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The Effect of Training Given to Nurses with Algorithm-Guided In-Situ Simulation on Preventing Pressure Ulcers: An Interventional Study

Hemşirelere Algoritma Rehberliğinde Yerinde Simülasyon ile Verilen Eğitimin Basınç Yarasını Önlemeye Etkisi: Müdahale Çalışması

Tuba YILMAZER[a], Hilal TÜZER[a], Bahar İNKAYA[a], Ayşegül ERCİYAS[b]

[a]Department of Nursing, Ankara Yıldırım Beyazıt University Faculty of Health Sciences, Ankara, Türkiye
[b]Ankara City Hospital, Ankara, Türkiye

ABSTRACT Objective: The aim of this study was to determine the effect of training given to nurses with algorithm-guided in-situ simulation on preventing pressure ulcers. **Material and Methods:** This was an intervention study. The study was conducted at a university hospital's orthopedia and traumatology clinic with 21 beds. The study sample consisted of 10 post-licensure nurses and 79 pre-simulation and 84 post-simulation patients over 18 years of age, who had stayed in the clinic for at least 24 h. In the collection of data, 3 forms (the demographic data form, the information assessment form, the skill assessment form) were administered to the post-licensure nurses and 3 forms (the demographic data, the Braden scale, the follow-up form) were administered to the patients. The study consisted of 3 stages. In the first stage (01.04.2018-30.06.2018), the nurses recorded the demographic characteristics, nursing interventions for pressure ulcer prevention, pressure ulcer risks, and pressure ulcer incidence data of the patients. In the second stage, nurses participated in a scenario-based standardized patient simulation at the clinic where they worked. In the third stage (01.07.2018-30.09.2018), the nurses recorded the demographic characteristics, nursing interventions for pressure ulcer prevention, pressure ulcer risks, and pressure ulcer incidence data of the patients. The nursing interventions during this period were guided by the algorithm. Incidences of pressure ulcers for 3 months before and 3 months after the simulation were compared at the end of the study. **Results:** Nurses' knowledge, performance, and care interventions significantly improved during the 3 months simulation ($p<0.05$). Incidences of Stage 1 pressure ulcers per 1,000 patient days were 8.51 and 4.73 during the 3 months before and the 3 months after simulation, respectively ($p=0.136$). **Conclusion:** In-situ simulation is a method to reduce the incidence of pressure ulcers.

Keywords: Simulation training in nursing; algorithms; pressure ulcer; prevention

ÖZET Amaç: Bu araştırma, hemşirelere algoritma rehberliğinde yerinde simülasyon ile verilen eğitimin basınç yarasını önlemeye etkisinin değerlendirilmesi amacıyla yapılmıştır. **Gereç ve Yöntemler:** Araştırma müdahale çalışması olup, bir üniversite hastanesinin 21 yataklı ortopedi ve travmatoloji kliniğinde gerçekleştirilmiştir. Çalışmanın örneklem grubunu 10 hemşire ve 18 yaşından büyük en az 24 saat klinikte kalan simülasyon uygulaması öncesi dönemde 79 hasta, simülasyon uygulaması sonrası dönemde ise 84 hasta oluşturmuştur. Verilerin toplanmasında hemşirelere 3 farklı form (demografik veri formu, bilgi değerlendirme formu, beceri değerlendirme formu) uygulanmıştır ve hastalara 3 farklı form (demografik veri formu, Braden basınç yarası risk değerlendirme ölçeği, basınç yarası önleme takip formu) uygulanmıştır. Araştırma, 3 aşamada gerçekleştirilmiştir. Birinci aşamada (01.04.2018-30.06.2018), çalışmanın yapıldığı klinikte bulunan hastaların demografik özellikleri, basınç yarasının önlenmesine ilişkin yapılan hemşirelik uygulamaları, hastaların basınç yarası riskleri ve basınç yarası insidans verileri hemşireler tarafından kayıt edilmiştir. İkinci aşamada, hemşireler çalıştıkları klinikte senaryo eşliğinde standart hasta simülasyonuna katılmıştır. Üçüncü aşamada (01.07.2018-30.09.2018), hemşireler tarafından hastaların demografik özellikleri, basınç yarasının önlenmesine ilişkin yapılan hemşirelik uygulamaları, hastaların basınç yarası riskleri ve basınç yarası insidans verileri hemşireler tarafından kayıt edilmiştir. Bu dönemde hemşirelik uygulamaları algoritma rehberliğinde yapılmıştır. Çalışma sonunda, simülasyon uygulamasından önceki ve sonraki 3 aylık dönemler arasındaki basınç yarası insidansları karşılaştırılmıştır. **Bulgular:** Hemşirelerin bilgi, performans ve bakım uygulamaları simülasyon uygulamasından sonraki 3 aylık dönemde anlamlı olarak yükselmiştir ($p<0,05$). Simülasyon uygulamasından önceki ve sonraki dönemler arası Evre 1 basınç yarası insidans hızı 1.000 hasta-günü için sırasıyla 8,51 ve 4,73 olarak belirlenmiştir ($p=0,136$). **Sonuç:** Yerinde simülasyonun basınç yarası insidans oranlarını azaltan bir yöntem olduğu görülmektedir.

Anahtar Kelimeler: Hemşirelikte simülasyon eğitimi; algoritma; basınç yarası; önleme

Correspondence: Tuba YILMAZER
Department of Nursing, Ankara Yıldırım Beyazıt University Faculty of Health Sciences, Ankara, Türkiye
E-mail: tyilmazer@ybu.edu.tr

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Providing evidence-based care is an important responsibility of nurses.[1] Undergraduate knowledge and skills are insufficient to integrate evidence-based information into clinical practice. Registered nurses should, therefore, continue to receive training on evolving evidence-based knowledge and practices.[2] Research shows that registered nurses have less knowledge and skills in many subjects, negatively affecting the care of patients, and hence, clinical outcomes.[3-5]

Simulation training is an effective way to involve registered nurses in learning and to improve their knowledge and skills.[6,7] In recent years, in-situ simulation has become a popular approach for educating registered nurses in their own environment. In-situ simulation achieves high-fidelity and makes it easier to put knowledge and skills to use in real patient care settings.[8] In this study, in-situ simulation was used together with a standardized patient, which is a simulation training method. The standardized patient and in-situ simulation provided participants with hands-on experience and an ideal learning environment. In recent years, researchers have begun to discuss how simulation training offered to registered nurses affects clinical outcomes.[7,9-12] This study, therefore, investigated the relationship between in-situ simulation and incidence of pressure ulcers, which is a clinical outcome.

For most of their professional lives, registered nurses encounter patients with or at risk of pressure ulcers. This requires them to be more knowledgeable and skillful about this matter and to provide evidence-based care accordingly. However, research shows that registered nurses have less knowledge and skills in the prevention of pressure ulcers.[3,4,7,13] Pressure ulcers are a preventable condition that is sensitive to nursing care. It is possible to prevent pressure ulcers in patients by increasing the knowledge and skills of nurses.[13] However, the incidence of pressure ulcers ranges from 4.3 to 30.8% and they lead to an increase in morbidity and mortality.[14-17] Pressure ulcers are, therefore, a significant health problem.

In this study, an evidence-based algorithm containing interventions for preventing pressure ulcers was used. Algorithms are significant clinical tools based on evidence-based clinical practice guidelines. Registered nurses use them in clinical practice to make decisions that affect care outcomes. Algorithms guide registered nurses through the steps of clinical decision making, improve their self-confidence, and prevent medical errors.[5,18]

This study assumes that in-situ simulation with an algorithm-guided standardized patient will increase participants' knowledge and skills, promote information retention, and reduce the incidence of pressure ulcers. This study is important not only because there has been no research on this issue but also because it will help increase post-licensure nurses' knowledge and skills, provide them with evidence-based clinical tools, and help reduce the incidence of pressure ulcers.

MATERIAL AND METHODS

RESEARCH DESIGN

The aim of this intervention study was to determine the effect of training given to nurses with algorithm-guided in-situ simulation on preventing pressure ulcers.

SETTING AND SAMPLE

The study was conducted in a university hospital's orthopedia and traumatology department, where patients cared for are at higher risk of pressure ulcers. It is a clinic with 21 beds and 10 nurses. Patients were followed up for a maximum of 3 months. Newly developed pressure ulcers (Stage 1) were used to assess the incidence of pressure ulcers. Participant nurses provided routine care to patients diagnosed with Stage 2, Stage 3, Stage 4, unstageable, deep tissue ulcer or mucosal membrane pressure ulcers.

The study sample consisted of ten registered nurses and 163 patients over 18 years of age, who had stayed in the clinic for at least 24 h. The patient circulation changes in the clinic where the study was conducted. Since the patient circulation changes, the number of patients pre- post simulasyon is different. Therefore, the study consisted of 79 pre-simulation and 84 post-simulation patients.

DATA COLLECTION INSTRUMENT

Data were collected using forms developed by the researchers based on the literature references. The forms were finalized after receiving feedback from eight experts. The forms were given in two groups in terms of applied to patients and nurses.

Three forms were applied to the registered nurses. First form: The demographic data form consisted of 5 items eliciting information on age, gender, educational level, duration of employment and number of patients with pressure ulcers treated.[3,4,13] Second form: The information assessment form consisted of 20 multiple choice questions designed to assess nurses' pre- and post-simulation knowledge.[3,13,19,20] Third form: The skill assessment form consisted of 23 items assessing nurses' skills in skin assessment and care, pressure ulcer risk assessment, and management of activities, nutrition, moisture/incontinence, and support surfaces.[19]

Three forms were applied to the patients. First form: The demographic data form consisted of questions eliciting information on age, gender, medical diagnosis, pressure ulcer condition, etc.[19,21] Second form: The Braden scale for predicting pressure sore risk was used to assess patients' pressure ulcer risks. The scale was developed by Bergstrom et al.[22] The validity and reliability of the Turkish version of the scale were established first by Oğuz and Olgun and then by Pınar and Oğuz.[23,24] These authors reported the Cronbach's alpha as 0.95 and 0.85, respectively, which were high. Third form: The follow-up form for the prevention of pressure ulcers consisted of items assessing pressure ulcer occurrence and stages, skin assessment and care, pressure ulcer risk assessment, and management of activities, nutrition, moisture/incontinence, and support surfaces. It was used to keep track of nursing care and pressure ulcer incidence data.[3,13,19-21]

PRESSURE ULCER PREVENTION ALGORITHM

Yılmazer and Bulut developed an evidence-based pressure ulcer prevention algorithm consisting of skin care, and management of activities, nutrition, moisture/incontinence, and support surfaces, leading registered nurses to preventive care. The content validity of the pressure ulcer prevention algorithm is 0.90 out of 1.0.[25]

PROCEDURE

The study consisted of 3 stages.

Pre-Simulation Period

In the pre-simulation period (01.04.2018-30.06.2018), the nurses recorded the demographic characteristics, nursing interventions for pressure ulcer prevention, pressure ulcer risks, and pressure ulcer incidence data of the patients.

In-Situ Simulation with an Algorithm-Guided Standardized Patient

The nurses were asked to complete the demographic data form before the simulation. The nurses also filled out the information assessment form before and after the simulation and in the third month. Afterward, the in-situ simulation was applied to the nurses by the researcher. A standardized patient was brought to a patient room at the clinic. The standardized patient was experienced and had been trained by the researchers about the scenario. The nurses were expected to make pressure ulcer assessment on the standardized patient accompanied by a suitable scenario including pressure ulcers. These assessments constituted the first performance assessment. After the simulation, the nurses in groups of five were engaged in a debriefing using the Gather-Analyze-Summarize model. Meanwhile, the nurses were given feedback on their performance.

Post-Simulation Period

In the post-simulation period (01.07.2018-30.09.2018), the nurses recorded the demographic characteristics, nursing interventions for pressure ulcer prevention, pressure ulcer risks, and pressure ulcer incidence data of the patients. The nursing interventions during this period were guided by the algorithm.

After 3 months, the nurses were expected to make pressure ulcer assessment again on the standardized patient accompanied by a different scenario including pressure ulcers. These assessments constituted the second performance assessment. After performance evaluation, a knowledge test was used to evaluate the retention of the training.

The incidences of pre- and post-simulation pressure ulcers were compared at the end of the study.

ETHICAL CONSIDERATIONS

The study was approved by the Ethics Committee of Ankara Yıldırım Beyazıt University in accordance with the Helsinki Declaration principles (no: 2018/10, date: 23.3.2018). Permission was obtained from the management of the university hospital. Written informed consent was obtained from all nurses and patients who participated in the study.

STATISTICAL ANALYSIS

The distribution of continuous variables such as age was examined using the Shapiro-Wilk test and normality plots. The continuous variables with normal distribution were presented with mean±standard deviation (mean±SD) and other continuous and discrete variables were presented with median (minimum-maximum). The categorical variables were presented with number (%).

Repeated measurements ANOVA was used to compare the nurses' pre-and post-simulation knowledge test scores. A Wilcoxon test was used to compare their performance test scores. A Bonferroni correction test was used for pairwise comparisons after repeated measurements ANOVA. Mann-Whitney U and Chi-square tests were used to compare the patients' inter-period demographic characteristics. The inter-period pressure ulcer care level of the nurses was calculated as the ratio of the total number of days of intervention for each bed to the number of days in that period. The levels of the implementation of the section of the follow-up form for the prevention of pressure ulcers were calculated as the median of the levels of implementation of the items of the section in question. Paired t-test and Wilcoxon test were used to compare the inter-period pressure ulcer care level of the nurses. The incidence of Stage 1 pressure ulcers was calculated by dividing the number of newly developed pressure ulcers by the number of patient-days and was presented with a 95% confidence interval (CI) for 1,000 patient-days. Fisher's exact test was used to compare the incidence of inter-period pressure ulcers while Chi-square tests were used to compare the distribution of pressure ulcers by stage and area. Stata 14 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.) was used for incidences. The Statistical Package for Social Sciences (IBM SPSS, Version 21.0. Armonk, NY: IBM Corp.) was used for other statistical analyses and calculations at a significance level of 0.05

RESULTS

All nurses who participated in the study were women. Their mean age was 33.20±6.68 years. The median duration of employment was 8.5 years (minimum-maximum 1-20). Six nurses had a bachelor's degree, 5 nurses provided care to at least 3 patients with pressure ulcers every week, and the other 5 provided care to at least 4 patients with pressure ulcers every week (Table 1).

The nurses' mean pre-simulation, post-simulation, and third-month knowledge test scores were 56.50±6.69, 70.50±8.32 and 65.50±7.25, respectively (Table 1). The nurses' post-simulation and third-month knowledge scores were statistically significantly higher than their pre-simulation knowledge scores ($p<0.05$). Their post-simulation and third-month knowledge scores were similar ($p=0.069$). The nurses' third-month performance score (73.91; minimum: 69.57, maximum: 84.78) was statistically significantly higher than their pre-simulation performance score (31.52; minimum: 17.39, maximum: 45.65) ($p<0.05$).

The nurses' post-simulation pressure ulcer prevention care practices according to the results of "the follow-up form for the prevention of pressure ulcers" levels were significantly higher than their pre-simulation levels ($p<0.05$, Table 2).

The patients' age and body mass index (BMI) were low, while the number of patients with chronic

TABLE 1: Distribution of knowledge and performance scores.

Variables	Knowledge score	Performance score
Period (n=10)	Mean±SD	Median (minimum-maximum)
Pre-test	56.50±6.69[1,2]	31.52 (17.39-45.65)
Post-test	70.50±8.32[1]	–
3 months later post-test	65.50±7.25[2]	73.91 (69.57-84.78)
Test statistics	F=21.234	Z=2.807
p value	0.001	0.005

[1,2]$p<0.05$; SD: Standard deviation; F: Repeated measures ANOVA result; Z: Wilcoxon test result.

TABLE 2: Pressure ulcer care practices according to the results of the follow-up form for the prevention of pressure ulcers in the pre and post simulation education periods.

Care practices	Pre-simulation education period	Post-simulation education period	Statistical analysis t/Z	p value
Assess the skin	26.63 (21.74-32.61)	68.48 (61.96-72.83)	4.202	<0.001
Skin care	25.90±4.54	62.38±3.02	31.802	<0.001
Assess the pressure ulcer prevention risk	61.91±2.99	75.50±2.71	14.405	<0.001
Activity management	56.52 (52.17-58.70)	76.09 (71.74-76.09)	4.211	<0.001
Nutrition management	57.61 (55.43-58.70)	76.09 (72.83-81.52)	4.209	<0.001
Moisture/incontinence management	68.57±2.27	77.03±2.39	18.260	<0.001

t: Paired t-test result; Z: Wilcoxon test result.

kidney disease (CKD), incidence of urinary incontinence, and number of patients with a Braden risk score of 13-14 were higher in the post-simulation period than in the pre-simulation period ($p<0.05$, Table 3).

Most of the pre-simulation (56.3%, n=18) and post-simulation (59.1%, n=13) pressure ulcers were Stage 1. Half (n=16) of the pre-simulation and 36.4% (n=8) of the post-simulation pressure ulcers were on sacrum (Table 4). The stage and area distributions of the pre- and post-simulation pressure ulcers were similar ($p=0.746$ and $p=0.354$, respectively).

The incidences of the pre- and post-simulation Stage 1 pressure ulcers per 1,000 patient days were 8.51 (95% CI: 4.58-12.44) and 4.73 (95% CI: 1.80-7.66), respectively. The difference was not statistically significant despite the decrease in the incidence rate ($p=0.136$). Figure 1 shows the incidence rates of the monthly pre- and post-simulation pressure ulcers.

DISCUSSION

Simulation with a standardized patient is an effective way to increase post-licensure nurses' knowledge and skills. In-situ simulation provides registered nurses with training in clinical settings and improves the quality of the simulation.[26]

Using standardized patient in-situ simulation and evidence-based algorithms together might positively affect pressure ulcer incidence rates. However, there are no studies in which standardized patient in-situ simulation and evidence-based algorithms were used together. We, therefore, believe that this study will increase nurses' knowledge and skills and contribute to the prevention of pressure ulcers, which is an important clinical problem.

Our results show that standardized patient in-situ simulation increased the registered nurses' knowledge scores and achieved retention. The nurses' performance scores also increased in the third-month after the simulation. Research shows that simulation increases nurses' knowledge and skills.[7,10] The number of studies investigating the effect of in-situ simulation on nurses' knowledge and performance is limited.[27,28] Similar researches indicate that in-situ simulation increases nurses' knowledge, skills, satisfaction and self-efficacy.[27-30]

Van Herck et al. assessed the condition of 6,030 patients in 22 centers using a pressure ulcer prevention care algorithm database. He reported that 35.1% were at risk of pressure ulcers and that pressure ulcer interventions, such as the use of special mattresses, changing patient positions, and patient education on pressure ulcer risk, were insufficient, concluding that appropriate care is not provided to prevent pressure ulcers.[31] Our results show that the nurses failed to provide appropriate care for preventing pressure ulcers before the simulation and that their pressure ulcer prevention care levels increased significantly after the simulation. Although this is a positive result, it is known that individual and environmental factors are also effective in the formation of pressure ulcers. In our study, the majority of patients had a mild risk of pressure ulcers (Braden score in the pre-simulation period: 63.3%; Braden score in the post-simulation period 52.4%). The previous study showed that 32% of the patients were at mild risk of developing

TABLE 3: Demographic characteristics of patients pre and post simulation education periods.

Variables	Pre-simulation education period (n=79) Median (minimum-maximum) n (%)	Post-simulation education period (n=84) Median (minimum-maximum) n (%)	Test statistics	p value
Age (year)	62 (20-91)	56 (18-88)	Z=2.433	0.015
Female	35 (44.3)	29 (34.5)	χ^2=1.633	0.201
Body mass index	27.68 (16.07-41.02)	25.46 (19.57-39.84)	Z=3.049	0.002
Comorbities (number, %)				
Insulin-dependent diabetes	37 (46.8)	27 (32.1)	χ^2=3.685	0.055
Hypertension	32 (40.5)	29 (34.5)	χ^2=0.622	0.430
Peripheral vascular disease	13 (16.5)	9 (10.7)	χ^2=0.710	0.399
Chronic renal failure	7 (8.9)	19 (22.6)	χ^2=4.768	0.029
Other	43 (54.4)	56 (66.7)	χ^2=2.556	0.110
Length of stay in days	31 (9-61)	31 (6-92)	Z=1.371	0.170
Oral nutrition	59 (74.7)	81 (96.4)	χ^2=14.140	<0.001
Enteral nutrition	4 (5.1)	1 (1.2)	–	0.199
Parenteral nutrition	16 (20.3)	2 (2.4)	χ^2=11.481	0.001
Urinary incontinence	25 (31.6)	21 (25.0)	χ^2=0.590	0.442
Frequency of urinary incontinence	3 (1-4)	4 (2-6)	Z=4.009	<0.001
Fecal incontinence	25 (31.6)	16 (19.0)	χ^2=2.795	0.095
Frequency of fecal incontinence	2 (1-2)	2 (1-3)	Z=0.031	0.989
Activity status			χ^2=2.897	0.408
Confined to bed	7 (8.9)	5 (6.0)		
Mobilized with wheelchairs	7 (8.9)	14 (16.7)		
Moving in bed	14 (17.6)	17 (20.2)		
Mobilized	51 (64.6)	48 (57.1)		
Braden scale score			χ^2=8.468	0.037
15-18	50 (63.3)	44 (52.4)		
13-14	6 (7.6)1	20 (23.8)1		
10-12	15 (19.0)	15 (17.9)		
<10	8 (10.1)	5 (6.0)		

[1]p<0.05; Z: Mann-Whitney U test result; χ2 test result; t: Independent sample t-test result.

TABLE 4: Distribution of pressure ulcer stages and region in the pre- and post simulation education periods.

	Pre-simulation education period			Total	Post-simulation education period			Total		
	March n (%)	April n (%)	May n (%)	(n=32)	July n (%)	August n (%)	September n (%)	(n=22)	Test statistics	p value
Stages of pressure ulcer									χ^2=1.230	0.746
Stage 1	10 (71.4)	5 (38.5)	3 (60.0)	18 (56.3)	3 (37.5)	5 (71.4)	5 (71.4)	13 (59.1)		
Stage 2	4 (28.6)	5 (38.5)	2 (40.0)	11 (34.4)	4 (50.0)	2 (28.6)	1 (14.3)	7 (31.8)		
Stage 3	0 (0.0)	2 (15.4)	0 (0.0)	2 (6.3)	1 (12.5)	0 (0.0)	1 (14.3)	2 (9.1)		
Stage 4	0 (0.0)	1 (7.6)	0 (0.0)	1 (3.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		
Region of pressure ulcer									3.253	0.354
Sacrum	7 (50.0)	7 (53.8)	2 (40.0)	16 (50.0)	3 (37.5)	2 (28.6)	3 (42.9)	8 (36.4)		
Coccyx	2 (14.3)	2 (15.4)	0 (0.0)	4 (12.5)	4 (50.0)	1 (14.3)	1 (14.2)	6 (27.3)		
Right elbow	1 (7.1)	2 (15.4)	1 (20.0)	4 (12.5)	0 (0.0)	1 (14.3)	0 (0.0)	1 (4.5)		
Other	4 (28.6)	2 (15.4)	2 (40.0)	8 (25.0)	1 (12.5)	3 (42.8)	3 (42.9)	7 (32.8)		

χ^2 test result.

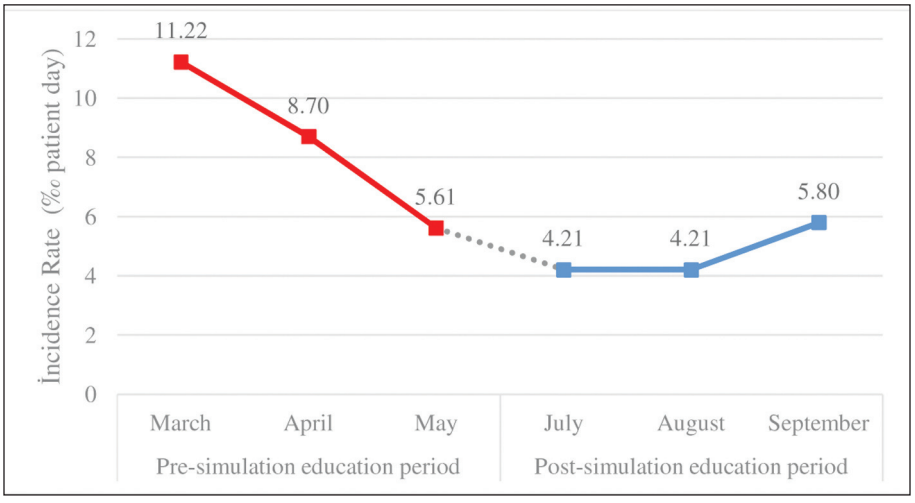

FIGURE 1: Stage 1 pressure ulcer incidence rates in pre- and post-simulation education periods.

pressure ulcers.[32] Additionally, chronic diseases (diabetes, hypertension, peripheral vascular disease, chronic renal failure etc.) clinically contributes to the emergence of pressure ulcers.[33] In our study, the number of patients with CKD, incidence of urinary incontinence were higher in the post-simulation period than in the pre-simulation period. As a result, the characteristics of different periods and different patients are also effective in reducing pressure ulcers.

Despite their differences from our study, there are some studies assessing care guided by pressure ulcer prevention algorithms.[5,20,21] Armour-Burton et al. reported that the algorithm used resulted in a significant reduction in the prevalence of pressure ulcers. The prevalence of pre-algorithm pressure ulcers ranged from 0.0 to 18.92% (mean: 4.85%) while that of post-algorithm pressure ulcers ranged from 0.0 to 3.3%.[5] Sendelbach et al. reported a 33% reduction in post-algorithm pressure ulcers while Zaratkiewicz et al., reported that the incidence of pressure ulcers decreased from 1.89 to 0.86 per 1,000 patient days and from 1.4 to 0.6 per 100 admissions.[20,21] In our study, the incidence of Stage 1 pressure ulcers decreased from 8.51 to 4.73 per 1,000 patient days. This result is consistent with the literature.

LIMITATIONS

This study focused on the prevention of pressure ulcers in adult patients. Patients under the age of 18 years who stayed at the clinic for less than 24 hours were not included in the study. The participant nurses could not use any support surfaces for pressure ulcer prevention because the hospital did not have any. This study evaluated the effect of the algorithm-guided, standardized patient intervention and care on pressure ulcer prevention and was conducted in a single center, and therefore, the results cannot be generalized. Pressure ulcers cannot be kept independent of individual (age, BMI, comorbidity, etc.) and environmental factors. Every factor that facilitates pressure ulcers was not included in the study. In our study, the patients' age and BMI were low, while the number of patients with CKD, incidence of urinary incontinence, and number of patients with a Braden risk score of 13-14 were higher in the post-simulation period than in the pre-simulation period ($p<0.05$, Table 3). Therefore, the limitation of our study is that the characteristics of different periods and different patients are also effective in reducing pressure ulcers.

CONCLUSION

The in-situ simulation was effective in reducing pressure ulcer incidence rates. Using a standardized patient in-situ simulation and an evidence-based algorithm together reduced the incidence of pressure ulcers. Further studies are warranted to investigate the effect of in-situ simulation on the prevention of pressure ulcers, which are a major problem in clinics. Also, similar clinical studies on different sample sizes should be conducted with larger samples.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Tuba Yılmazer, Hilal Tüzer, Bahar İnkaya;* ***Design:*** *Tuba Yılmazer, Hilal Tüzer, Bahar İnkaya;* ***Control/Supervision:*** *Tuba Yılmazer, Hilal Tüzer, Bahar İnkaya;* ***Data Collection and/or Processing:*** *Ayşegül Erciyas, Tuba Yılmazer, Hilal Tüzer, Bahar İnkaya;* ***Analysis and/or Interpretation:*** *Tuba Yılmazer, Hilal Tüzer, Bahar İnkaya;* ***Literature Review:*** *Tuba Yılmazer, Hilal Tüzer, Bahar İnkaya;* ***Writing the Article:*** *Tuba Yılmazer, Hilal Tüzer, Bahar İnkaya;* ***Critical Review:*** *Tuba Yılmazer, Hilal Tüzer, Bahar İnkaya;* ***References and Fundings:*** *Tuba Yılmazer, Hilal Tüzer, Bahar İnkaya;* ***Materials:*** *Tuba Yılmazer, Hilal Tüzer, Bahar İnkaya, Ayşegül Erciyas.*

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