongly disagree"= 1 and so on. A total score less

than 40 out of 55 were considered as negative attitudes while that above 40 were considered as positive attitude **(Moore Z, Price P, 2004).**

Tool (V Moore & Price attitude scale (Moore& Price, 2004).

This tool was developed by researcher to assess bed sores that develop among patients assessed before the implementation of the program and compared with another group of 50 age- and sex- matched patients after program implementation. It includes:

Part I: Demographic characteristics questionnaire:

Demographic data and medical information sheet was designed by the researcher to elicit subject's age, gender, marital status, level of education, occupation …etc.

Part II: pressure ulcer data:

This part represents size and stages, site and number of pressure ulcer, diagnosis, length of stay. The patient was assessed by the researchers by daily skin assessment, and using the Braden scale.

Tool (VI): Braden Scale Sheet:

The Braden scale is a highly reliable instrument in the identification of patients at high risk of pressure ulcers **(Bergstrom, 1987).** The Braden scale for predicting pressure tools is composed of 6 subscales, sensory perception, activity, mobility, moisture, nutrition, and friction/shear. Each subscale included title and each level has a key concept descriptor and a one of two - phrase/sentences description of qualifying attributes. Five of the six subscales are rated from 1 (least impaired) to 4 (most impaired); the friction/shear subscale is rated from 1 to 3 the potential scores can range from 6 to 23, with scores of 18 - 23 at low risk, 11-17 moderate risk and <11 as at high risk.

Validity and reliability of the tools:

Validity of tools was done by 7 experts from medical and nursing field to check the relevancy, clarity, comprehensiveness, and applicability of the questions. According to their opinions, minor modifications were done and the final form was developed. The reliability of the tools was tested using the internal consistency method. It was found that Cronbach's alpha reliability coefficient for The Pieper Zulkowski-Pressure Ulcer Knowledge Test (PZPUKT, Facility Assessment Checklist, Moore & Price attitude scale and Braden scale was 0.162, -0.001, 0.093, and 0.173 respectively.

Pilot study:

Pilot study was conducted on 10% of patients. This number was excluded from the studied sample to identify the obstacles and problems that may be encountered in data collection, applicability and feasibility of the tools.

Field work:-

The study was done from the beginning of October 2019 to end of February 2020. Data were collected by the researcher three days per week, during the morning shift from 9Am to 2 Pm.

Data were collected in the following sequence:

-An official permission from director of neurological units at Mansoura University Hospital to carry out the study after identification of the purpose of the

study. The data were collected throughout three phase of assessment by using six tools. The first phase of assessment was collected prior to training program. The second phase, immediately after application of the training program. The third phase, applied three months post application of the training program to assess the gain of knowledge for nurses. Additionally, studied patients (100 patients) enrolled in the study was divided into two group each group consist of 50 patients. First group was assessed before application of the training program. Another group of 50 age- and sex- matched patients was assessed after the application of the program, and comparison between two groups will be done statistically to reveal the impact of training program for nurses on patients outcome.

-Development of the training program was based on analysis of the collected data. It was developed guided by reviewing the most recent related literature; the researchers developed a training program for nurses using teaching aids and media, video and also Arabic handouts.

-Data were collected a Medical Neurological Units (A and B) at Mansoura University Hospital, Egypt. This program covered by 3 sessions including theoretical and practical training regarding identification, prevention, and management of pressure ulcer among stroke patients. Each session take 30-45 hours.

-The same tools was provided for all recruited nurses three months after application of training program to assess gain knowledge, practice and assess their attitudes regarding prevention , identification and management of pressure ulcer among stroke patients . Also, patient was evaluated after implementation of training program to assess patient's outcomes.

Training program about pressure ulcer among stroke patients:

Covered the following main items regarding pressure ulcer it including:

- Nursing knowledge about pressure ulcer as definition, causes, clinical manifestation, and medical treatment.
- Stages of pressure ulcer, common sites for pressure ulcer.
- Nursing practices to identify risk factors for pressure ulcer among stroke patients.
- Preventive methods for pressure ulcer.
- Nursing intervention for managing pressure ulcer.
- International guidelines regarding prevention of pressure ulcer.

Ethical consideration:

An approval to conduct the study was obtained from the director of Medical Neurological Units (A and B) at Mansoura University Hospital in Egypt after applying complete explanation provided by the researcher regarding the aim of the study. Verbal consent was obtained from each nurses and patients enrolled in the study after explaining the aim and importance as well as stressing on confidentiality of the collected data. The researchers emphasized that the participation on the study are absolutely voluntary and each participants has the right to withdraw from the study without explaining any reason. The process of data collection did not disturb the

harmony of the work. All data collected were used for the study purpose only and were processed in total confidentiality.

Statistical analysis:

The data were tested for normality using the Anderson-Darling test and for homogeneity variances prior to further statistical analysis. Categorical variables were described by number and percent (N, %), where continuous variables described by mean and standard deviation (Mean, SD). Chi-square test was used to compare between categorical variables where compare between continuous variables by t-test. A two-tailed $p< 0.05$ was considered statistically significant. We are used person Correlation to Appear the Association between scores .All analyses were performed with the IBM SPSS 20.0 software.

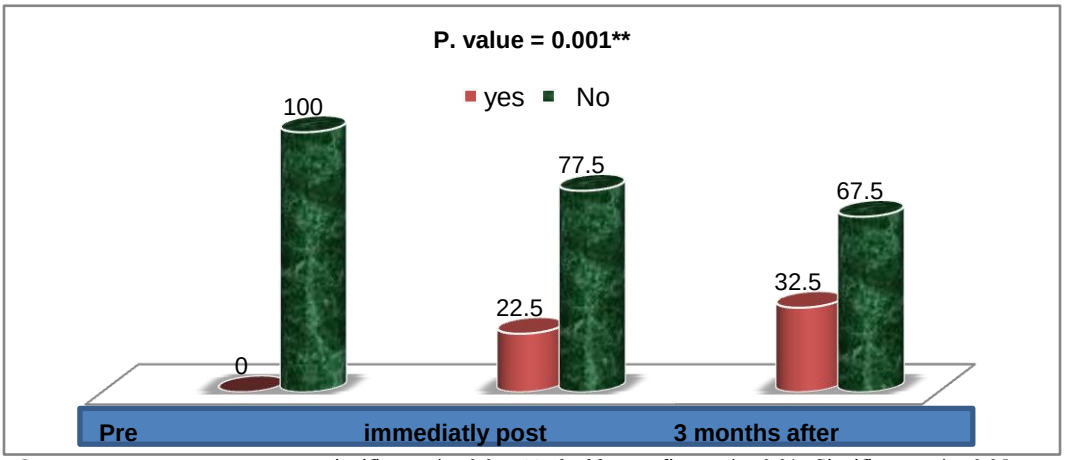
Results:

Table (1) Frequency distribution of the studied nurses regarding their demographic characteristics (N. =40)

Demographic characters	**N .=40**	**%**
Age	31± 8.9 years old	
Sex		
Female	40	100.0
Marital status :	40	100.0
Married		
Years of experience		
1-5 year	2	5.0
6-10 year	34	85.0
above 10 years	4	10.0
Level of education		
diploma in nursing	37	92.5
BSN	3	7.5
Source of education		
Never	20	50.0
university / collage	3	7.5
work place	17	42.5
having training about pressure ulcer		
No	40	100.0
last time attend workshop on PU		
Never	40	100.0
last time reading article or book about PU		
Never	40	100.0
last time searching on web site about PU		
Never	40	100.0
last time reading NPUAP/EPUAP guidelines about PU treatment and prevention		
Never	40	100.0

Table (1): showed that all (100%) studied nurses were female, and married. majority of the studied nurses' ages 31 ± 8.9 years old and their years of experiences were from 6 to 10 years old with 85% , and 92.5% of them had a diploma in nursing. Regarding nurses' source of education were no source and from work places. In addition, all (100%) of them didn't read books, web articles or NPUAP/EPUAP guidelines about pressure ulcers treatment and prevention.

Figure (1): Relationship between pre, immediately and after 3 months of nursing training application regarding using the Pieper Zulkowski-Pressure Ulcer Knowledge Test (PZPUKT), (N. = 40).



One way anova t-test non significance *p>0.0 **= highly significance *p≤0.01 Significance =*p<0.05.

Figure (1): showed that there was a statistically significant difference between pre, immediately and after 3 months of nursing training application regarding The Pieper Zulkowski-Pressure Ulcer Knowledge Test (PZPUKT) .

Table (2): Relationship between pre, immediately and after 3 months of nursing training application regarding The Pieper Zulkowski-Pressure Ulcer Knowledge Test (PZPUKT) total score.

		Mean	Std. Deviation	Minimum	Maximum	p. value
Total prevention Score 0-56	pre	26.57	2.62	22.00	34.00	0.001*
	Immediately	45.92	2.52	40.00	52.00	
	post3month	45.22	2.74	38.00	51.00	
	Total	39.24	9.36	22.00	52.00	
Total staging 0-40 score	Pre	17.10	1.83	12.00	20.00	0.001*
	Immediately	35.97	1.62	32.00	40.00	
	post3month	35.20	1.89	30.00	39.00	
	Total	29.42	8.93	12.00	40.00	
Total assessment 0-48 score	Pre	20.05	1.33	17.00	23.00	0.001*
	Immediately	43.70	2.12	38.00	48.00	
	post3month	43.32	2.59	36.00	48.00	
	Total	35.69	11.29	17.00	48.00	
Total Score 0-144	Pre	63.72	3.61	54.00	73.00	0.001*
	Immediately	125.60	3.52	118.00	133.00	
	post3month	123.75	4.49	115.00	132.00	
	Total	104.35	29.12	54.00	133.00	

one way anova t-test on significance *p>0.0 **= highly significance *p≤0.01 Significance = *p<0.05

Table (2): showed that there was a statistically significant difference between pre, immediately and after 3 months of nursing training application regarding The Pieper Zulkowski-Pressure Ulcer Knowledge Test (PZPUKT) total score.

Table (3): Relationship between pre, immediately, after 3 months regarding the level of knowledge was judged according to McDonald"s standard of learning outcome (N. =40).

Items	Pre		Immediately		After 3 month		p. value
	N.	%	N.	%	N.	%	
90%-100% very high level of knowledge	0	0	4	10.0	6	15.0	**0.001****
80%-89 high level of knowledge	0	0	36	90.0	34	85.0	
70%-79 moderate level of knowledge	0	0	0	0	0	0	
60%-69 low level of knowledge	0	0	0	0	0	0	
60% a very low level of knowledge.	40	100.0	0	0.0	0	0.0	
Means ±SD	63.72±3.61		125.60±3.52		123.75±4.49		**0.001****

one way anova and Chi-Square Tests t-test non significance *p>0.0
**= highly significance *p≤0.01 Significance = *p<0.05

Table (3): showed that there was a statistically significant difference between pre, immediately, after 3 months regarding the level of knowledge was judged according to McDonald"s standard of learning outcome (N. =40). Also, the table showed that; the studied nurses' level of knowledge was judged according to McDonald"s standard of learning outcome, the majority of them had low level of knowledge pre the nursing training, but that improved immediate and after 3 months of nursing training to a high level of knowledge.

Table (4): Relationship between pre, immediately, after 3 months regarding the level of practice according to facility assessment checklist (N. =40).

Items	Pre		Immediately		After 3 month		p. value
	N	%	N	%	N	%	
90%-100% very high level of practice	0	0	0	0	0	0	0.001**
80%-89 high level practice	0	0	4	10.0	17	42.5	
70%-79 moderate level of practice	0	0	27	67.5	16	40.0	
60%-69 low level of practice	0	0	0	0	0	0	
60% a very low level of practice.	40	100.0	9	22.5	7	17.5	
Means of total practice	12.52± 1.03		32.82± 5.53		34.30± 6.50		0.001**

one way anova and Chi-Square Tests t-test non significance *p>0.0
**= highly significance *p≤0.01 Significance = *p<0.05

Table (4): showed that there was a statistically significant difference between pre, immediately, after 3 months regarding the level of practice according to facility assessment checklist. Also, the table showed that; the studied nurses' level of practice the majority of them had very low level of practice pre the nursing training, but that improved immediate and after 3 months of nursing training to a high level of knowledge.

Table (5): Relationship between pre, immediately, after 3 months regarding the level of attitude according to Moore & Price attitude scale (N. =40).

Items	Pre		Immediately		After 3 month		p. value
	N.	%	N.	%	N.	%	
Negative attitude (less than 40)	40	100.0	0	0	2	5.0	0.001**
Positive attitude (more than 40)	0	0	40	100.0	38	95.0	
Means of total attitude	32.45± 2.33		56.17± 2.44		48.60± 3.71		0.001**

one way anova and Chi-Square Tests t-test non significance *p>0.0 **= highly significance *p≤0.01 Significance = *p<0.05

Table (5): showed that there was a statistically significant difference between pre, immediately, after 3 months regarding the level of altitude was judged according to Moore & Price attitude scale. Also, the table showed that; the majority of them had negative attitude pre the nursing training, but that improved immediate and after 3 months of nursing training to a positive attitude.

Table (6) Frequency distribution of the studied patients regarding their demographic characteristics (N. =50)

	N	%
Age	45.62±8.81	
Male	25	50.0
Female	25	50.0
Married		
Married	46	92.0
Widow	4	8.0

Table (6) showed that half of the studied patients were male and another half (50%) were female and most (92%) of them were married.

Table (7): Frequency distribution of bed sore sites for the studied patients pre and post intervention (N=50).

Site of sore	Pre-intervention				Post-intervention				p. value
	No		Yes		No		Yes		
	N	%	N	%	N	%	N	%	
Pressure ulcer site of elbow	43	86.0	7	14.0	47	94.0	3	6.0	.159
Pressure of heel	34	68.0	16	32.0	43	86.0	7	14.0	.028
Upper back and shoulder	46	92.0	4	8.0	48	96.0	2	4.0	.339
Low back	16	32.0	34	68.0	30	60.0	20	40.0	.004
Buttocks	9	18.0	41	82.0	19	38.0	31	62.0	.022
Knee	50	100.0	0	0	50	100.0	0	0	-----
Ear	50	100.0	0	0	50	100.0	0	0	-----

Chi-squre – Tests non significance *p>0.0 **= highly significance *p≤0.01 Significance = *p<0.05

Table (7) showed that the majority of the studied patients were buttocks and low back in both pre and post the nursing training with no statistical significant difference between before and after the nursing training.

Table (8) Frequency distribution of the studied nurses regarding Stages of pressure ulcer (N. =40)

Stages of pressure ulcer	Pre-intervention		Post-intervention		p. value
	N	%	N	%	
stage 1	0	0	41	82.0	.000
stage II	6	12.0	9	18.0	
stage III	12	24.0	0	0	
stage IV	20	40.0	0	0	
stage V	12	24.0	0	0	
length of hospital stay					
2-7 days	23	46.0	23	46.0	.579
8- 14 days	27	54.0	27	54.0	

Chi-squre - Tests non significance *p>0.0 **= highly significance *p≤0.01 Significance = *p<0.05

Table (8) showed that the patients were in degree IV but it decreases after application of the nursing training to stage I with a statistically significant difference between them. The table showed the length of stay was from 8 to 14 days in both pre and post the training application with no statistically difference.

Figure (2) Frequency distribution of the studied patients regarding type of stroke (N. =50).

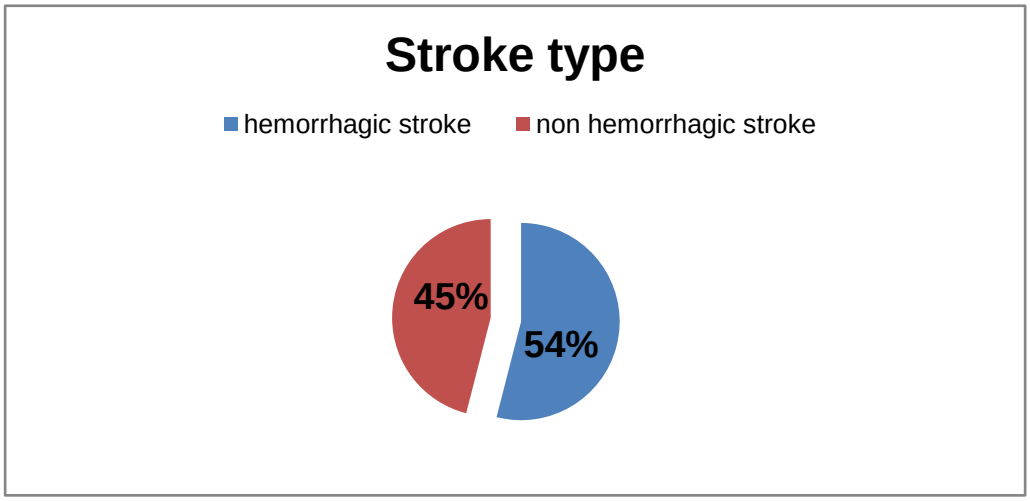


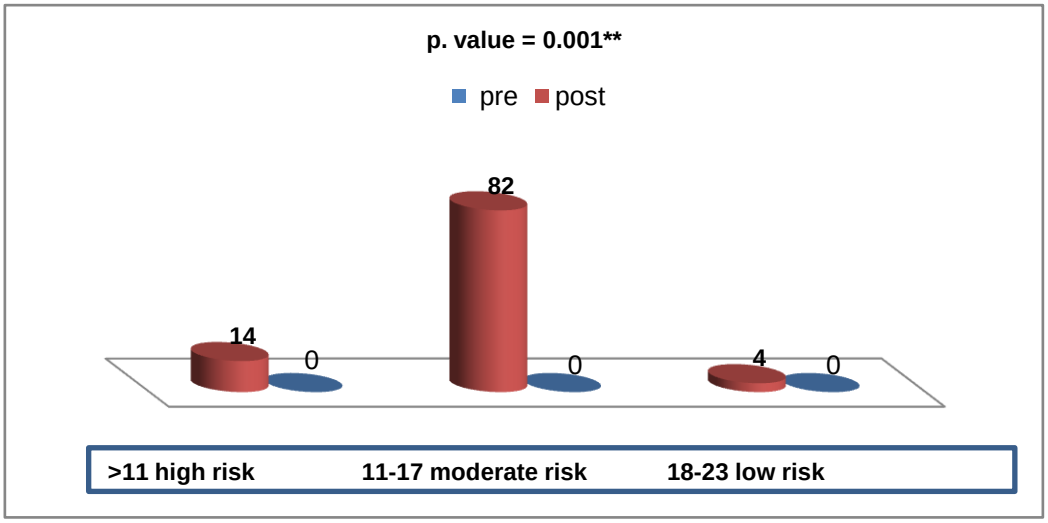
Figure (2): showed that the patients with non hemorrhagic stroke were 54%.

Table (9) Frequency distribution of the studied patients regarding Braden scale pre and post intervention (N. =50).

	Pre-intervention		Post-intervention		p. value
	N	%	N	%	
Sensory perception					
completely limited	50	100.0	32	64.0	0.001
very limited	0	0	6	12.0	
slightly limited	0	0	7	14.0	
no impairment	0	0	5	10.0	
Moisture					
constantly moist	42	84.0	0	0	0.001
Often moist	8	16.0	6	12.0	
constantly moist	0	0	8	16.0	
rarely moist	0	0	36	72.0	
Activity					
Bed fast	50	100.0	40	80.0	.011
Chair fast	0	0	1	2.0	
walk occasionally	0	0	7	14.0	
walk frequently	0	0	2	2.0	
Mobility					
completely limited	50	100.0	31	62.0	0.001
very limited	0	0	1	2.0	
slightly limited	0	0	12	24.0	
no limited	0	0	6	12.0	
Nutrition					
very poor	13	26.0	5	10.0	.045
probably inadequate	23	46.0	23	46.0	
adequate	14	28.0	18	36.0	
excellent	0	0	4	8.0	
Friction and share					
problem	50	100.0	32	64.0	.001
potential t problem	0	0	8	16.0	
no apparent problem	0	0	10	20.0	

Table (9) showed that there was a statistically significant difference between Braden scale pre and post intervention among he studied patients. This result may indicate that most of the stroke patients had slight mobility limitations. However, the majority of the participants had mild to moderate stroke deficits and bedfast activity. The patients required greater assistance with the activities of daily living. In this study, majority of the participants with pressure ulcers had very poor nutrition or inadequate nutrition. This table showed that skin moisture was associated with pressure ulcer development in older stroke patients.

Figure (3): Frequency distribution of Total Braden scale for patient pre and post intervention n=50



Chi-square – Tests non significance *p>0.0 **= highly significance *p≤0.01 Significance = *p<0.05

Figure (3): showed that 82% of patients had moderate risk for pressure ulcer

Table (10): Correlation between the studied patients' demographic data and knowledge, practice, attitude, barden and risk of bed sores

Items	Correlation	Knowledge	Practice	Attitude	Barden scale	Risk of bed sores
Age	**R**	.016	.035	.011	-.003	-.062
	Sig.	.863	.704	.909	.980	.541
Years of experience	**R**	.027	-.016	-.026	-.016	-.033
	Sig.	.766	.860	.777	.872	.745
Level of education	**R**	.018	.000	.048	.000	.065
	Sig.	.843	.996	.599	1.000	.519
Training about pressure ulcer	**R**	.818**	.834**	.817**	.672**	-.704**
	Sig.	**.000**	**.000**	**.000**	**.000**	**.000**
Knowledge	**R**	1.000	.667**	.718**	.516**	-.562**
	Sig.	.	**.000**	**.000**	**.000**	**.000**
Practice	**R**	.667**	1.000	.646**	.618**	-.687**
	Sig.	**.000**	**.**	**.000**	**.000**	**.000**
Attitude	**R**	.718**	.646**	1.000	.492**	-.510**
	Sig.	**.000**	**.000**	**.**	**.000**	**.000**
Barden scale	**R**	.516**	.618**	.49**2	1.000	-.871**
	Sig.	**.000**	**.000**	**.000**	**.**	**.000**
Risk of bed sores	**R**	-.562**	-.687**	-.510**	-.871**	1.000
	Sig.	**.000**	**.000**	**.000**	**.000**	**.**

Correlation is positive significance at the 0.01 level p. value .
R= Correlation Coefficient sig= Significance

Table (10): showed that, there was no correlation between demographic data and knowledge, practice, attitude, barden and risk of bed sores except with training about

pressure. The table showed that there was a positive correlation within all of knowledge, practice, attitude, barden and risk of bed sores. The table revealed that, there was no statistical significance between nurses' qualification and knowledge regarding physical restraints.

Discussion:

Pressure injury prevention is one of many nursing care priorities and is a key indicator of the quality of nursing care. In order to achieve optimal quality care in this area, nurse managers and other administrators should make efforts to improve nursing knowledge and attitudes based on the latest scientific evidence for pressure injury prevention. Moreover, stroke patients with pressure injury increase mortality rate more than stroke patients without pressure injury (**Tirgari et al., 2018).**

The results of the present study will be discussed and covered as the following:

Regarding nurses:

The present study showed that all studied nurses were female, and married. This match with Also, **Shamian et al., (2016**) said that the percentage of the nursing team exceeds 90%; is female because of the male contingent in nursing showing a current trend and the majority of nursing schools and institutes students mainly females.

The existing study revealed that; majority of the studied nurses' ages 31 ± 8.9 years old) and their years of experiences were from 6 to 10 years old, had a diploma in nursing. These matched with **Riandini et al., (2018)** whom revealed that the majority of nurses working in the vital and critical places their ages ranged from 20-40 years, married, female, and have diploma of nursing, more than half of them their experience was more than 5 years.As well, **Mohammed et al., (2019)**stated that nurses with less years of experience may require maximum additional instruction before they are ready to take a patient assignment, nurses working in one clinical specialty may need amount of instructions to acquire through training program.

Regarding nurses' source of education were no source and from work places this may due to the lack of available knowledge about pressure ulcer and work load which give them the chance to search for it. Adding to this all of the studied did not attain any training or workshop about pressure ulcer. In addition, all of them didn't read books, web articles or NPUAP/EPUAP guidelines about pressure ulcers treatment and prevention. This might due to hospital have no staff development program. This result was not supported by **Barakat-Johnson et al., (2019)** who said that nurses who are working with stroke patients needs additional education to provide optimal care for such critical patients to prevent pressure ulcers.

However, this result did not match with previously findings been described in **Hoxmeier & Lenk, (2020)**'s study with the highest main source being seminars and workshops accounting for gaining information. This difference might be explained by the recent advancement in internet technologies and most of the educational materials and health messages on pressure ulcer, which may have urged healthcare providers to use internet technology to gain access to those documents. This is supported by other previously conducted research that observed how this way of communicating information has an important impact on healthcare workers' knowledge.

Regarding Using Braden scale or other scale for assessing high risk patients for PU, this present study showed that all of the studied nurses didn't Usie Braden scale or other scale for assessing high risk patients for PU that before the nursing

training. While high percentage of them use it after application of the nursing training. This mean that the training had a positive effect on the nurses awareness toward the important of using it for early detection of pressure ulcer among the patients.

The fact that nurses were not well oriented with such advanced measures and using the Braden scale could also explain their lack of knowledge about PU prevention. This lack of knowledge could lead to less than optimal care, especially if nurses use and practice outdated methods and/or inconsistent therapies. Moreover, a lack of both tissue viability nurse specialists in Mansoura University hospital and national PU guidelines may impact PU prevention in Egypt through inadequate knowledge and an absence of updated, evidence-based practice in this area of specialization.

This match with **Meehan et al., (2016)**who reported that periodical using of risk assessment scales for pressure ulcer prevention in clinical practice, degree of validation of risk assessment scales, and effectiveness of risk assessment scales considers an indicators of risk of developing a pressure ulcer.

But this not match with **Ghali et al., (2018)**who Concluded that; there was no evidence that the use of risk assessment scales decreases pressure ulcer incidence. The Braden Scale offers the best balance between sensitivity and specificity and the best risk estimate.

Regarding the Pieper Zulkowski-Pressure Ulcer Knowledge scores; there were statistically significant difference between pre, immediately and post 3 months of the nursing training with an improvement of their level. This mean that the training had a great effect on the the level of the studied nurses knowledge regarding pressure ulcer.

The present study showed that; the studied nurses' level of knowledge was judged according to McDonald‟s standard of learning outcome, the majority of them had low level of knowledge pre the nursing training, but that improved immediate and after 3 months of nursing training to a high level of knowledge.

This deficiency in knowledge is due to one or more of the following reasons, lack of orientation program prior to work as well lack care conferences during work in availability of procedure book specially prepared for the critical care areas and lack of direction and nurse's appraisal about patient's care.

As the researcher's opinion, the difference may be due to lack of updating information regarding palliative care, and this might be due to the fact that basic education was not incorporated into either diploma or degree curricula. On the other hand, Egyptian nurses, particularly those works in bedside care are overworked because of the nursing shortage in the nursing staff. Therefore, they have limited time to enhance their knowledge about stroke care.

Further, the majority of nurses had no post graduate pressure injury education. Accordingly, the lack of opportunity to be trained and up-to-date on pressure injuries might prevent the nurses from remembering, and applying suitable knowledge regarding pressure injury prevention.

Saindon & Berlowitz, (2020) stated that having accurate, ongoing, and up-to-date knowledge regarding pressure injury risk, prevention, staging, and treatment is the most effective way to prevent them.

In a cross-sectional study, orthopedic nurses' knowledge about pressure injuries was examined in 2 teaching hospitals in Iran by **Tirgari et al., (2018).** They used the Pieper-Zulkowski Pressure Ulcer Knowledge test. The results of this study suggested that orthopedic

nurses in Iran were not sufficiently knowledgeable about pressure injuries. In a different study, **Tirgari et al.,** assessed knowledge about pressure injuries among 126 nurses working in Iran.

Results showed that the level of knowledge was insufficient to provide optimal care. Nurse knowledge plays an important role in the prediction, prevention, and treatment of pressure injuries, as well as the incidence and prevalence in hospitalized patients **(Barakat-Johnson eta l., 2019).**

Therefore, nurses' knowledge should be evaluated on a regular basis and maintained at a high level. Although most nurses know the common risk factors, many nurses do not have sufficient knowledge about contributing factors, and this lack of knowledge negatively affects their performance **(Evripidou et al., 2019).**

This result contradicted with **Kol et al., (2017);** who stated that health care provision of, requires in-service training programmers for nurses. Also and stated that continuing professional development by education and training after the point of qualification and or registration help nurses in improvement of patient care and enables professional nurse practitioners to provide quality nursing care and service delivery to their patients.

Different outcomes came from **Qaddumi & Khawaldeh (2014)** who assessed nurses' knowledge on PU care and reported that nurses' knowledge was moderate.

Regarding the studied nurses' practices regarding pressure ulcer were measured using facility assessment checklist, the results of the present study reported that the majority of them had low level of practice pre the nursing training, but that improved immediate and after 3 months of nursing training to a high level of practice.

Furthermore, more than half **(Berihu et al., (2020)** participants had good expressed pressure ulcer prevention practice, whereas **Tharu, (2018**) study in Bangladesh found that studied nurses perceived a moderate level of overall practice regarding pressure ulcer prevention. Consistent with the studies done in Turkey by **Tulek et al., (2016).**participants in this research reported some of the frequently applied pressure ulcer prevention practices. These include patient repositioning, keeping patient skins dry and moist balanced diet, protecting the skin during patient transfer, documenting prevention strategies, and removing any tightly fitting clothes from the patient.

This in the same line with **Nakata, & Suzuki, (2019)**who mentioned that; regarding practices result of pretest indicates that the level of practices significantly increase with the level of education but effects of an training program make the correlation significant in posttest. Moreover, the nurses lack the efficiency of updating their practice after being and settled in the clinical environment for a longer time and possible explanation for this finding is that the workload **(Nilsson et al., 2019).**

Creamer, & Austin, (2017) reported that training programs for nursing staff play an important role in assist in staff nurses in developing and enhancing their skills needed to provide high standards of care to their patients. This agreed with the present study as nurse's knowledge and practice improved after implementation of the nursing training.

Zhang et al., (2008)in the same line with the current study findings, their study revealed that an improvement in nurses' practice after the attendance at continuing nursing training sessions. Research findings indicated that continued nursing education programs increase knowledge, practice and can also improve attitudes.

This in the same line with **Didwania et al., (2020)** who found in their result that healthcare providers, despite the precision and mastery skills, are not immune to such errors due to the educational system has shortcomings or high work load and pressure as well as the responsibilities of the nurses which caused the errors so that they in need for continuous education program.

Mohamed et al., (2019) concluded that although most of the recommendations on pressure ulcer care found in guidelines are well known by nurses, there is a group of interventions about which they have insufficient knowledge and low implementation rates. Regarding Moore & Price attitude scale, the present study revealed that all of the studied nurses had a negative attitude toward pressure ulcer among stroke patients before application of the nursing training. However, immediate and after 3 months of the nursing training application majority of them had a positive level of attitude toward pressure ulcer among stroke patients.

This result much lower than a survey done in Sweden where nursing study as a whole demonstrated positive attitude regarding pressure ulcer prevention (**Mäkinen et al., 2020)** and similarly in Iraq where nearly all of the nurses had positive attitude toward pressure ulcer prevention practice **(Ibrahim et al., 2019).** Even if pressure ulcer is a multidisciplinary problem, it is important that these two occupational groups have adequate knowledge and a positive attitude on pressure ulcers and that they take an active part in its prevention **(Clarkson et al., 2019).**

Pressure ulcer prevention is a multifaceted problem, where attitudes may be important in influencing behavior **(Avsar et al., 2019).**If an individual has a very negative attitude towards a given topic, and then it is unlikely that the individual will perform positive or supportive behaviors in relation to that topic. For example, the more pressure ulcer prevention is valued the greater the likelihood of preventative practices being carried out **(Kaşıkçı et al., 2018).**

Hynes & Wilson, (2016) suggested that there are two independent influences determining an individual's intention to perform a particular behavior. These influences are personal (the attitude towards the behavior) and social (the social pressure to perform the behavior).

Tissue viability is often perceived as a nurse based problem and the development of pressure ulcers may be linked to nurse attitudes, education and competence in the area of pressure ulcer prevention and management.

Regarding patients:

The present study showed that half of the studied patients were male and another half was female and most of them were married. Previous studies identified that gender, age, urbanization, and hospital characteristics were associated with adverse outcomes after stroke. These demographics and medical conditions were also associated with pressure ulcer **(Lee et al., 2016).** This not matches with **Schott et al., (2018)** study who found that the incidence rate of pressure ulcer among the stroke patients in relation to gender is higher in men than in women. The present study reported that the mean number of sores was 2.04 pre application of the nursing training and was 1.12 post applications with statically significance between them.

This is a potential reduction in pressure ulcers of 80 per cent. Preventing pressure ulcers is an important aspect of patient safety **(Sharp et al., 2019).** In addition, the majority of stroke patients have a sensory perception impairment that prevents them from feeling the discomfort of prolonged pressure which protects skin tissue from damage **(Alimansur, & Santoso, 2019).**

Related to stroke type, the present study showed that the main stroke type was hemorrhagic stroke. The found data were not associated to **Manwani et al., (2019)** in which the study evidenced ischemic stroke as the most frequent, with of the cases and only small percentage of hemorrhagic stroke.

The present study revealed that the majority of the studied patients were buttocks and low back with no statistical significant difference between before and after the nursing training. This match with **Spruce, (2017)** who concluded that the patient's pressure injury was present in the coccyx bone region. This coccyx bone is an area susceptible to pressure injury because of pressure by the bone and added with the longtime pressure. Pressure injury can occur anywhere on the surface of the body if it is exposed to continuous pressure. In line with previous research which stated that the areas most at risk for exposure to pressure injury are the sacral area **(Levy et al., 2017).** Similarly, **Palese et al.** found that pressure injury is the most common in the sacral area **(Palese et al., 2015).**

The present study showed the length of stay was from 8 to 14 days in both pre and post the training application with no statistically difference. In this respect, **Hoyer et al., (2019)** reported that, depression is also associated with stroke severity, increased functional impairment, poorer outcomes and increased length of hospital stay, while leading to increased morbidity and mortality. This not match with **Wilson et al., (2018)** who found that number of the days of patient stay in the stoke unit were more than 80 days. The result showed the studied patients were in degree IV but it decreases after application of the nursing training to stage I with a statistically significant difference between them. This was not match with **Galvão et al., (2017)** who found in the study result that showed the patient sores was in degree III. Similar results were also found by **Razmus & Bergquist-Beringer, (2017)**that half of the pressure injury had occurred before admission to the hospital and was severe pressure injury category III and IV.

In line with research by **Amir et al., (2017)** that half of the patients had got pressure injury $\leq$ 2 weeks. Two weeks period is recommended to evaluate the development of wound healing **(Shefa et al., 2017).** The length of this period can be used for nurses to detect early complications and to evaluate whether the treatment plan is continued or changed. So, the researcher opinion, once the nurse has information about how long the patient has been suffering pressure injury, it aims to inform the patient and family about the estimated duration of treatment and monitor the healing process.

This findings match with **Barrois et al., (2018)** who found that the prevalence of pressure ulcers observed in this study is toward the lower end of the training program for nurses when compared with earlier findings. Regarding Braden scale for patient pre and post intervention of the nursing training, the present study revealed that there were statistically significant difference were found between all items of Braden scale with a significant improvement after the nursing training application. In this point, **Seyhan, (2018)** mentioned that, Physical mobility and activity were associated with pressure ulcer development. In the final multivariate model, however, mobility did not share a statistically significant association with pressure ulcer development, which is different from the finding that activity is a predicting factor in pressure ulcer development.

This result may indicate that most of the stroke patients had slight mobility limitations. Thus, the patients were able to change body or extremity positions independently which led to increased blood flow to various parts of the body, especially in pressurized areas **(Goswami et al., 2019).** However, the majority of the participants had mild to moderate stroke deficits and bedfast activity. As a result, the

patients required greater assistance with the activities of daily living. According to the findings of previous studies **(Kalavina, 2019)** which indicated that stroke patients who had physical problems due to inability to perform self-care had pressure ulcer development. Besides that, **Schott et al., (2018)** was observed that the patients with stroke diseases had good scores referred to nutrition (probably adequate or excellent) and this could be related to disease acute phase, in which the patient still was found in a good state nutritional. Stroke often leads to dysphagia and subsequently to malnutrition **(Feng et al., 2019).**Malnutrition status directly affects skin integrity and puts patients at four times greater risk for pressure ulcers than in normal nutritional status stroke patients **(Plácido de Brito Vieira et al., 2016).**

In this study, majority of the participants with pressure ulcers had very poor nutrition or inadequate nutrition. Nutrition was associated with pressure ulcer development in older stroke patients. In the final multivariate model, nutrition was statistically significant and strongly associated with pressure ulcer development. This is consistent with studies by **Bereded et al., (2018).** So, **Schott et al., (2018)** recommended that the enteral nutrition therapy is necessary when the clinical conditions related to deglutition were compromised. The enteral nutrition has as objective to offer needed nutrients to patients, in order to guarantee the adequate nutritional intake and prevent the clinical under nutrition. Nevertheless, the early enteral nutrition indication in patients enable of feeding orally does not happen, damaging the receipt of caloric/protein daily needs.

Not surprisingly, this study showed that skin moisture was associated with pressure ulcer development in older stroke patients. In the final multivariate model, skin moisture also shared a statistically significant predicting pressure ulcer. One possible reason for these findings was that many of the participants with pressure ulcers had constant skin moisture. A common post-stroke complication is faecal and urinary incontinence and estimates of the prevalence on post-stroke urinary incontinence **(Richard-Denis et al., 2016**). Urine causes moist skin and decreases skin tolerance and strength, while faeces also irritates and damages the skin which can precipitate pressure ulcers **(Santamaria et al., 2019).**

Another important factor associated with developed pressure ulcers in older stroke patients in this study was friction and shearing. The present study revealed that friction and shearing was statistically significant and strongly associated with pressure ulcer development. This result may be due to the fact that the majority of older stroke patients with pressure ulcers had friction and shearing problems (**Gefen et al., 2020).**

From observational data, most of the patients had reduced ability to move in bed or in a chair independently with insufficient muscle strength to lift their bodies up. Unavoidably, most of the patients required more assistance from caregivers in moving, positioning and transferring. In addition, the caregivers pulled the patients to turn them in changing position. Thus, the friction and shearing occurred between the epidermis and clothes and bed linens during position changes which resulted in the dermal–epidermal junction being destroyed, the stratum corneum peeling off, the subcutaneous capillaries being lacerated and decreased blood flow to the skin resulting in pressure ulcers **(Hasegawa et al., 2020).**These findings are similar to those of previous studies **Lima-Serrano et al., (2018)** which found that friction and shearing force were factors capable of predicting the prevalence rate of pressure ulcers.

Regarding the total Braden scale for patient pre and post intervention there was a statistically significant between pre and post the nursing training intervention, also the present study showed that the majority of

the studied patients had a moderate risks and this percentage improved after the training application of the nursing training.

This match with **Schott et al., (2018)** who reported According to the PU risk classification, it can be seen that these patients are a risk group to developing PU, since the majority presented moderate PU risk in the hospitalization, being an aggravating factor to PU development during the stay of these patients in the hospital. In the other hand **Chaboyer et al., (2016)** said that; there is no data showing how far the prevention and treatment of pressure injury has been given to stroke patients

In the present study, there was no correlation between demographic data and knowledge, practice, attitude, barden and risk of bed sores except with training about pressure. The table showed that there was a positive correlation within all of knowledge, practice, attitude, barden and risk of bed sores. The findings of the exciting study revealed that, there was no statistical significance between nurses' qualification and knowledge regarding physical restraints; these results agreed with **Sapiano et al., (2018)** who reported that, there were non-significant differences in knowledge score between nurses had a diploma and bachelor degree in nursing. Regards to nurses' qualification, the present study reported that, there was no correlation between nurses' qualification and practice, these findings agreed with **Wonggom et al., (2020)** who stated that Bachelor degree of nursing science (BSN) superior than diploma nurses regarding to professional practices.

In relation to nurses' gender, the current study revealed that, there was a no correlation between nurses' gender and knowledge and practice; these findings disagreed with **Sulistiyawati & Cahyati, (2020)** they stated that nurses' gender had no effect on their knowledge and practice related pressure ulcer prevention. Concerning to nurses' years of experience, the available study documented that, there was no correlation between nurses' experience years and attitude and practice score, these results in line with **Lechner et al., (2017)** they said that the nurses had more experience years; they are acting the best technique with positive attitude related to pressure ulcer than less years of experienced nurses.

This not match with **Arkan et al., (2018)**who showed in his study that bachelor register nurse were significantly better patient outcomes, that not in it line with the present study results. The educational level, and years of experience of studied nurses could be factors affecting on level of nurse's knowledge and practice forwardly on their attitude.

In my opinion**;** the knowledge and practice depend on each other. This result was congruent with a recent study which found that critically ill patients' management are directly influenced by nurses.

Jiang et al., (2015) who reported opposite results regarding correlation between knowledge and practice, there was no correlation between emergency nurses' knowledge and practice.

The researchers' opinion that the goals of the upcoming educational program should focus on the nurses with insufficient knowledge and this should improve the rate of good practice and perception of nurses. More knowledge among nurses, compared to other healthcare providers, might be explained by their greater opportunities of professional development, clinical training and previous experience with similar viral infections of epidemic potential. Similar positive correlation between knowledge and practice of healthcare workers was reported by **Gupta et al., (2015)** among nurses.

In view of this, it could be established that adequate knowledge can lead to good practice that could be explained by **Neutzling et al., (2019)** who

explained that a person's intention to a specific behavior is predicted by his perception toward that behavior and how he thinks other people would view him if he performed the behavior. Thus it could be concluded that correct knowledge results in good perception which could be translated into practice to achieve desirable outcomes **(Hardy et al., 2019).**

Further, positive attitudes toward prevention are an important component for successful interventions to prevent pressure injury. Therefore, this study aimed to examine the relationship between knowledge and attitudes toward prevention of pressure injuries among nurses working at the medical neurological units at Mansoura University Hospital in Egypt.

Pressure ulcer prevention and management involves not only emphasizing educational strategies but also promoting a positive attitude towards this aspect of patient care. Therefore, the aim of this study was to identify nurses' attitudes, behaviors and perceived barriers towards pressure ulcer prevention and management.

Physical and/or mental inability that the patient can present after stroke depends of the stroke number and type. In this study could be observed that these patients exhibited some physical and/or mental sequel, since the majority was found restricted to the hospital bed. Due to these consequences, these patients can exhibit difficulties in evaluating the pressure on bone prominences favoring the emergence of PU.

Conclusion:

The assessment before intervention of the nursing training indicated an inappropriate level of nurses' knowledge and practice and a positive attitude toward pressure ulcer prevention. However, the immediately posttest 3 months posttest evaluation following the training application showed a statistical significant increase in the total mean scores of knowledge, attitude and practice. Regarding the studied patients; the present study showed that the patients were in degree IV but it decreases after application of the nursing training. Regarding Braden scale among the studied patients, the percentage of high risks decreased after the training application. These finding indicated that continuous nurse's educational regarding PU prevention is important.

Recommendation

Developing a continuous educational program to improve nurses' knowledge, attitude and practice towar dpressure ulcer prevention. In addition to preventing pressure ulcer risks.

Conflicts of interest disclosure

The authors declare they have no conflicts of interests.

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