Journal Homepage: -www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI:10.21474/IJAR01/21855
DOI URL: http://dx.doi.org/10.21474/IJAR01/21855

RESEARCH ARTICLE

THE EFFECT OF AN EDUCATIONAL PROGRAM BASED ON SIMULATION WITH MOULAGE REGARDING CARE OF PATIENTS WITH PRESSURE ULCER ON SECOND YEAR NURSING STUDENTS'PERFORMANCE AND SATISFACTION

Ayat Mostafa Abdel Hady[1], Badria Abd Elshahed Elkattan[2] and Zeinab Hussein Ali[3]

1. Assistant Lecturer in Critical Care and Emergency Nursing, Faculty of Nursing, Fayoum University, Egypt.
2. Assist Professor of Adult Health Nursing, Faculty of Nursing, Helwan University, Egypt.
3. Professor of Adult Health Nursing, Faculty of Nursing, Helwan University, Egypt.

Manuscript Info

Manuscript History
Received: 19 July 2025
Final Accepted: 21 August 2025
Published: September 2025

Key words:-
Second year nursing students,
Simulation, Moulage, Performance

Abstract

Background:-Simulation based education is considered the gold standard for facilitating the development of clinical competence in nursing education.Moulage may be considered as one of the high-fidelity low-cost simulators.

Aim of the study: was to evaluate the effect of an educational program based on simulation with moulage regarding care of patients with pressure ulcer on second year nursing students'performance and satisfaction.

Research design: A quasi-experimental research design was utilized in this study.

Setting: The study was conducted at thefaculty of nursing, Fayoum University.

Subjects: A purposive sample of 218 medical surgical nursing students affiliated to the mentioned setting.

Tools: Four tools were used for data collection in the present study.

Tool I: A self-administered assessment questionnaire.

Tool II: Second year nursing students' knowledge assessment question naire.

Tool III: Pressure ulcer care observational checklist.

Tool IV: Moulage evaluation and satisfaction questionnaire for second year nursing students.

Results: the study results reported the implementation of the educational program based on simulation with moulage resulted in a marked improvement in students' knowledge and practice regarding the care of patients with pressure ulcer. The proportion of students with a satisfactory level of knowledge in study group increased from 35.9% pre-program implementation to 87.9% post-program implementation, and those demonstrating a satisfactory level of practice increased from 32.1% to 86.2%, with highly statistically significant differences ($P < 0.001$*). Furthermore, the majority of students82.6%reported a satisfactory level regarding total moulage evaluation and satisfaction among study group post program Implementation.

Conclusion: The study concluded that the implementation of the educational program based on simulation with moulage led to marked improvement in students' knowledge and practice.
Recommendation: An orientation program should be done for nursing students to familiarize them with differenttypes of simulators and learning environment especially simulation with moulage. Further research; evaluate nursing students'perception regarding simulation with moulage. Examine usage of simulation with moulage with additional nursing courses to measure intended learning outcomes.

Introduction:-

Regarding to Acosta-Hernández, et al., (2023) the three most important international associations regarding pressure ulcers(PUs), the European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel and Pan Pacific Pressure Injury Alliance (EPUAP/NPIAP/PPPIA) define PUs as a damage to the skin and/or underlying tissues that are usually located on a bone prominence, caused by intense pressure or a combination of pressure and shear. This type of injury arises mainly in immobilized patients during long stays where, due to their intrinsic and extrinsic factors. Pressure ulcers are a prevalent complication for hospitalized patients who are confined to physical activities (Liang, et al., 2024).

Nurses play a key role in preventing pressure injuries as their primary responsibility involves maintaining the skin integrity of the patients. Nursing students can also help prevent pressure injuries as they are the future nursing workforce. Therefore, nursing students should be adequately prepared in terms of their knowledge and attitudes to contribute to pressure injury prevention (Al Gharash, et al., 2024). Providing a maximum clinical learning experience to nursing students remains a great challenge for nurse educators. Training of medical students in the domain of clinical skills is an essential component of medical education delivery. Among the various clinical skills, exposing medical students to the management of wounds has immense significance, as it prepares them with the desired skills to provide immediate and effective care in heterogeneous clinical settings (Shrivastava, et al., 2024).

As regards Sengul et al., (2025) Simulation-based education has emerged as a powerful teaching strategy in healthcare, allowing learners to apply theoretical knowledge in realistic scenarios without risking patient safety. Moulage,is the art of applying mock injuries or wounds to simulate real-life clinical conditions, enhances the realism of simulation sessions and improves learners' engagement and skill acquisition. When incorporated into pressure ulcer training, simulation with moulage offers a unique opportunity to develop nurses' visual and tactile recognition skills, clinical decision-making, and confidence in delivering care.

Significance of the study:

Globally, 23 % to 30 % of hospitalized patients and about 30 % of people in long-term care facilities are affected by PUs. The incidence of pressure ulcers in patients in the ICU ranges from 6.78% to 25.9%, it has been recorded that the incidence of pressure ulcers in ICU patients is higher than the incidence found in general units and that pressure ulcers are associated with higher mortality rates and a significant increase in health care expenditures, placing a serious burden on both patients and society (Chen, et al., 2023).

The incidence of PUs is considered as an indicator of poor quality of care and nursing care have a significant impact on the development and prevention of PUs because nurses are at the frontlines of the provision of health care. A desirable level of basic knowledge and practice is essential to improve the quality and safety of nursing care (Ghorbani Vajargah, et al., 2023). It is estimated that almost 60% of PUs that develop in these units are avoidable, being able to affirm that the treatment and prevention of PUs in ICUs are a public health need (Acosta-Hernández, et al., 2023).

Nursing education seeks to provide nurses with the clinical competencies needed to function in the ever-changing healthcare setting. Clinical competence in nursing practice entails the use of knowledge, understanding, and judgment, as well as the competencies of the exhibition of skills, attitudes, and qualities, in the delivery of safe patient care in specific situations. Globally, simulation based education is considered the gold standard for facilitating the development of clinical competence of nursing students (Salifu, et al., 2022).

The adoption of alternative teaching approaches such as simulation is essential to enhance the preparation of nursing students to assume professional nurse roles. In nursing, simulation is an alternative teaching modality whereby nursing students learn cognitive, affective, and psychomotor skills in a harmless, nonthreatening practice

environment using realistic equipment that mimics actual clinical practice settings (Svellingen, et al., 2021). Moulage is a tool to enhance the fidelity of simulations regardless of the environment and modality used (Fourie, et al., 2023).

Theory of the study:
The present study employed The National League for Nursing (NLN) Jeffries Simulation Theory as a theoretical framework of reference in implementing the educational program based on simulation with moulage. NLN Jeffries Simulation Theory is a highly systematic process and provides a basis for improved learning and performance measurements (Jeffries, 2016) & (Jeffries, et al., 2015).

The NLN/Jeffries Simulation Framework outlines major concepts that contribute to the science of nursing simulation research and evidence-based nursing practice. This framework uses a highly systematic simulation design feature integrated with six major concepts. The six concepts are context, background, design, educational practices, simulation experience, and outcomes. Simulation educational practices under this framework in nursing contribute to best evidence-based practice standards in both educational outcomes and patient care outcomes in health care organizations (Cowperthwait, 2020) &(Salifu, et al., 2022).

Aim of the study:-
This study will aim to evaluate the effect of an educational program based on simulation with moulage regarding care of patients with pressure ulcer on second year nursing students'performance and satisfaction.

This aim will be achieved through: -
- Assess second year nursing students' knowledge and practice regarding care of patients with pressure ulcer.
- Design the educational program based on simulation with moulage.
- Implement the program for second year nursing students.
- Evaluate the effect of the provided program on students' knowledge, practice and satisfaction.

Research Hypothesis:-
To fulfill the aim of this study. The following research hypotheses are formulated:
H1: At the end of the study, the mean score of knowledge for students whom will attend the educational program based on simulation with moulage will be higher than those students whom will not attend.
H2: The mean score of practice for students whom will attend the educational program based on simulation with moulage will be higher than those students whom will not attend.
H3: Students' satisfaction whom will attend the educational program based on simulation with moulage will be more satisfaction than those will not attend program.

Subjects and Method:-
Research design:-
A quasi-experimental research design was utilized in this study, involving two groups study and control group of students (pre-/post-program).

Setting:
The present study was conducted at theclinical skills lab,faculty of nursing, Fayoum University.

Sampling:
A purposive sample includes of medical surgical nursing students affiliated to the second year from faculty of nursing, Fayoum University in the academic year 2023 - 2024. And number of students were (n= 500). Based on sample size equation (Machin, et al., 2018), students were (218) participated in the study, recruited from the previously mentioned setting. The sample size was calculated by adjusting the power of the test to 80% and the confidence interval to 95% with margin of error accepted, adjusted to 5%.

P= 0.5

N= Total population

$$n = \frac{N \times p(1-p)}{\left[\left[N-1 \times \left(d^2 \div z^2\right)\right] + p(1-p)\right]}$$

Z= Z value "1.96"

D= Standard Error

n= sample size

Students divided into two equal groups, study group & control group (109) students for each group. The students in both groups were selected according to the following criteria:

Exclusion criteria:
Second year nursing students affiliated to the faculty from nursing institutes were excluded from the study sample because they previously had lecture about care of patients with pressure ulcer and wound care in the institute.

Tools for data collection:
Four tools were utilized to collect data pertinent to the study:
Tool I: A Self- administered assessment questionnaire:
This tool was developed by the researcher to assess student's personal characteristics. It contained items regarding student's personal data such as age, gender, the final evaluation at first year as regard to nursing subject, specific courses on pressure ulcers, last time you listened to a lecture on pressure ulcer and last time you read an article or book on pressure ulcers.

Tool II: Second year nursing students'knowledge assessment questionnaire:
Which was developed by the researcher based on review of related literature Hulsenboom, et al., (2007); Mwebaza, et al., (2014); Dilie& Mengistu, (2015) and Manderlier, et al., (2017), to assess second year nursing students'knowledge regarding care of patients with pressure ulcer, it consists of the following questions: Anatomy and physiology of skin, definition and etiology of pressure ulcer, risk assessment, classification, preventive measures of pressure ulcers and health education about pressure ulcers. It consists of 40 multiple choice & true and false questions.

Scoring system:
Second year nursing students' knowledge assessment questionnaire consisted of 40 questions. The correct answers were predetermined according to literature review, a correct answer was scored 1 point and incorrect answer was scored 0 point. The total score were 40 scores. According to statistical analysis as following: The level of knowledge considered satisfactory if the total score equal 80 % or more (≥80 %) equal (≥32 grade). Unsatisfactory level of knowledge, if the total score less than 80 % (<80 %) equal (<32grade).

Tool III: Pressure ulcer care observational checklist for second year nursing students:
It was developed by the researcher based on relevant literature Khojastehfar, et al., (2020); Nasreen, et al., (2017) and Zeydi, et al., (2022), to assess second year nursing students' practice regarding care of patients with pressure ulcer. This tool consisted of 53 items with three subscales including assessment of patients in intensive care unit (13 item), developing a pressure ulcer preventive care plan in intensive care unit for patients who at risk to have pressure ulcer (29 item), and monitoring progress of pressure ulcer (11 item).

Scoring system:
The total items of questionnaire were (53), each item has 2 levels of answers (not done, done). These were respectively scored (0, 1). According to statistical analysis the level of practice considered satisfactory if the total score equal 80 % or more (≥80 %) equal (≥42 grade). Unsatisfactory level of practice if the total score less than 80 % (<80 %) equal (<42grade).

Tool IV: Moulage evaluation and satisfaction questionnaire for second year nursing students:
It was adapted by the researcher from Uzelli Yilmaz, et al., (2021). To assess students' response about effectiveness of moulage and their satisfaction with its use for care of patients with pressure ulcer. It consists of the five questions.

Scoring system:
The questions were scored on a five-point Likert scale by the students (1: strongly disagree to 5: strongly agree). The resulted scores ranged from 5 to 25 (with a mean of 1-5) and the higher scores indicated better evaluation or more satisfaction.

Validity:
The content validity of the tool was assessed by a jury of five expertise academic staff at adult health nursing department from faculty of nursing Helwan University. Accordingly, essential modifications were made.

Reliability of the Tools:
Reliability of the tool was tested to determine the extent to which the questionnaireitems are related to each other. The Cronbach's alpha model, which is a model of internal consistency, was used in the analysis. Statistical equation of Cronbach's alpha reliability coefficient normally ranges between 0 and 1. Higher values of Cronbach's alpha (more than 0.7) denote acceptable reliability.

Ethical Considerations:
An ethical approval to conduct the proposed study was obtained from the Scientific Research, Ethical Committee of the faculty of Nursing, Helwan University. Ethical Committee number (36) date 3/10/2023. The study facilitation letter to conduct the study was received from the dean of faculty of nursing at Helwan University and sent to the dean of faculty of nursing, Fayoum University. An official permission was obtained from the administrative authority of the selected setting for the current study. The researcher obtained an oral and written consent from the studied students.Participation in the study was voluntary, studied students were given complete full information about the study and their role before signing the informed consent. The ethical considerations include explaining the purpose and nature of the study, stating the possibility to withdraw at any time, confidentiality of data assured by the researcher by using codes to identify participants instead of names or any other personal identifiers. Ethics, values, culture and beliefs were respected.

Pilot study:
A Pilot study was carried out with 10% (22 students) of the sample under study to test the applicability, clarity and efficiency of the tools, then the tools modified according to the results of the pilot study. Modifications included: rephrasing and rearrangement of some questions. After modification, the final form of tools was developed. Students who shared in pilot study are excluded from the study sampleand replaced by an others.

Fieldwork:
This study introduced an educational program based on simulation with moulage regarding care of patients with pressure ulcer designed to assist second year nursing students in acquiring knowledge and skills with the goal of preventing or treating of pressure ulcer and satisfaction regarding simulation with moulage. Includes four phases:

Assessment phase:
Students' knowledge and skills in performing pressure ulcer care and preventive measures were evaluated using multiple-choice questions, practical exams, and observations. Skill gaps and weaknesses in their abilities, such as difficulties with risk assessment and dressing of pressure ulcer, were identified. PowerPoint presentations provided theoretical instruction and lab demonstrations using low-fidelity simulators or video demonstrations.

Planning phase:
Involved defining goals, objectives, budget, and simulation types while designing the program based on NLN Jeffries Simulation Theory. Educational materials were developed, including procedure manuals, moulages of pressure ulcer and instructional videos, and briefing and debriefing strategies were planned. One simulation scenario was designed, with three to four-hour practice sessions scheduled. A simulation hospital was set up to replicate a clinical environment, focusing on pressure ulcer care. Simulation with moulage for different stages of pressure ulcer were prepared to enhance students' experience.

Implementation phase:
During this phase, students first participated in a briefing session, reviewing theoretical materials and videos before simulation. A 60-minute orientation introduced them to the lab environment, roles, expectations, and safety guidelines. Briefing emphasized a safe learning environment, patient room setup, equipment usage, and

documentation. Students were divided into two groups. Half of the students (109) were taken to a 4-hour session at the clinical skills lab to have pressure ulcer care and prevention procedures demonstrated by the researcher on simulation with moulage, then the other half (109) were also taken to a session at the skills lab to have pressure ulcer care and prevention demonstrated by the researcher on a low-fidelity simulator. Every student had a procedure manual booklet including all information regarding pressure ulcer care and prevention destined to be taught in the educational program. In the first-run simulation experience, a 30-minute simulation scenario focused on pressure ulcer, where students practiced techniques, identified abnormalities, communicated with patients, and documented findings. Simulations ran for four weeks (three times weekly), with 20 students per session. Afterward, students participated in a structured debriefing session. The process included reaction, analysis, and application phases to enhance reflective learning and clinical competency.

Evaluation phase:
Students' knowledge was re-evaluated using a knowledge assessment questionnaire. The performance was re-evaluated using a pressure ulcer care observational checklist by the researcher and evaluated students' responses regarding moulage evaluation and satisfaction. The evaluation process took 20–30 minutes per student.

Results:-

The present study aimed to evaluate the effect of an educational program based on simulation with moulage regarding care of patients with pressure ulcer on second year nursing students' performance and satisfaction.

Table (1): Frequency and percentage distribution of studied students regarding to their demographic and educational characteristics: Comparison between study and control groups (n=218).

Variables	Studygroup (n=109)		Controlgroup (n=109)		Chi-square	
	N	%	N	%	X2	P-value
Age						
18<20	48	44.0	58	53.2	1.862	**0.394**
20<22	41	37.6	35	32.1		
22ormore	20	18.3	16	14.7		
Mean±SD	**21.5±2.53**		**20.72±2.4**			
Gender						
Male	40	36.7	47	43.1	0.937	**0.333**
Female	69	**63.3**	62	**56.9**		
Final evaluationat first year as regard to nursing subject						
Accepted	22	20.2	19	17.4	3.530	**0.317**
Good	32	**29.4**	45	**41.3**		
Verygood	30	**27.5**	23	**21.1**		
Excellent	25	22.9	22	20.2		
Specific courses on pressureulcers						
Yes	55	**50.5**	48	**44.0**	0.902	**0.342**
No	54	49.5	61	56.0		
Last time you list enedtoalectureon pressureulcer						
1yearorless	60	**55.0**	48	**44.0**	4.345	**0.114**

>1year	41	37.6	56	51.4		
Never	8	7.3	5	4.6		
Lasttimeyoureadanarticleorbookonpressureulcers						
1yearorless	50	**45.9**	37	**33.9**	3.556	**0.169**
>1year	29	26.6	39	35.8		
Never	30	27.5	33	30.3		

Table (1): shows that there was no statistically significant difference between the study and control groups regarding the assessed variables, as the p-values were > 0.05, indicating proper matching between both groups. It also demonstrates that the mean age of students in the study and control groups was 21.5±2.53 and 20.72±2.4, respectively. The majority of students in both groups were female, representing 63.3% of the study group and 56.9% of the control group.

Regarding the final evaluation at first year as regard to nursing subject, most students in both groups had either good or very good grades, with 29.4% good and 27.5% very good in the study group, compared to 41.3% good and 21.1% very good in the control group. As regards to specific courses on pressure ulcers, 50.5% of the study group and 44% of the control group reported attending such courses. Concerning the last time students listened to a lecture on pressure ulcers, in both groups did so within one year or less 55% in the study group and 44% in the control group. As for the last time they read an article or book on pressure ulcers, 45.9% of the study group and 33.9% of the control group had done so within the one year or less.

Table (2): Frequency and percentage distribution of studied students'totallevel of knowledge regarding pressure ulcer care: Comparison of pre and post program in study and control groups (n=218).

Total knowledge	**Studygroup(n=109)**				**Controlgroup(n=109)**				**Chi-square**	
	Satisfactory		**Unsatisfactory**		**Satisfactory**		**Unsatisfactory**			
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**X^2**	**P-value**
Pre	39	**35.9**	70	64.1	37	**33.9**	72	66.1	0.081	**0.776**
Post	96	**87.9**	13	12.1	42	**38.8**	67	61.2	57.580	**<0.001***

>0.05 Non significant <0.05* significant <0.001* High significant

Table (2): illustrates that there were no statistically significant difference between the study and control groups in pre program with P = 0.776, with satisfactory knowledge reported in 35.9% of students in the study group and 33.9% in the control group. However, post program, there was a highly statistically significant improvement (P < 0.001*) in the study group, where the proportion of students with satisfactory knowledge increased dramatically to 87.9%, compared to only 38.8% in the control group.

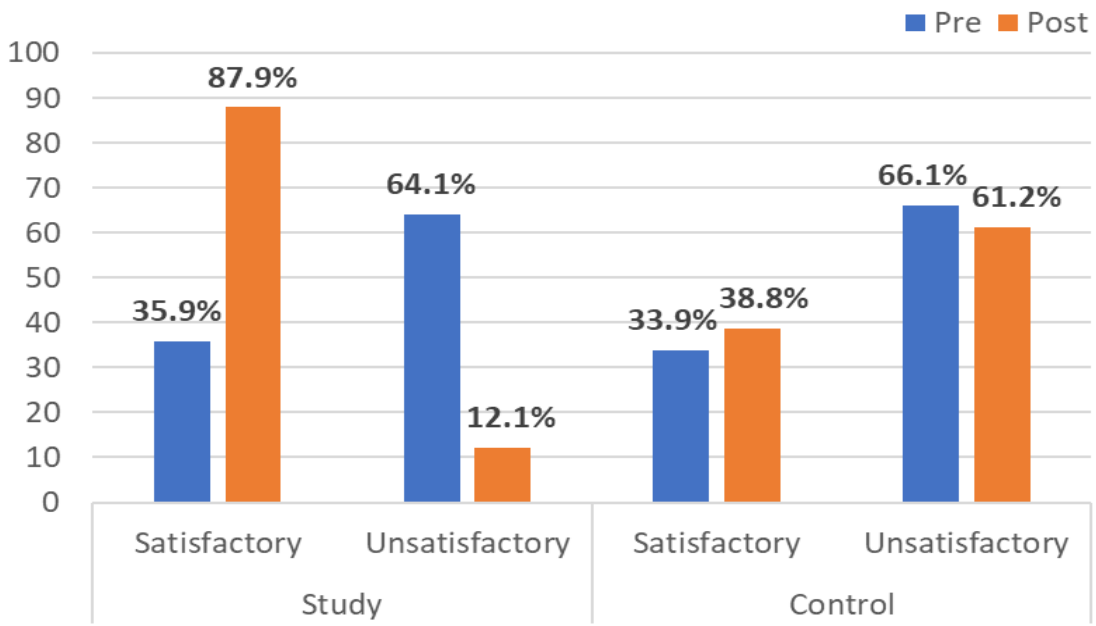

Figure (1): Percentage distribution of studied Students' total level of knowledge regarding pressure ulcer care: Comparison of pre and post program in study and control groups (n=218).

Figure (1): illustrates that the study group showed a significant improvement in total knowledge post-program. Satisfactory knowledge increased from (35.9% to 87.9%), while the control group showed minimal increase (33.9% to 38.8%).

Table (3): Frequency and percentage distribution of studied students' total level of practice regarding pressure ulcer care : Comparison of pre- and post -program in study and control groups (n=218).

Total practice	Studygroup(n=109)				Controlgroup(n=109)				Chi-square	
	Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory			
	N	%	N	%	N	%	N	%	X^2	P-value
Pre	35	**32.1**	74	67.9	34	**31.2**	75	68.8	0.471	**0.492**
Post	94	**86.2**	15	13.8	43	**39.4**	66	60.6	51.097	**<0.001***

Table (3): illustrates that there were no significant difference between the study and control groups in the pre-program (P = 0.492), with 32.1% of students in the study group and 31.2% in the control group were competent. Post program, the study group showed a highly statistically significant improvement (P < 0.001*), with 86.2% of students were competent, compared to 39.4% in the control group.

Figure (2): Percentage distribution of studied students' total level of practice regarding pressure ulcer care: Comparison of pre- and post -program in study and control groups (n=218).

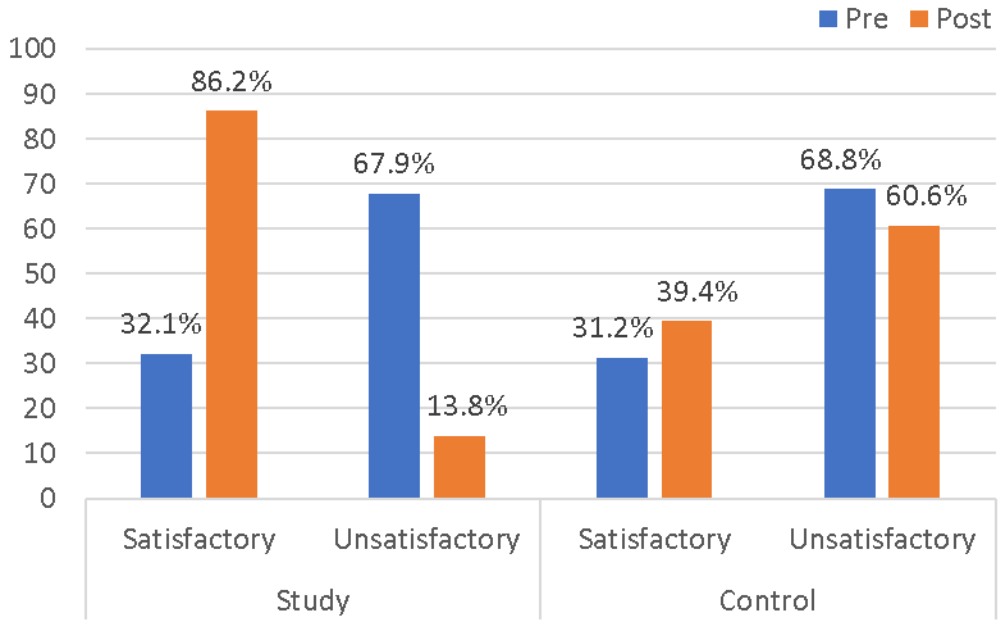

Figure (2):illustrates that the study group showed a significant improvement in total practice satisfaction post-program. Satisfaction increased from 32.1% to 86.2%, while the control group showed minimal increased from 31.2% to 39.4%.

Table (4): Frequency and percentage distribution of studied students regarding moulage evaluation and satisfaction: post -program among study group (n=109).

Moulageevaluationandsatisfaction		Studygroup(n=109)				
		Strongly agree	Agree	Uncertain	Disagree	Stronglydisagree
The pressureulcermoulage simulation was close to there alexperience of caring are alpatient.	N	50	35	12	8	4
	%	**45.9**	32.1	11.0	7.3	3.7
Theappearanceofpressureulcermoulageswasrealistic.	N	39	47	20	2	1
	%	35.8	**43.1**	18.3	1.8	0.9
Themoulageswererealisticenoughtobeusedinnursingeducation	N	52	24	15	12	6
	%	**47.7**	22.0	13.8	11.0	5.5
Themoulagehelpedmetobetterunderstandtheassessmentofthepressureulcer.	N	45	36	19	7	2
	%	41.3	33.0	17.4	6.4	1.8
Themoulagespositivelyaffectedmyskillsinthecareofpressureulcer.	N	32	48	20	8	1
	%	29.4	**44.0**	18.3	7.3	0.9

Table (4): shows that, 45.9% of studied students strongly agree toward the pressure ulcer moulage simulation was close to the real experience of caring a real patient and 43.1% of them had response of agree that the appearance of pressure ulcer moulages was realistic. Also 47.7% of them strongly agree regarding the moulages were realistic enough to be used in nursing education. While, 44% of them had response of agree that the moulages positively affected my skills in the care of pressure ulcer.

Figure (3): Percentage distribution of studied students regarding total moulage evalution and satisfaction among study group (n=109).

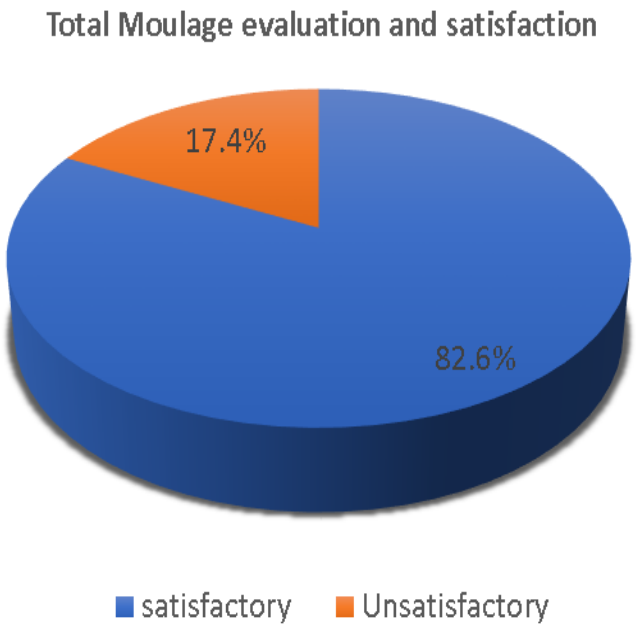

Figure (3): illustrates that 82.6% of studied students reported a satisfactory level regarding moulage evaluation and satisfaction, while only 17.4% reported unsatisfactory in study group post program.

Table(5):

Table (5): Correlations between knowledge, practice, and moulage evaluation and satisfaction among study group (n=109)

Variables	Knowledge		Practice	
	r	P-value	r	P-value
Pre				
Practice	**0.375**	**0.005***		
Post				
Practice	**0.356**	**<0.001***		
Moulage evaluation and satisfaction	**0.806**	**<0.001***	**0.394**	**<0.001***

Table (5): Shows that there was a strong and highly significant positive correlation found post-program between knowledge and moulage evaluation and satisfaction (r=0.806, P<0.001). In addition, knowledge demonstrated a significant moderate correlation with practice both pre-program (r=0.375, P=0.005) and post-program (r=0.356, P<0.001). Moreover, moulage evaluation and satisfaction showed a moderate and statistically significant correlation with practice in the post-program phase (r=0.394, P<0.001).

Discussion:-

Regarding Monaco et al., (2021) pressure ulcers, also known as bedsores or decubitus ulcers, remain a significant healthcare challenge, particularly among immobile and critically ill patients. These skin injuries, caused by prolonged pressure on the skin and underlying tissues, can lead to serious complications such as infections, delayed recovery, increased healthcare costs, and even mortality. Despite the availability of preventive measures and care protocols, pressure ulcers continue to occur due to gaps in knowledge, inadequate clinical skills, and inconsistent adherence to best practices among healthcare providers, particularly nurses.

As regardsSengul et al., (2025)simulation-based education has emerged as a powerful teaching strategy in healthcare, allowing learners to apply theoretical knowledge in realistic scenarios without risking patient safety. Moulage, is the art of applying mock injuries or wounds to simulate real-life clinical conditions, enhances the realism of simulation sessions and improves learners' engagement and skill acquisition. When incorporated into pressure ulcer training, simulation with moulage offers a unique opportunity to develop nurses' visual and tactile recognition skills, clinical decision-making, and confidence in delivering care.

As regards, demographic data of nursing studentsregarding age, the current study findings showed that more than two-fifths of participants in the study group were between 18 and <20 years, compared to slightly more than half in the control group. The similarity in age distribution enhances the internal validity of the study by reducing the likelihood that age-related factors, such as cognitive maturity or clinical exposure, influenced the outcomes of the educational program. This explanation supported by Batmaz et al., (2025)who conducted a study about “The simulation realism scale for healthcare professionals and students: A development, validity and reliability study” at a public university in Turkey, revealed that sample of 215 participants, 76.7% were students and 84.1% were 18-30 years old.

The current study finding was compatible with the study conducted by Núñez et al., (2024) entitled “Perception of University Nursing Students and Faculty Members Regarding Simulated Practices: A Mixed Methods Study” who reported that the majority of nursing students were late teens to early twenties more than two-fifths aligns well with (18-22 years). In opposite, the current study findings were contradicted with the study conducted by Mather, et al., (2022) entitled "Australian first-year nursing student knowledge and attitudes on pressure injury prevention: A three-year educational intervention survey study" who reported that the Mean ± SD age of the students was 25.57±8.06 years.

As regards gender, the current study findings revealed that near to two thirds of study group and more than half of control group were female. These results may be explained by the fact that nursing is a universal feminine profession especially in our society culture as well as the enrolment of the male students in this profession was started in the late decades this explanation supported by Prosen et al., (2025) who conducted a study about “Nursing students’ views on men in nursing: a gender diversity challenge in the healthcare workforce” in Slovenia, revealed that future efforts should focus on redefining nursing as a gender-neutral profession.

These findings agreed with Ayed, et al., (2022) who conducted a study entitled “Effect of Pressure Ulcer Prevention Program on Nurses' Performance and Orthopedic Patients' Outcomes” found that more than half of study sample participants were females. The same as reported by Özden et al., (2025) whose study entitled “Effect of moulage on nursing students' endotracheal suctioning knowledge and skills” who concluded that more than two thirds of nursing students were females.

Regarding specific courses on pressure ulcers, the present study's findings indicated that just over half of the study group had taken such courses, compared to nearly half of the control group. These results may be explained by the fact that the participants were second-year nursing students. At this stage in their education, their curriculum likely includes foundational nursing principles, which may touch upon pressure ulcer prevention and management as part of broader patient care modules rather than as highly specialized, standalone courses. The "specific courses"

reported might refer to short modules, workshops, or perhaps even self-directed learning that complements their core curriculum. Given their relatively early stage of professional training, it's understandable that advanced or highly specialized courses might not yet be a widespread part of their educational experience, thus leading to no significant difference between the two groups this explanation supported by Halász et al., (2023**)** who conducted a study about "EPUAP Pressure Ulcer Curriculum".

Concerning percentage distribution of studied students'totallevelofknowledge regardingpressureulcercare, the current study findings showed that a significant improvement in total knowledge of pressure ulcer prevention post the program in the study group compared to the control group.This marked improvement can be explained by the comprehensive and interactive nature of the educational program, which combined theoretical instruction with simulation-based practice using moulage. By engaging multiple learning modalities visual, auditory, and kinesthetic to facilitated deeper understanding and retention of information. The realistic simulation scenarios likely enabled students to connect theoretical knowledge with clinical application, enhancing their ability to recognize risks, understand stages, and implement appropriate preventive measures. Such active learning environments have been shown to be more effective than traditional methods, particularly in building holistic clinical competence, which explains the significant gain in overall knowledge observed in the study group, this explanation supported by Farooq et al., (2025).

The current study finding was similar to the study conducted by Chongtham, (2024) entitled "Assess the effectiveness of self-instructional module on knowledge and practice regarding prevention and management of pressure sores in bed ridden patients among staff nurses working in selected hospitals, at Bangalore" the findings indicate a significant improvement in the mean knowledge scores of staff nurses regarding pressure sore prevention post program, with pre-test scores averaging 9.36 and post-test scores averaging 24.76, demonstrating the program's effectiveness in enhancing knowledge among the participants.

At the same line, Suma et al., (2024) whoconducted a study entitled "A Study to Evaluate the Effectiveness of Structured Teaching Programme (STP) on Knowledge Regarding Use of Braden Scale for Predicting Pressure Sore Risk Among Student Nurses in KLEs Institute of Nursing Sciences, Hubballi" reported that the pre- structured teaching programme, 78% of student nurses had average knowledge regarding the use of the Braden Scale for predicting pressure sore risk. Post-program, 94% demonstrated good knowledge, indicating a significant improvement in total knowledge. The gain in knowledge score was 34.12%, with a paired "t" test value of 26.08, confirming the effectiveness of the program in enhancing knowledge about pressure ulcer prevention among the study group.

Concerning percentage distribution of studied students' total level of practice regarding pressure ulcercare, the present study findings indicated that there was a significant improvement in total practice satisfaction post-program. This improvement reflects the positive impact of the simulation-based educational program, which provided students with realistic, hands-on experiences that helped translate theoretical knowledge into practical skills. Such findings are consistent with existing literature emphasizing that simulation using moulage enhances learner engagement, builds clinical confidence, and fosters skill acquisition ultimately leading to better performance in patient care activities related to pressure ulcer prevention and treatment.

The current study finding was similar to the study conducted by Uzelli Yilmaz et al., (2021) they found that students who underwent clinical scenario simulations achieved substantially higher skills scores (29.04 ± 6.00) than those in the lecture-based control group (12.38 ± 4.15; $P < 0.001$). Furthermore, the present study finding was consistent with the study done by Yilmazer et al., (2020) the study involved 38 nursing students utilized standardized patient simulations for pressure ulcer prevention and showed notable gains in performance: pre-test performance averaged 43.7/100, but increased to 75.9/100 post-simulation ($p < 0.001$).

At the same line, Sezgunsay et al., (2020) concluded in their study entitled "Is Moulage effective in improving clinical skills of nursing students for the assessment of pressure injury?" that there was a significant improvement in total practice in clinical skills of nursing students post program.

As regards, percentage distribution of studied students regarding total moulage evaluation and satisfaction, it was noticed that the evaluation of moulage simulation for pressure ulcer care demonstrates that the majority of studied students (82.6%) reported a satisfactory level regarding total moulage evaluation and satisfaction, indicating

that the simulation had a positive impact on student satisfaction and learning outcomes. The present study finding was consistent with the study done by Uzelli Yilmaz et al., (2021) who reported that 77.3% of students evaluated the moulages as realistic post-simulation, with 62.1% strongly agreeing their assessment skills improved. The mean satisfaction score was 4.56±0.59, indicating significant enhancement in student satisfaction and learning outcomes regarding pressure injury assessment.

The present study finding was compatible with the study done by Baran et al., (2025) entitled "Comparison of standardized patient and medium-fidelity simulation practices on nursing students' knowledge, staging, and satisfaction regarding pressure injuries: A randomized controlled trial" in Western Turkey, indicates significant improvements in student satisfaction regarding moulage simulation for pressure ulcer care post-program. Students' perceptions shifted from dissatisfaction to strong agreement on realism and educational value, highlighting the simulation's positive impact on learning outcomes.

The present study finding was similar to the study conducted by Altun et al., (2022) entitled "Low-fidelity simulation vs. standardized patients in prevention and management of pressure injury education"in North Cyprus, indicates that post-program, students significantly improved their satisfaction with moulage simulations for pressure ulcer care, perceiving them as realistic and valuable for learning, contrasting with pre-program assessments where dissatisfaction was prevalent regarding realism and educational value.

Regarding correlations between knowledge, practice, and moulage evaluation and satisfaction, it was noticed that the most significant correlation is observed in the post-program between knowledge and moulage evaluation and satisfaction with ($r = 0.806$) and (P-value < 0.001), indicating a strong, statistically significant correlation. These findings highlight the effect of the educational program in strengthening the connection between theoretical knowledge, hands-on practice, and positive learning experiences.

The present study finding was similar to the study conducted by DCosta et al., (2024) entitled "The impact of moulage on learners' experience in simulation-based education and training: systematic review" they concluded that after the moulage program, a strong correlation emerged between students' knowledge and their evaluation and satisfaction with the experience, emphasizing the educational intervention's effectiveness in enhancing the relationship between theoretical knowledge, practical skills, and learning experiences.

The present study finding was in agreement with the study conducted by Bayram et al., (2024) about "Exploring the relationship between pressure ulcer knowledge and self-efficiency among nursing students: A multicenter study" in Turkey, the study found a significant positive relationship between nursing students' knowledge and their self-efficacy in managing pressure ulcers.

Recommendations:-

Based upon the results of the current study, the following recommendations are suggested:
Recommendations for nursing education:
- An orientation program should be done for nursing students to familiarize them with different types of simulators and learning environment especially simulation with moulage.

Recommendations for furthers researches:
- Replication of the study on larger sample from different universities in Egypt.
- Future studies are recommended to evaluate nursing students'perception and knowledge regarding simulation with moulage.
- Future studies are recommended to examine usage of simulation with moulage with additional nursing courses to measure intended learning outcomes.

Acknowledgment:-

The researchers would like to express heartfelt appreciation to all students who generously volunteered to participate in this study on educational program based on simulation with moulage. Their commitment, active participation, and openness to this program were instrumental to the study's success. We are deeply grateful for the time they invested, their dedicated engagement throughout the process, and the invaluable insights they shared, all of which significantly enhanced the quality and impact of this research.

References:-

1. Acosta-Hernández, C., Fernández-Castillo, R. J., Montes-Vázquez, M., & González-Caro, M. D. (2023): Is caring for pressure ulcers in the intensive care unit in Spain still a challenge? A qualitative study on nurses' perceptions. Journal of Tissue Viability, 32(1), 114-119.
2. AlGharash, H., Alharbi, A., Alshahrani, Y., & Mousa, O. (2024): Knowledge and attitude of nursing interns toward pressure injury prevention in Saudi Arabia: A multiregional cross-sectional study. SAGE Open Nursing, 10, 23779608241251631.
3. Altun, S., & Tastan, S. (2022): Low-fidelity simulation vs. standardized patients in prevention and management of pressure injury education. Journal of Tissue Viability, 31(4), 643-648.
4. Ayed, M., Abd Elaziem Mohamed, A., Abd Elsalam Amin, M., Ibrahim, E., Mohamed Rashed, N., Mostafa Khalifa Ali, S., & El Zahra Kamal, F. (2022): Perception, satisfaction, and obstacle of online learning faced by academic nursing students during COVID-19 pandemic. Egyptian Journal of Health Care, 13(1), 1-14.
5. Baran, Z., Ayik, C., & Özden, D. (2025): Comparison of standardized patient and medium-fidelity simulation practices on nursing students' knowledge, staging, and satisfaction regarding pressure injuries: A randomized controlled trial. Nurse Education Today, 151, 106735.
6. Batmaz, F., Öztürk, H., Bayram, Ş., & Özkaya, A. (2025): The simulation realism scale for healthcare professionals and students: A development, validity and reliability study. Clinical Simulation in Nursing, 106, 101788.
7. Bayram, A., Şara, Y., Uzgör, F., & Öztürk, H. (2024): Exploring the relationship between pressure ulcer knowledge and self-efficiency among nursing students: A multicenter study. Journal of Tissue Viability, 33(4), 681-687.
8. Chen, F., Wang, X., Pan, Y., Ni, B., & Wu, J. (2023): The paradox of obesity in pressure ulcers of critically ill patients. International Wound Journal, 20(7), 2753-2763.
9. Chongtham, R. (2024): Assess the effectiveness of self-instructional module on knowledge and practice regarding prevention and management of pressure sores in bedridden patients among staff nurses working in selected hospitals, at Bangalore. International Journal of Nursing Education and Research, 12(1), 57-62.
10. Cowperthwait, A. (2020): NLN/Jeffries simulation framework for simulated participant methodology. Clinical Simulation in Nursing, 42(c), 12-21.
11. D'Costa, S., Zadow, G., Reidlinger, D., Cox, G., Hudson, C., Ingabire, A., & Stokes-Parish, J. (2024): The impact of moulage on learners' experience in simulation-based education and training: Systematic review. BMC Medical Education, 24(1), 6.
12. Dilie, A., & Mengistu, D. (2015): Assessment of nurses' knowledge, attitude, and perceived barriers to expressed pressure ulcer prevention practice in Addis Ababa government hospitals, Addis Ababa, Ethiopia. Advances in Nursing, 2015, 1-11. https://doi.org/10.1155/2015/796927
13. Farooq, M., Zubair, M., Ahmad, I. W., Islam, N., Khan, Z., & Amin, M. (2025): Effectiveness of simulation training on undergraduate nursing students' knowledge and competency in pressure ulcer prevention at INS Khyber Medical University Peshawar. Frontier in Medical & Health Research, 3(5), 269-275.
14. Fourie, C., Botma, Y., & Botha, B. S. (2023): High-fidelity burns moulage makes simulations come alive. Teaching and Learning in Nursing.
15. Ghorbani Vajargah, P., Mollaei, A., Falakdami, A., Takasi, P., Moosazadeh, Z., Esmaeili, S., & Karkhah, S. (2023): A systematic review of nurses' practice and related factors toward pressure ulcer prevention. International Wound Journal, 20(6), 2386-2401.
16. Halász, B., Alves, P., O'Connor, T., Pokorná, A., Sørensen, C. L., Smet, S., & Strapp, H. (2023): EPUAP Pressure Ulcer Curriculum. Journal of Wound Care, 32(9), 598-606.
17. Hulsenboom, M., Bours, G., & Halfens, R. (2007): Knowledge of pressure ulcer prevention: A cross-sectional and comparative study among nurses. BMC Nursing, 6(1), 1-11.
18. Jeffries, P. R. (2016): The NLN Jeffries Simulation Theory (1st ed.). Wolters Kluwer Health.
19. Jeffries, P. R., Rodgers, B., & Adamson, K. (2015): NLN Jeffries Simulation Theory: Brief narrative description. Nursing Education Perspectives, 36(5), 292-293.
20. Khojastehfar, S., Ghezeljeh, T., & Haghani, S. (2020): Factors related to knowledge, attitude, and practice of nurses in intensive care unit in the area of pressure ulcer prevention: A multicenter study. Journal of Tissue Viability, 29(2), 76-81.
21. Liang, H., Hu, H., Feng, L., Wei, H., Ying, Y., & Liu, Y. (2024): The knowledge and attitude on the prevention of pressure ulcers in Chinese nurses: A cross-sectional study in 93 tertiary and secondary hospitals. International Wound Journal, 21(4), e14593.

22. Machin, D., Campbell, M., Tan, S. B., & Tan, S. H. (2018): Sample Sizes for Clinical, Laboratory and Epidemiology Studies (4th ed.). Wiley-Blackwell, Chichester, United Kingdom.
23. Manderlier, B., Van Damme, N., Vanderwee, K., Verhaeghe, S., Van Hecke, A., & Beeckman, D. (2017): Development and psychometric validation of PUKAT, a knowledge assessment tool for pressure ulcer prevention. International Wound Journal, 14(6), 1041-1051.
24. Mather, C., Jacques, A., & Prior, S. J. (2022): Australian first-year nursing student knowledge and attitudes on pressure injury prevention: A three-year educational intervention survey study. Nursing Reports, 12(3), 431-445.
25. Monaco, D., Iovino, P., Lommi, M., Marano, G., Zaghini, F., Vellone, E., & Sili, A. (2021): Outcomes of wound care nurses' practice in patients with pressure ulcers: An integrative review. Journal of Clinical Nursing, 30(3-4), 372-384.
26. Mwebaza, I., Katende, G., Groves, S., & Nankumbi, J. (2014): Nurses' knowledge, practices, and barriers in care of patients with pressure ulcers in a Ugandan teaching hospital. Nursing Research and Practice, 2014, 1-6. https://doi.org/10.1155/2014/973602
27. Nasreen, S., Afzal, M., Sarwar, H., & Waqas, A. (2017): Nurses' knowledge and practices toward pressure ulcer prevention in General Hospital Lahore. Saudi Journal of Medical and Pharmaceutical Sciences, 3(6), 520-527.
28. Núñez, R., Bermeo, R., Casierra, N., Tusconi, M., Curcio, F., & Gonzalez, C. (2024): Perception of university nursing students and faculty members regarding simulated practices: A mixed methods study. Nursing Reports, 14(4), 2975-2989.
29. Özden, D., Yılmaz, İ., & Sönmez, S. (2025): Effect of moulage on nursing students' endotracheal suctioning knowledge and skills. Nurse Education in Practice, 83, 104262.
30. Prosen, M., & Čekada, T. (2025): Nursing students' views on men in nursing: A gender diversity challenge in the healthcare workforce. BMC Nursing, 24(1), 820.
31. Salifu, D., Christmals, C., & Reitsma, G. (2022): Frameworks for the design, implementation, and evaluation of simulation-based nursing education: A scoping review. Nursing & Health Sciences, 24(3), 545-563.
32. Sengul, T., Celik, S. S., & Kirkland-Kyhn, H. (2025): The role of simulation in pressure injury education: A systematic review. Nursing Administration Quarterly, 49(1), 35-43.
33. Sezgunsay, E., & Basak, T. (2020): Is moulage effective in improving clinical skills of nursing students for the assessment of pressure injury? Nurse Education Today, 94, 104572.
34. Shrivastava, S. R., Bobhate, P. S., Telrandhe, S., & Mendhe, H. G. (2024): Exploring the role of moulage in facilitating the acquisition of clinical skills among medical students. Indian Journal of Community Health, 36(2), 323-326.
35. Suma, K., Sanjay, M., & Sharon, K. (2024): A study to evaluate the effectiveness of structured teaching programme (STP) on knowledge regarding use of Braden Scale for predicting pressure sore risk among student nurses in KLE's Institute of Nursing Sciences, Hubballi. International Journal of Recent Innovations in Medicine and Clinical Research, 3(3), 7-13.
36. Svellingen, A. H., Søvik, M. B., Røykenes, K., & Brattebø, G. (2021): The effect of multiple exposures in scenario-based simulation — A mixed study systematic review. Nursing Open, 8(1), 380-394.
37. Uzelli Yilmaz, D., Akin, E., Yildirim, D., Caliskan, S., & Hamarat Tuncali, S. (2021): Nursing students' performance and satisfaction regarding the classification of pressure injuries using simulation with moulage. Journal of Client-Centered Nursing Care, 7(4), 311-318.
38. Yilmazer, T., Tuzer, H., Inkaya, B., & Elcin, M. (2020): The impact of standardized patient interactions on nursing students' preventive interventions for pressure ulcers. Journal of Tissue Viability, 29(1), 19-23.
39. Zeydi, A., Ghazanfari, M. J., Esmaeili, S., Mobayen, M., Soltani, Y., Sigaroudi, A., & Karkhah, S. (2022): Knowledge, attitude, and practice of Iranian nurses towards pressure ulcer prevention: A systematic review. Journal of Tissue Viability, 31(3), 444-452.*