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The Effect of the Training Provided to Intensive Care Nurses on the Ventilator Care Bundle, Aspiration Knowledge Level and Attitudes Towards Evidence-Based Nursing

Yoğun Bakım Hemşirelerine Verilen Eğitimin, Bakım Paketi, Aspirasyon Bilgi Düzeyi ve Kanıta Dayalı Hemşireliğe Yönelik Tutuma Etkisi

This research presented as an oral presentation at the 2nd International Aegean Health Fields Symposium. (7-8 March 2022 / Online).

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Abstract

The use of care bundle, which is one of the evidence-based applications, in intensive care may prevent the development of many complications. The aim of this study is to compare the pre-training and post-training performance of intensive care nurses on the use of care bundle and aspiration practices, and to examine the effects of the training on their attitudes towards care bundle practices and evidence-based nursing. This study has been conducted by using the single group pretest-posttest model. The EBNAQ scores of the nurses with a graduate degree and the nurses with responsibility for 0-2 patients were found to be high. Evaluation of the outputs from the ventilator care bundle and aspiration monitoring form showed a difference after the training regarding the nursing interventions conducted in all areas except for the “Performed a physical examination with auscultation over the trachea" parameter ($p<0.05$). It was determined that there was an increase in the application rates after the training compared to the pre-training in all care bundle and aspiration parameters.

Keywords: Evidence-based nursing, patient care bundles, respiratory aspiration

Özet

Kanıta dayalı uygulamalardan biri olan bakım paketinin yoğun bakımda kullanılması birçok komplikasyonun gelişmesini engelleyebilmektedir. Bu çalışmanın amacı, yoğun bakım hemşirelerinin bakım paketi kullanımı ve aspirasyon uygulamalarına ilişkin eğitim öncesi ve eğitim sonrası performanslarını karşılaştırmak, bakım paketi uygulamaları ve kanıta dayalı uygulamalara yönelik tutumlarını incelemektir. Bu çalışma, tek grup ön test-son test modeli kullanılarak yapılmıştır. Mezun hemşireler ile 0-2 hasta sorumluluğu olan hemşirelerin EBNAQ puanları yüksek bulundu. Ventilatör bakım paketi ve aspirasyon izlem formu çıktılarının değerlendirilmesi “Trakea üzerinden oskültasyon ile fizik muayene yapıldı” parametresi dışında tüm alanlarda yapılan hemşirelik girişimlerine ilişkin eğitim sonrası farklılık olduğu belirlendi ($p<0,05$). Tüm bakım seti ve aspirasyon parametrelerinde eğitim öncesine göre eğitim sonrası uygulama oranlarında artış olduğu belirlendi.

Anahtar Kelimeler: Hasta bakım paketleri, kanıta dayalı hemşirelik, respiratuar aspirasyon

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1. Introduction

Intensive care units are clinics where holistic care is at the forefront, treatment and healthcare interventions are implemented for those who cannot meet their self-care requirements and whose lives are threatened, and critical nursing care is practiced (Çınar and Eti Aslan, 2017). Patients in intensive care units are monitored 24 hours a day by multidisciplinary teams. These patients require close monitoring and undergo many invasive and non-invasive procedures such as intubation, aspiration, catheterization, and monitorization for follow-up and treatment purposes (Yıldırım and Yıldız, 2020). The aspiration procedure that is implemented mostly by intensive care nurses is very important in terms of the oxygenation of the patients (Pedersen et al., 2009). There are some basic and important steps that the nurses should comply with before, during, and after the aspiration procedure. Indicators of the need for aspiration are the presence of visible secretion in the respiratory tract, an increase in peak inspiratory pressure during volume-controlled mechanical ventilation, the decrease of tidal volume in pressure-controlled mechanical ventilation, deterioration of SpO2 or arterial blood gas values, and development of acute respiratory distress (American Association for Respiratory Care [AARC], 2010). The decision to perform aspiration should be taken if one or more of these findings are observed. One must be careful to ensure that the procedure is performed in a sterile manner while monitoring the patient's vital signs, and the oxygen and carbon dioxide levels (Smith et al., 2012). The nurses who implement the procedure should be aware of the potential risks and perform the practices while ensuring patient safety (Kelleher and Andrews, 2008). If aspiration is not performed with the proper method, it can cause several complications such as mucosal damage, bleeding, hypoxemia, bradycardia, tachycardia, hypotension, hypertension, cardiac arrhythmia, cardiac arrest, atelectasis, alveolar collapse, increased intracranial pressure, and especially ventilator-associated infection (AARC, 2010).

Intensive care nurses must have certain knowledge and should have received practical training while performing their legally defined independent roles such as aspiration (AARC, 2010; Pendersen et al., 2009). Evidence-based practice [EBP] is the approach of transferring the best scientific evidence to clinical decision-making, problem-solving, and practice by combining it with clinical expertise and patient needs for the benefit of the patient in the individual patient care decisions (Scurlock Evans et al., 2014; Şenyuva, 2016). Intensive care nurses should use current evidence in their practices in the care and aspiration procedures of the ventilator-dependent patient in order to increase the quality of healthcare (Abuejheisheh et al., 2020). While the study conducted by Şadi reported that 60% of the nurses had knowledge of EBP (Sadi Şen and Yurt, 2021), another study found that 97.8% of the nurses believed that the care they give should be based on evidence (Yılmaz and Gürler, 2017). However, despite the high level of knowledge and belief ratios, problems are seen to be present in transferring evidence-based practices among the basic nursing practices to clinical practice. Studies in the literature report that the aspiration practices of intensive care nurses vary as nurses are not informed on the latest scientific recommendations, do not have sufficient knowledge about aspiration, and base their practices mostly on their habits and traditional practices, while the protocols or guidelines are generally lacking in the practice environment (Day et al., 2001; Kelleher and Andrews, 2008; Sharma et al., 2014). Care bundles are easily applicable and super visible examples of

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evidence-based practices to increase the quality of healthcare and patient safety (Kurutkan, 2014; Resar et al., 2021). They are plans that ensure standard interventions are carried out regularly by the patient and healthcare professionals and that identify the institutional protocols and are more useful when implemented together (Candaş and Gürsoy, 2017). The ventilator care bundle developed by the Institute of Health Care Improvement [IHI]) in the United States includes the components of elevation of the head of the bed, providing oral care, interruption of daily sedation and evaluation of readiness for extubation, peptic ulcer prophylaxis, and deep vein thrombosis prophylaxis (IHI, 2012). When the components in the care bundle are implemented regularly, the rates of Ventilator-Associated Pneumonia [VAP] in intensive care patients were reported to decrease (Gillespie, 2009; Kurutkan, 2014; Onarıcı and Karadağ, 2014). Identifying the level of knowledge of the team, defining the deficiencies, and providing training on the correct implementation steps are required to ensure the use of care bundles. This study was conducted to identify the effect of training given to intensive care nurses on the ventilator care bundle, aspiration implementation, and evidence-based practices.

2. Method

2.1. Aim

The aim of this study was to compare the pre-training and post-training performance of intensive care nurses on the use of care bundle and aspiration practices, and their attitudes towards care bundle practices and evidence-based nursing.

2.2. Research Questions

- Is there a statistical difference between pre-post training Evidence-Based Nursing Attitude levels of the participating?

- What is the pre-training ventilator care bundle and aspiration application level of nurses?

- Is there a statistical difference between pre-post training ventilator care bundle and aspiration application?

2.3. The Population and Sample of the Study

Data were collected at the sample hospital between December 2020 and January 2021.The study population consisted of 45 nurses working at the Haydarpaşa Numune Training and Research Hospital's, level three Anesthesia and Reanimation Intensive Care Unit. The nurse-patient ratio in this unit is 1:2. In this ICU medical and surgical patients are followed. When patients need advanced respiratory support alone or monitoring and support for two or more "organ systems", they are admitted to a level three ICU (ICS, 2021). In order to collect research data, we needed especially followed intubated patients in a third-level intensive care unit. In addition to this reason, hospital give permission to our study and be ready for cooperation, data were collected in this intensive care unit. The study was completed with 42 nurses who volunteered to participate in the study, and were over the age of 18, working full-time in the intensive care unit, and able to adapt to the care bundle. Nurses who could not take responsibility for the patient by themselves and filled the necessary forms incompletely were excluded from the study.

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2.4. Data Collection and Data Collection Tools

The data of this study was collected between, December 2020-January 2021. The “Descriptive Characteristics Form” and the “Attitudes Towards Evidence-Based Nursing Questionnaire” were administered by one-to-one interviews with the participants. The "Ventilator Care Bundle and Aspiration Monitoring Form" was completed by the researchers by observation.

2.4.1. Descriptive Characteristics Form: This form, which was prepared by the researchers in line with the literature, consists of a total of 11 questions (Ayhan et al., 2015; Ersoy et al., 2017; Ruzafa-Martinez et al., 2011).

2.4.2. Evidence-Based Nursing Attitude Questionnaire (EBNAQ): The questionnaire developed by Ruzafa-Martinez et al. in 2011 to identify the attitudes, level of knowledge, and practice skills of the nurses about evidence-based practices consists of 15 items. A minimum of 15 and a maximum of 75 points can be obtained from the questionnaire (Ruzafa-Martinez et al., 2011) A high score indicates a strong attitude level. The Turkish validity and reliability coefficient of the EBNAQ was found to be α=0.90 (Ayhan et al., 2015). The value of Cronbach’s Alpha was found to be 0.87 in this study.

2.4.3. Ventilator Care Bundle and Aspiration Monitoring Form: The form was created by the researchers by using the ventilator care bundle subcomponents as a guide and reviewing the literature (AARC, 2010; Kelleher and Andrews, 2008; Zeb et al., 2017). The form includes a total of 38 questions. The criteria were classified in the form of 'performed’ and 'not performed'.

2.5. Ethical Principles of The Study

Ethics committee permission no. 128 dated 11/11/2020 was obtained from the Republic of Turkey Okan University. Additionally, institutional permission was obtained from the Istanbul Province Directorate of Health for the hospital practice. Verbal and written informed consent was obtained from the intensive care nurses who participated in the study. To ensure that nurses could comfortably answer the questions and continue routine daily patient care, they were instructed not to give their names or surnames.

2.6. Limitations

Limitations include the small sample size and single-unit setting. Another limitation of the study was that only one observation was made after the training. Making the last observation only one week after the training may have made it easier to remember the information. Finally, it is likely that the nurses' patient care behavior was modified because of the presence of observers.

2.7. Data Analysis

The data obtained in the study was analyzed by using the SPSS (Statistical Package for the Social Sciences) for the Windows 26.0 program. Numbers and percentages were used in the analysis of demographic data. In the analysis of the data, the Mann-Whitney U-test, the t-test and ANOVA analyses were used. The type I error level was accepted as $p < 0.05$ and the confidence interval as 95%.

3. Results

The nurses included in the study were aged 25-44 years (mean=28.67±4.26); 52.4% were female, 64.3% were single, and 73.8% had an undergraduate degree. Of the sample group, we found that 57.2% had 1 to 5 years of intensive care work experience, 92.8% took the responsibility of a maximum of two patients in one shift, 63.3% had a Ministry of Health-approved intensive care certificate, 64.3 had received training on hospital infections, and 83.3% had not received training on aspiration and the care bundle previously.

When the attitude towards the evidence-based nursing questionnaire subdimensions and total scores obtained by the nurses was evaluated and no significant difference was seen despite a positive increase in the answers given after training compared to the pre-training period (Table 1).

Table 1. Total and subdimension mean scores of the nurses from the attitudes towards evidence-based nursing questionnaire

Questionnaire And Sub dimensions	Min-Max	PreTraining	PostTraining	*
		X ± SD	X ± SD	
Beliefs and Expectations Regarding Evidence-Based Nursing Sub dimension	(15-35)	31.00 ± 4.12	31.88 ± 4.07	p= 0.189
Intention to Apply Evidence-Based Nursing Sub dimension	(5-20)	16.17 ± 3.08	16.60 ± 3.05	p= 0.483
Feelings Related to Evidence-Based Nursing Sub dimension	(7-20)	17.29 ± 2.73	17.50 ± 2.85	p= 0.662
Attitudes Towards Evidence-Based Nursing Questionnaire (Total)	(27-75)	64.45 ± 9.12	65.98 ± 9.12	p= 0.353

Min= Minimum, Max-=Maximum, X= EBNAQ mean score, SD= Standard Deviation, p = Mann Whitney U test, p < 0.05*

Comparison of the mean EBNAQ score and the socio-demographic characteristics of the nurses revealed a relationship between the nurses' questionnaire scores and their educational level ($p<0.05$). The EBNAQ scores of the nurses with a postgraduate degree were found to be higher than those of the nurses with a high school degree. A post-hoc Tukey test showed that high school and postgraduate educational groups differed significantly at $p <0.05$ (a>b). When we look post-hoc analyses Similarly, a difference was seen to be present between the post-training EBNAQ scores of the nurses with responsibility for 0-2 patients in one shift compared to those with responsibility for 3-5 patients, when compared to the pre-training scores ($p<0.05$) (Table 2).

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Table 2. Comparison of the attitudes towards EBNAQ score of the nurses according to their socio-demographic features

Socio-Demographic Features	Pre-Training EBNAQ X ± SD	p	Post-Training EBNAQ X ± SD	p
Gender				
Female	65.95 ± 6.69	p= 0.268	67.41 ± 6.46	p= 0.291
Male	62.80 ± 11.16	t= 1.123	64.40 ± 11.33	t= 1.070
Educational level				
High school [a]	58.33 ± 3.56		63.33 ± 6.95	
Pre-graduate	60.50 ± 4.95	**p= 0.040**	62.50 ± 6.36	**p= 0.047**
Graduate	65.19 ± 9.74	**F= 3.951**	66.06 ± 9.83	**F= 2.274**
Postgraduate [b]	71.67 ± 4.93		72.67 ± 4.04	
Post hoc: a>b				
Marital status				
Single	64.59 ± 9.64	p= 0.896	65.07 ± 9.58	p= 0.396
Married	64.20 ± 8.42	t= 0.132	67.60 ± 8.31	t= -0.857
Intensive care certificate				
Yes	63.47 ± 6.19	p= 0.608	66.87 ± 7.14	p= 0.643
No	65.00 ± 10.47	t= -0.517	65.48 ± 10.15	t= 0.467
Receiving training about infections				
Yes	64.19 ± 6.38	p= 0.836	66.48 ± 6.74	p= 0.636
No	64.93 ± 12.95	t= -0.210	65.07 ± 12.57	t= 0.477
Receiving training about aspiration and the care package				
Yes	64.57 ± 5.13	p= 0.970	67.71 ± 4.92	p= 0.587
No	64.43 ± 9.78	t= 0.037	65.63 ± 9.76	t= 0.548
Work experience				
Less than 1 year	75.00 ± 0.00		60.00 ± 0.00	
1-5 years	65.19 ± 10.28	p= 0.419	66.52 ± 10.11	p= 0.888
6-10 years	63.27 ± 6.62	F= 0.965	65.73 ± 7.19	F= 0.212
More than 10 years	58.67 ± 2.89		64.00 ± 9.53	
Intensive care experience				
Less than 1 year	55.50 ± 19.89		55.50 ± 19.89	
1-5 years	66.86 ± 6.87	p= 0.052	67.72 ± 6.36	p=0.084
6-10 years	61.00 ± 6.66	F= 2.822	64.57 ± 8.20	F= 2.393
More than 10 years	59.50 ± 3.57		66.50 ± 12.02	
Number of patients cared for during a shift				
0-2 patients	64.79 ± 9.39	p= 0.126	66.41 ± 9.30	**p= 0.048**
3-5 patients	60.00 ± 3.61	t= 1.870	60.33 ± 3.26	**t= 2.554**

EBNAQ=Evidence-Based Nursing Attitude Questionnaire, X=EBNAQ mean score, SD=Standard Deviation, a=High school, b= Postgraduate, t=t test, F=ANOVA, p < 0.05

Evaluation of the outputs from the ventilator care bundle and aspiration monitoring form showed a difference after the training regarding the nursing interventions conducted in all areas except for the “Performed a physical examination with auscultation over the trachea" parameter, which was included in the subheading of the interventions determining the aspiration decision (p<0.05). As regards the “Taking infection control measures before a procedure” subheading, a difference was found in post-training "Hand washing before the procedure and wearing gloves" interventions compared to the pre-training scores (p<0.05). However, there was no difference related to any parameter of the “Informing

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the patient about the aspiration procedure" subheading (p>0.05). A difference was found in the "Controlling the aspiration pressure, providing hyper-oxygenation, and Following the patient's monitor parameters" areas of the "Making preparations before the aspiration procedure" subheading, when compared before and after the training (p<0.05). Similarly, a difference was found after training in all interventions of the aspiration procedure and in providing oxygenation after aspiration (p<0.05). A difference was found during observation after the training compared to the three observations before the training in all areas except the "Peptic ulcer prophylaxis" parameter included in the care bundle parameters (p<0.05) (Table 3).

Table 3. Distribution of the nurse observations according to the ventilator care bundle and aspiration monitoring form

Ventilator Care Bundle and Aspiration Monitoring	Pre-training 1st obs	Pre-training 2nd obs	Pre-training 3rd obs	Post-training obs	p
	Performed	Performed	Performed	Performed	
Decision to aspiration					
Checked ventilator parameters.	71.4%	47.6%	28.6%	88.1%	**p= 0.001**
Observed that the ventilator was giving a high-pressure alarm.	73.8%	50.0%	33.3%	88.1%	**p= 0.001**
Observed a disturbance of the oxygen saturation.	71.4%	78.6%	90.5%	95.2%	**p= 0.011**
Observed visible secretion in the airway.	71.4%	78.6%	95.2%	92.9%	**p= 0.005**
Performed an examination with auscultation over the trachea.	0.0%	2.4%	0.0%	4.8%	p= 0.296
Evaluated the blood gas results.	21.4%	28.6%	26.2%	66.7%	**p= 0.001**
Taking infection control measures before the procedure					
Ensured hand hygiene before the procedure.	54.8%	54.8%	54.8%	92.9%	**p= 0.001**
Ensured hand hygiene before putting on gloves.	57.1%	57.1%	54.8%	97.6%	**p= 0.001**
Put on a gown.	95.2%	100.0%	100.0%	100.0%	p= 0.109
Put on a mask.	97.6%	100.0%	100.0%	100.0%	p= 0.394
Put on glasses.	97.6%	100.0%	100.0%	100.0%	p= 0.394
Put on sterile gloves.	35.7%	38.1%	21.4%	16.7%	p= 0.074
Informing the patient about the aspiration procedure					
Discussed the need for aspiration	26.2%	42.9%	35.7%	47.6%	p= 0.203
Discussed the results if aspiration was not performed.	21.4%	38.1%	28.6%	42.9%	p= 0.155
Discussed the effects of aspiration.	16.7%	23.8%	19.0%	40.5%	p= 0.051
Reported that the procedure could be uncomfortable.	26.2%	42.9%	33.3%	45.2%	p= 0.245
Reported that it would be short.	26.2%	42.9%	35.7%	47.6%	p= 0.203
Reported that it could be required multiple times.	21.4%	38.1%	28.6%	42.9%	p= 0.155

obs=Observation, p* = Mann Whitney U test, *p < 0.05*

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Table 3. Distribution of the nurse observations according to the ventilator care bundle and aspiration monitoring form (continued)

Ventilator Care Bundle and Aspiration Monitoring	Pre-training 1st obs Performed	Pre-training 2nd obs Performed	Pre-training 3rd obs Performed	Post-training obs Performed	p
Pre-procedure preparation					
Selected an aspiration catheter of suitable size.	92.9%	95.2%	95.2%	97.6%	p= 0.794
Checked aspiratory pressure by clamping the aspirator tube.	64.3%	61.9%	59.5%	100.0%	**p= 0.001**
Used hyper-oxygenation	100.0%	100.0%	92.4%	95.2%	**p= 0.001**
Observed the monitor parameters.	40.5%	64.3%	59.5%	92.9%	**p= 0.001**
Did not administer physiological saline before the procedure.	57.1%	64.3%	61.9%	64.3%	p= 0.898
Application of the aspiration procedure					
Clamping the aspiration tube before aspiration	16.7%	14.3%	16.7%	95.2%	**p= 0.001**
Applied continuous negative pressure when removing the aspiration catheter from the tube.	85.7%	97.6%	97.6%	100.0%	**p= 0.008**
Removed aspiration catheter from the tube with a single movement.	23.8%	35.7%	47.6%	95.2%	**p= 0.000**
The whole aspiration process was under 15 sec.	52.4%	57.1%	66.7%	97.6%	**p= 0.001**
Observed monitor during the procedure.	45.2%	50.0%	52.4%	95.2%	**p= 0.001**
Post-aspiration procedures					
Used hyper-oxygenation	35.7%	33.3%	28.6%	97.6%	**p= 0.001**
Observed patient respiratory status.	83.3%	97.6%	92.9%	95.2%	p= 0.075
Taking infection control measures after the procedure					
Aspiration performed in a sterile manner.	33.3%	40.5%	21.4%	21.4%	p= 0.147
Hand hygiene practiced after the procedure.	92.5%	93.4%	93.6%	97.6%	p= 0.901
Hand hygiene practice after leaving patient bed area.	97.6%	100.0%	97.6%	100.0%	p= 0.574
Care Bundle					
Oral care	88.1%	78.6%	59.5%	90.5%	**p= 0.001**
Bed head elevation	16.7%	16.7%	4.8%	85.7%	**p= 0.001**
DVT prophylaxis	0.0%	0.0%	0.0%	35.7%	**p= 0.001**
Peptic ulcer prophylaxis	61.5%	62.3%	64.3%	69.0%	p= 0.958
Considering sedation interruptions and assessment of readiness to extubate	31.0%	28.6%	9.5%	83.3%	**p= 0.001**

obs=Observation, p* = Mann Whitney U test, *p < 0.05*

4. Discussion

Evaluation of the attitudes of the intensive care nurses included in the study towards the post-training EBPs showed that they had obtained points (65.98 ± 9.12) above the mean score from the scale (Table 1). Similar studies conducted by using EBNAQ in Turkey have reported mean total

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questionnaire scores of 57.35±9.4 (Daştan and Hintistan, 2018), 57.14±8.27 (Yılmaz et al., 2018), 46.36±3.95 (Yılmaz et al., 2019), and 43.53 ± 3.08 (Menekli and Korkmaz, 2021). The higher scores obtained by our sample group compared to the results of other studies could be related to the fact that the majority of our subjects had undergraduate or master's degrees. No difference was found in the questionnaire total score and its subdimensions after the training compared to the pre-training state in the current study. The reason for such a difference, although the answers given to all the items increased positively after the training, could be the positive attitudes of the nurses before the training and the time-consuming concept of creating a change in attitude (Table 1).

When the mean score of the attitudes towards evidence-based nursing questionnaire was compared to the socio-demographic characteristics, a statistically significant difference was found between the pre-training and post-training scores of the nurses with a master's degree who were providing care to 0-2 patients per shift. The literature contains many studies supporting the notion that the attitudes regarding evidence-based practices of nurses with a master's degree are higher than in the other groups (Menekli and Korkmaz, 2021; Şen and Yurt, 2021). The inclusion of evidence-based practices in nursing undergraduate curriculums, and the literature searches and reviews conducted when preparing undergraduate and graduate work and theses are thought to be the reason for the increased awareness of the importance of evidence-based practices (Ergan et al., 2016; Ersoy et al., 2017) (Table 2).

When Table 3 obtained by observing each nurse's ventilator care package and aspiration tables for a total of four times was evaluated, a difference was found to be present in several healthcare areas after training compared to the pre-training state. It was reviewed respectively; a difference was found after training compared to pre-training in all parameters except "Performing physical examination with auscultation" included under the subheading of deciding for aspiration. The presence of at least one of the basic findings of visible secretion in the airway, hearing coarse rales on auscultation, high-pressure alarm in the ventilator, decrease in the oxygen saturation and/or deteriorating blood gas values is required in determining that the patient needs aspiration (AARC, 2010; Day et al, 2001; Kelleher and Andrews, 2008; Sharma et al., 2014). When the study results were reviewed, we observed that the nurses had already been checking all the parameters prior to the training, and the checking rate had increased after training. This result can be correlated to the high educational level and intensive care experiences of the sample group. Similar results were seen to be present in the literature when the reasons for the low rate of listening to the sound of lungs with auscultation, which is a part of physical examination and one of the important components of the aspiration decision, were investigated. Many studies have reported that nurses do not regularly use physical evaluation skills in the clinic (Birks et al., 2013; Giddens, 2007). Although 87.2% of the nurses knew that the respiratory sounds should be listened to, only 53.6% stated that they used it in the clinic in the study conducted by Çevik (Çevik et al., 2018). Auscultation of the lung and analyzing the sounds heard are important determinants in the ability to decide whether aspiration needs to be performed. Besides, blood gas evaluation is one of the most specific skills for critical care nurses. Because they report these normal or abnormal results to the physician who will then prescribe further treatment for the critically ill

patients (Ibrahem et al., 2021). Although knowledge of the practice of the aspiration and blood gas evaluation is included in nursing undergraduate and graduate theoretical and practical programs, it is necessary to identify the reasons why nurses avoid its use and to find a solution. Hand hygiene application rates before the aspiration procedure were seen to increase after the training in the study. However, the rate of wearing sterile gloves before the procedure, included in the same title, was found to be low both before and after the training. The current guideline based on the results of evidence-based practice on the aspiration procedure reports that open system aspiration must be performed wearing sterile gloves and sterile catheters in order prevent the development of infection (AARC, 2010). Similarly in this study, Çelik and Elbaş found in their study that 97.6% of nurses did not wear sterile gloves during the aspiration procedure (Çelik & Elbas, 2000). Özden and Görgülü observed that more than half of the nurses (66.7%) prepared non-sterile disposable gloves, but that some of them (4.2%) prepared sterile gloves (Özden and Görgülü 2012). Our findings were highly important in terms of showing that the nurses' performing aspiration with sterile gloves was inadequate. An increase was observed in the implementation rates of the items of the "Informing the patient about aspiration" subheading after the training as compared to before, but no significant difference was found. Similar to the study data, studies revealing that nurses lack skills related to communication with patients undergoing mechanical ventilation have been found in the literature (Carroll, 2017; Patak et al., 2004). Unconscious or conscious, and verbal or non-verbal communication techniques should be used during communication with the intubated patient in the intensive care units. Similarly, explaining all the procedures to the patients is both a professional and ethical responsibility. A more in-depth investigation of this result is important in terms of finding a solution. A difference was found after the training compared to before the training regarding the parameters of "Controlling aspirator pressures, Used hyper-oxygenation and Monitoring the patient" before the aspiration procedure as included in the preparation subheading. However, a decrease was observed in the "Used hyper-oxygenation" sub-header after the procedure. In the content of the training given to nurses, this issue was discussed and its importance was mentioned. This negative result should be considered, the reasons should be determined, and the rate should be increased to 100% again. When we look at the "Application of the aspiration procedure" section, it was observed that the rates of application before training were very low except for "Applied continuous negative pressure when removing the aspiration catheter from the tube". While entering the tracheal tract during the aspiration procedure, the suction pressure should be interrupted in order to prevent damage to the tracheal mucosa, the procedure should be completed within 15 seconds to prevent hypoxia, and the patient should be followed up closely in terms of respiratory and hemodynamic complications (AARC, 2010; Çelik and Elbas, 2000). The high implementation rate in all the sub-steps of the "Application of the aspiration procedure" header at the end of the training is a satisfactory result. Regarding the post-aspiration procedures section, there was a difference in the "Used hyper-oxygenation" application after the training compared to the pre-training status. Combining pre and post-oxygenation has been found to reduce the occurrence of hypoxia by almost 50% (Pedersen et al., 2009). In this study, the rate of providing hyper-oxygenation before and after aspiration was over 95%. Evaluation of taking infection control measures during and after the procedure subheading revealed no difference in the "Implementing hand hygiene" parameter before

and after the training. However, the reason could be the fact that the hand hygiene adherence rate of the nurses was high before training as well. No difference was found between the post-training and pre-training states for the “Not performing the procedure in a sterile manner” parameter. A difference was found between the implementation rates for all fields of the nurses before and after the training, except for "peptic ulcer prophylaxis", which was included in the ventilator care bundle in the study. A care bundle is the combined implementation of a few evidence-based interventions that affect the patient's healing process positively when each is implemented individually, with the effect increasing when all are implemented together (Resar et al., 2021).

The most commonly used care package is supported by the Institute for Healthcare Improvement (IHI) and comprises the VAP interventions of peptic ulcer disease prophylaxis, deep vein thrombosis prophylaxis, head of the bed elevation, and sedation vacation. The ventilator care bundle is a healthcare approach that was developed to prevent ventilator-associated pneumonia and the complications that may occur due to the use of a mechanical ventilator and has given positive results in the literature (Resar et al., 2021; Sulis et al., 2014). In order for the care bundle to be implemented successfully and to obtain positive patient outcomes, all components in the bundle must be fulfilled correctly and completely (Resar et al., 2012; Rello et al., 2010). All components of the care bundle should be used together in the routine care and follow-up of intubated patients who require mechanical ventilator support. Team collaboration is required for the successful implementation of the care bundle. The interventions of oral care and head of bed elevation, which are included in the bundle content, are among the independent roles of the nurses while other interventions require team cooperation and physician directives (Yılmaz and Gürler, 2017). The rates of the "Oral care, Head of bed elevation" interventions were seen to increase significantly after training. Compared to the literature, peptic ulcer prophylaxis usage rates were found to be high (Krag et al., 2015) but not at the desired level, and no difference was seen after the training. It is an unexpected and undesirable result that the application rates of “Bed head elevation and DVT prophylaxis” components were very low before the training. However, the increase in the rate of nurses applying the components of the care package after the training compared to the pre-training is a satisfactory result showing that the training provided is effective (Table 3).

5. Conclusion

The mean EBNAQ score was found to be high in this study conducted to investigate the effect of the training given to nurses on care bundle practices and their attitudes towards evidence-based nursing. The use of EBP was found to have been affected by the nurses’ educational level. and the number of patients receiving care at each shift. The training provided ensured the development of quite positive differences in the steps of the ventilator care bundle and aspiration practice. Nurses play important roles in the successful implementation of a care bundle and tracheal aspiration because they are the prime healthcare practitioners in the care of patients. This study demonstrated that nurses’ knowledge and skills regarding VAP prevention bundle was improved after the training program. Implementation of the care bundle in nurse education would be effective at reducing the rate of ventilator-associated pneumonia.

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Based on the results of the present study, the following recommendations were made:

- Providing more in-service trainings to critical care nurses about VAP Prevention Bundle.
- Assessing the impact of similar educational interventions over a long period of time.

Authors Contributions

Topic selection: Sİ, ST; Design: Sİ, ST; Planning: Sİ, ST; Data collection: Sİ; Data analysis: Sİ; Article writing: Sİ, ST; Critical review: Sİ, ST.

Conflict of Interest

No conflict of interest has been declared by the authors.

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