Effects of Provided Trainings Regarding Non-Invasive Mechanical Ventilation on the Knowledge Level of Nurses

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Abstract

Objective: Having experienced members in the team for obtaining successful outcomes in non-invasive mechanical ventilation (NIMV) is important. The aim of our study is to determine the effectiveness of training on nurse's level of knowledge about NIMV

Methods: This study was done with 70 nurses who were working at an university hospital. The data collection tools that were used were form for individual characteristics and knowledge test questions form consisting of multiple-choice for NIMV. Firstly, Pre-tests have been collected in the survey. Secondly, courses regarding NIMV indications, contraindications and patients management topics were given verbally by researchers. Finally, final tests were performed and data were collected. Analyzing for data were used frequency, percentage, wilcoxon and dependent samples Mc Nemar tests.

Results: Mean age were 33.2±7.3, 87.1% were female, 68.6% had bachelor degrees. Of 47.1% were working in intensive care. 54.3% often provide care to NIMV applied patients. 94.7% mentioned that they don't have any knowledge of NIMV applications. The differences between the pre-post training scores were higher statistically ($p<0.001$). It was determined that knowledge levels of nurses about NIMV indications and contraindications after training increased statistically significantly. ($p<0.05$).

Conclusion: In our research it was understood that nurses' knowledge has increased significantly after the training for non-invasive applications. By means of these trainings that will develop the affective, cognitive and psychomotor skills of nurses, it is expected to reveal the results of the extensive research and successful outcomes for NIMV applications will increase.

Keywords: Level of knowledge, noninvasive mechanic ventilation, nurse

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INTRODUCTION

Noninvasive mechanical ventilation (NIMV) is the administration of respiratory support via the upper respiratory tract without using an invasive artificial airway (1, 2). It is indicated in the literature that NIMV should be performed during the treatment of diseases that cause hypercapnic respiratory failure and of chronic obstructive pulmonary diseases accompanied by respiratory acidosis (3-5).

Achieving patient-ventilator interaction is the most important step to obtain successful results in NIMV. In addition to choosing an appropriate mask, the location of NIMV application according to the patient's need, the characteristics of the mask to be used, the mode and settings of the selected mechanical ventilator, and experienced and well-equipped team members are also important to the management of the ventilation process (2, 6, 7).

Respiratory therapists are responsible for NIMV treatment in some countries. However, in countries such as Turkey, where the number of respiratory therapists is insufficient, physicians and nurses are responsible for the selection of the mask, for the appropriate placement of the mask, for the adjustment of the ventilator to alleviate respiratory distress, and for the initiation of NIMV. For this reason, nurses

should be knowledgeable about following up patients, the problems that can occur, and methods to prevent those problems (3).

Noninvasive mechanical ventilation is a nurse-controlled practice; due to developing technologies, nurses must acquire new skills to provide maximum benefit and safety to the patient when administering NIMV. Although studies that measure the level of knowledge and the skills of nurses are limited in this respect, the existing research shows that nurses lack information regarding the follow-up and care of NIMV patients (7, 10).

This research was conducted to determine the knowledge levels of nurses regarding NIMV application, to evaluate the effectiveness of the training given to the nurses in this regard, and to create a literature source for NIMV patients to receive quality nursing care.

Research Hypothesis: The NIMV application training that is given to nurses positively affects the knowledge levels of the nurses in comparison to their levels before the training.

METHODS

This study was conducted with 70 nurses who worked in the adult intensive care units of a State University Hospital, who had experience with NIMV application, and who agreed to participate in the research between the months of March and May 2015. The strength of the study was found to be 0.90, with an effect size of 0,50 and with an error of 5%. The following data collection tools were used in 70 subjects:

Structured information form: Eight questions were included in the form prepared by the researchers to determine the age, gender, and education level of the nurses.

NIMV information form: The information form, which was prepared on the basis of literature information, consisted of 20 questions (7, 11-18). More than one of the options provided in questions 1, 2, 3, 4, 5, 6, 9, 10, and 20 were correct; the participants were expected to mark all correct items. Only one of the options was correct in questions 7, 8, 11, 12, 13, 14, 15, 16, 17, 18, and 19; the participants were asked to choose only one option. The participants obtained 1 point for each correct item they marked on the information form, to a maximum score of 63 points.

NIMV training: This was established by the researchers on the basis of the literature regarding indications, contraindications, application methods, possible complications, and patient management in NIMV. Training-related documents were prepared to be provided to the participants before and after training (7, 11, 13, 14, 16-18).

Application: Before the training began, the nurses were asked to fill out the structured information form and the information forms related to NIMV in a quiet environment. One week after the pre-training data was collected, oral NIMV-related training was provided to the participants by an intensive care specialist, a specialist physiotherapist, and a specialist nurse for two hours a week for four weeks. Four weeks after the training, the participants were asked to fill out the NIMV information form again, and the data was collected. The responses of the questions measuring the knowledge levels of the nurses were evaluated and are presented in the results section.

Required permissions: The nurses were informed about the study prior to the research, and their verbal approval was received. Ethical approval was obtained from the Ethics Board of Non-Interventional Clinical Research, Medipol University, İstanbul.

Statistical Analysis

The results were analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows (version 21.0, released 2007, Chicago, IL, USA); percentage, frequency, McNemar, and Wilcoxon tests were used. The results were in the 95% confidence interval, and significance was evaluated as $p<0.05$.

RESULTS

The mean age of the nurses was 33.2±7.3 years; it was also determined that 87.1% of the nurses were women, 68.6% held a bachelor's degree, 47.1% worked in general intensive care units, and 54.3% frequently provided care for patients to whom NIMV was applied. Of the nurses, 94.3% believed that they were not knowledgeable about the care of NIMV patients. The mean total score that the nurses obtained on the pre-training information form was 32.87±7.40 (min: 15, max: 51); however, this was found to be 36.70±6.16 (min: 19, max: 52) after the training, and the difference was statistically significant ($p<0.001$, Table 1).

When the individual characteristics were compared with the total mean scores obtained before and after the training, it was determined that the post-training average knowledge scores statistically significantly increased in nurses who were 26 years of age and older, who were women, who graduated from Medical Vocational High Schools (MVHS), and who had bachelor's and master's degrees (Table 1). When the average knowledge scores were evaluated in terms of the professional experiences of the nurses, it was observed that the post-training average knowledge scores statistically significantly increased in nurses who worked in adult intensive care units, who had over one year of experience, and who had frequent, rare, or no experience caring for patients to whom NIMV was administered (Table 1).

It was found that the post-training knowledge scores statistically significantly increased in nurses who believed they did not have knowledge about providing care to NIMV patients; in nurses who used means such as books, magazines, and the internet to obtain knowledge on this issue; in nurses who obtained information from their colleagues; and in nurses who obtained knowledge from congresses, symposiums, and in-service training (Table 1).

When the average NIMV knowledge scores of nurses were examined before and after the training, it was determined that the mean knowledge scores of NIMV indications, contraindications, complications related to masks and air flow, the difference between invasive mechanical ventilation (IMV) and NIMV, success criteria, and knowing when to end NIMV increased statistically significantly in comparison to the levels before the training (Table 2). However, when the levels of knowledge of the advantages of NIMV in comparison to IMV were compared, it was found that the post-training mean scores did not show a statistically significant difference ($p=0.083$, Table 2).

When the nurses' knowledge of correct and incorrect expressions regarding the application of NIMV before and after the training was

Table 1. Individual characteristics of the nurses and average scores of the knowledge examinations (n=70)

Individual characteristics		n	%	Before the training Mean±SD	After the training Mean±SD	p*
Age	Between 18 and 25 years of age	10	14.3	33.00±4.89	36.50±5.66	0.062
	Between 26 and 35 years of age	36	51.4	32.05±7.76	35.52±6.50	p<0.001
	Between 36 and 45 years of age	16	22.9	34.81±8.02	39.00±6.54	0.002
	46 years of age and over	8	11.4	32.50±7.55	37.62±3.15	0.042
Gender	Female	61	87.1	32.53±6.97	36.60±5.49	p<0.001
	Male	9	12.9	34.00±9.93	36.55±9.91	0.168
Education level	Medical vocational high school	6	8.6	33.00±11.38	39.50±7.14	0.042
	Associate degree	7	10.0	36.85±5.33	38.42±2.22	0.285
	Bachelor's degree	48	68.6	31.91±6.82	35.81±6.32	p<0.001
	Master's degree	9	12,8	34.77±8.54	38.22±6.43	0.015
Working area	Coronary intensive care	7	10.0	30.85±7.19	35.71±7.15	0.017
	General intensive care	33	47.1	33.66±7.16	37.27±6.34	p<0.001
	Surgical intensive care	30	42.9	32.46±7.82	36.30±5.88	0.001
Duration of working years	Less than 1 year	3	4.3	31.50±7.77	34.71±8.66	0.180
	1 to 5 years	23	32.9	32.29±7.87	37.05±4.99	0.001
	6 to 10 years	13	18.6	33.07±7.03	35.64±5.55	0.051
	11 to 15 years	7	10.0	36.71±8.76	41.42±6.52	0.043
	16 years and over	24	34.3	32.83±6.69	36.88±4.58	p<0.001
Frequency of giving care to patients with NIMV	Every day I work	14	20.0	37.54±7.02	39.64±6.36	0.159
	Frequently	38	54.3	32.15±7.14	35.78±6.16	p<0.001
	Rarely	11	15.7	30.36±5.85	34.54±5.87	0.007
	Never	7	10.0	31.42±9.12	39.14±4.01	0.042
Level of knowledge about about care of NIMV patients	Yes	4	5.7	26.25±7.41	37.25±2.50	0.068
	No	66	94.3	33.27±7.26	36.66±6.32	p<0.001
Sources from which information was obtained about the nursing care of NIMV patients (More than one option can be selected)	Brochures, books, magazines, internet, etc.	20	28.6	26.25±7.41	37.25±2.50	0.004
	From my colleagues	53	75.7	32.40±8.10	35.75±7.25	p<0.001
	From congresses, symposiums, and in-service training	32	45.7	33.58±7.24	36.98±6.22	p<0.001
	Other	5	7.1	34.51±7.50	39.09±5.50	0.157
			Total	32.87±7.40	36.70±6.16	p<0.001

*Wilcoxon test
Mean±SD: Mean±standard deviation
NIMV: Noninvasive mechanical ventilation

evaluated (Table 2), it was found that the pre-training mean scores of the participants were 7.32±1.73 and the post-training mean scores were 8.15±1.50; this difference was statistically significant (p<0.001). When the nurses' responses to questions about the characteristics and preparation of devices related to NIMV were examined, it was found that the levels of knowledge of the nurses statistically significantly increased regarding the role and location of the asphyxia valves and the role and position of the pressure line port (Table 3).

Table 2. Distribution of participants' responses to questions regarding NIMV implementation and interventions during implementation (n=70)

Characteristics of NIMV application	Before the training Mean±SD	After the training Mean±SD	P*
Knowing the indications of NIMV ** (Min: 0–Max: 5 points)	2.98±1.32	3.52±1.13	p<0.001
Knowing the contraindications of NIMV ** (Min: 0–Max: 5 points)	2.45±1.40	2.77±1.33	0.001
Knowing the advantages of NIMV compared to IMV** (Min: 0–Max: 3 points)	1.47±0.65	1.55±0.65	0.083
Knowing the complications of NIMV related to "mask" ** (Min: 0–Max: 5 points)	3.08±0.81	3.38±0.78	p<0.001
Knowing the complications of NIMV regarding "air flow and pressure" ** (Min: 0–Max: 5 points)	2.32±1.03	2.62±1.06	p<0.001
Knowing the differences between NIMV and IMV in intensive care units ** (Min: 0–Max: 5 points)	1.82±1.12	1.95±1.12	0.024
Knowing when NIMV should be terminated ** (Min: 0–Max: 7 points)	3.37±1.49	3.87±1.53	p<0.001
Knowing the success criteria of NIMV application ** (Min: 0–Max: 6 points)	1.78±0.88	2.0±0.86	0.010
Knowing right and wrong expressions regarding NIMV ** (Min: 0–Max: 11 points)	7.32±1.73	8.15±1.50	p<0.001

* Wilcoxon test
** Each question contains more than one correct statement.
IMV: Invasive mechanical ventilation; Min: minimum; Max: maximum; NIMV: noninvasive mechanical ventilation

Table 3. Distribution of the participants' responses to questions related to NIMV devices and the features of the devices (n=70)

NIMV device features	Before the training n	Before the training %	After the training n	After the training %	P*
Place where bacteria filter is inserted in NIMV application **	53	76.0	53	76.0	0.999
Expression that is not a step of NIMV application **	59	84.0	55	79.0	0.344
Role of the exhalation port on the NIMV cycle **	62	89.0	63	9.0	0.999
Location of the heat and moisture exchanger filter in NIMV application **	17	24.0	19	27.0	0.727
Frequency of replacing the heat and moisture exchanger filter in NIMV application **	29	41.0	31	44.0	0.754
Role of the asphyxia valve **	38	54.0	51	73.0	0.002
Location of the asphyxia valve **	34	49.0	45	64.0	0.007
Role of the pressure line port **	25	36.0	40	57.0	0.001
Location of the pressure line port **	16	23.0	24	34.0	0.021
Administration of inhaler drugs in NIMV application **	50	71.0	51	73.0	0.999
Actions that should be taken when it is noticed that a bacterial filter is not used in the ventilation of an ARB-positive patient **	48	68.0	47	67.0	0.375

*McNemar test
**Each question contains one correct expression
ARB: Acid-resistant basil; NIMV: noninvasive mechanical ventilation

DISCUSSION

It is believed that training programs aimed to increase the knowledge and experience of healthcare team members have positive effects on reducing complications associated with NIMV. In our study, when the effects of NIMV training on the knowledge levels of nurses were evaluated, it was determined that their knowledge levels increased significantly after the training.

In our study, almost all the nurses believed that they did not have adequate knowledge regarding the care of patients to whom NIMV is applied. The mean knowledge scores of the nurses were determined to be medium before the training, which also supports these considerations. However, it was found that the knowledge of most nurses about the care of patients during NIMV was not based on a planned training process. In this study, it was determined that comprehensive, planned training significantly increased the mean knowledge scores of the nurses. Carlucci et al. (19) have shown that successful outcomes in NIMV implementation are associated with the experience and abilities of staff. In an article by Uysal (20), the participation of health workers in training regarding the application of mechanical ventilation was also emphasized to be important to ensure that mechanical ventilation techniques and interventions are implemented

effectively and at the right time. In other studies, it was concluded that successful NIMV application is associated with the experience of the team in addition to accurate selection of the patient and equipment (2, 21, 22).

It was observed that the knowledge of the nurses about the indications, contraindications, complications, NIMV ending time, and differences between IMV and NIMV, as well as the rates of correct responses to the success criteria, significantly increased after training. The literature on this subject is rather limited. In a study by Tarhan et al. (7), in which they examined the knowledge levels of nurses regarding NIMV, the level of knowledge of the nurses was similar to the pre-training level obtained in our research. The increase in the level of knowledge after the education in our research shows that comprehensive, planned training in NIMV has a positive effect on the knowledge level of nurses.

The responses of the nurses related to the advantages of NIMV in comparison to IMV were examined in our study; although there was no significant difference in terms of evaluation after the training, there was a significant increase in the knowledge level of the items related to the fact that NIMV application takes less time and does not prevent oral feeding of the patient. Poponick et al. (23) have stated that the time spent during the first 6 hours of respiratory support at the patient's bedside and the time spent by the nurses for follow-up in the next 42 hours are shorter than for IMV; this is in agreement with the opinions of the nurses in our study.

It was determined that the knowledge levels of the nurses regarding the problems of mask usage and air flow during NIMV significantly increased after training. In a study conducted by Torredà et al. (24) in different intensive care clinics, it was found that the knowledge level of nurses for this subject was low; however, it was stated in the study by Tarhan et al. (7) that most nurses expressed the opinion that face masks should be placed on the patient's face so that there is no space left in order to avoid leakage and should be properly taped to prevent the application of pressure on the nasal bridge. It was determined that our findings are consistent with Tarhan's results and that this ratio increased after training. Nursing care protocols associated with NIMV therapy advocate that, in addition to knowledge regarding the use of nursing equipment to protect skin integrity, training that increases the awareness of nurses may also reduce the development of problems (25).

When the nurses' responses to questions about the characteristics and preparation of devices related to NIMV were examined, it was determined that the correct response rates for most of the questions increased after the training. However, although the correct response rates to questions about the location of the heat and moisture exchanger filter and the location of the pressure line port were found to increase after the training, these response rates were still observed to be lower than those of the other questions. The results of the Tarhan et al. (7) study also support our research. In terms of the use of the devices, increasing the knowledge of nurses who are directly involved in the application of the NIMV method is very important to provide effective respiratory support to patients.

This study was conducted in a single center, the samples were limited to nurses working at the institution, and the study was conducted without a control group due to concerns that the number of samples might decrease even further; this restricts the generalization of these results to all nurses. Moreover, the fact that the vocational education levels of the nurses involved in the research were different, as in the country as a whole, limits the measurement of their expected knowledge and skills.

CONCLUSION

Noninvasive mechanical ventilation is a respiratory support therapy in which nurses and physicians actively participate. For this reason, nurses should have sufficient knowledge and skills regarding the preparation of the patient prior to NIMV application and regarding the nursing interventions to be performed for follow-up during ventilation and afterward. It can be understood from the results of this research that training provided to nurses regarding NIMV application positively affects their knowledge levels compared to the levels before the training. Starting at the undergraduate education level, it is believed that it is important to provide planned and practical training to all nurses who are expected to assist in NIMV application; also, it is important to observe the results of the education. It is clear that increasing the knowledge and skills of nurses in this regard will also increase the quality of care that patients receive. At the same time, it is believed that solutions for nursing care can be determined by conducting comprehensive nursing studies regarding the complications of NIMV in our country. In addition to their intensive working conditions, the knowledge levels of nurses about the importance of patient-ventilator interaction should also be increased to provide qualified care to patients; also, it is necessary to raise the awareness of administrators in terms of determining appropriate patient-nurse ratios. In this regard, it is considered that the successful application of NIMV can be increased by training that develops the cognitive, emotional, and psychomotor skills of nurses; increasing the competence of nurses will positively reflect on the presentation of health services, and these results can be revealed through comprehensive studies.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of İstanbul Medipol University.

Informed Consent: Verbal informed consent was obtained from all of the nurses who participated in this study.

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