Research Article

KNOWLEDGE LEVELS OF NURSES ABOUT OXYGEN THERAPY IN TURKEY

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Abstract: *Oxygen therapy, when duly performed, is very useful. On the other hand, when performed inappropriately, it has significant adverse effects in addition to its therapeutic characteristics. Therefore, nurses have to have enough knowledge of oxygen therapy. This descriptive study aims to determine the level of knowledge of nurses regarding oxygen therapy. The research sample consisted of 302 nurses who agreed to participate in the research, working in a state hospital in Ankara/Turkey. The data have been collected by a descriptive characteristic form and a knowledge test of 40 questions regarding oxygen therapy. In the study that the knowledge level score average of the nurses is $\overline{X}$ =22.94±4.5 (min=8, max=35). The knowledge levels score averages of the nurses are lower than expected and nurses' knowledge is particularly inadequate in terms of oxygen therapy application methods. In this research, the nurses over the age of 45, working in the same department for more than 14 years and working in the operating room have lower scores (p<0.05). In order to enhance the level of knowledge of nurses, it is recommended to provide more comprehensive oxygen therapy education at hospitals and the undergraduate level. It is thought that the results of the study shall contribute to determining the educational needs of nurses for oxygen therapy and be a guide for future researches.*

Keywords*: Nurses, oxygen, therapy, knowledge.*

1. Introduction

Oxygen therapy was started to be used for the treatment of various diseases at the end of the 18th century. Nowadays, oxygen is used very frequently for medical treatments. Among the indications of oxygen therapy are hypoxia, hypoxemia, cardiac and respiratory arrest, hypertension, low cardiac output, metabolic acidosis and respiratory distress [1,2]. Oxygen therapy, when performed with appropriate dosage, is useful, however, it has significant adverse effects in addition to its therapeutic characteristic when performed inappropriately. Among these adverse effects are hypoventilation, atelectasis, pulmonary oxygen toxicity, retrolental fibroplasia, irritation, pain and

infection [3-5]. The inappropriate administration also leads to increased hospital lengths of stay, higher rates of admission to high dependency units, and an increased risk of death [6].

Oxygen therapy is listed as a core item on the World Health Organization (WHO) model of essential medicines, which is a list of the most effective and safe drugs used in a health care system [7]. Oxygen therapy, like drug treatment, should be applied by nurses upon the written order of the physician [8-10]. The order of the physician should include the application method of oxygen therapy, treatment process, and targeted oxygen saturation [3, 6, 11]. The nurse should have knowledge of basic principles, indications, application methods, complications of oxygen therapy, and underlying causes of hypoxemia and should take the steps regarding the nursing care needs of the patient receiving oxygen therapy and record these steps [5, 12].

Different methods are used for oxygen therapy. These are nasal cannula, face mask, venturi mask, partial rebreather mask, nonrebreather mask, oxygen tent, oxygen hood, face tent, transtracheal catheter, and nasal catheter [2, 8,9]. In some studies [7, 13-16], the level of knowledge of the nurses regarding oxygen applications was assessed and their knowledge scores were identified to be low. However, there were only a few studies regarding the level of knowledge of Turkish nurses regarding oxygen therapy [13, 14]. We believe that more studies are needed to illustrate the subject. It is believed that identifying the nurses' level of knowledge regarding oxygen therapy will contribute to determining the need for relevant in-service training needs and creating the content of the in-service training to be provided and thus in remedying the practical deficiencies.

1.1. Research Objective

The research was performed to determine the level of knowledge of nurses regarding oxygen therapy.

1.2. Research Questions

1. What is the level of knowledge of nurses regarding oxygen therapy?
2. Do some indicative characteristics of the nurses participating in the research affect their level of knowledge regarding oxygen therapy?

2. Material and Methods

2.1. Place of Research and its Properties

The research was performed in a descriptive design. The research was carried out at a hospital in Ankara/Turkey. The hospital has 500 beds and 446 nurses work there. The hospital does not have a guideline or procedure on oxygen treatment or its application methods.

2.2. Research Population and Sample

The population of the research consisted of all the nurses working in the hospital (N=446). In total, 144 nurses were excluded from the study. Among them, 112 rejected participating, 26 were on annual or medical leave on the dates of research and six did not duly complete the forms. Thus, the research was conducted on 302 nurses. The participation rate of the research is 67.7%.

2.3. Data Collection Instruments

Data were collected using two questionnaire forms. One of the data collection forms are the descriptive characteristics form was prepared by the researcher using the relevant literature [2,13]. This form consists of 16 questions regarding their demographic characteristics, and the performance and training status of regarding oxygen therapy. The other is the Questionnaire on Nurses' Level of Knowledge Regarding Oxygen Therapy prepared by the researcher by basing on the relevant literature [11,15,17]. Opinions of three nursing experts and one measurement evaluation expert were sought on the content of the questionnaire. In line with the opinions and recommendations received, the questionnaire was modified accordingly and a pre-test of the questionnaire was conducted with 30 nurses working for a different hospital. According to the results obtained from the pre-test, the questionnaire was re-evaluated and two questions were removed from the questionnaire. The questionnaire was finalized after reconsider. There were 20 questions in total in the questionnaire among one-item includes a 16 preposition related to oxygen therapy, 18 are questions related to oxygen therapy and one includes a 6-item matching regarding oxygen application methods. Those providing correct answers and wrong answers have received "1 point" and "0 points" respectively. The maximum score for the questionnaire is 40.

2.4. Implementation of the Research

The research was carried out between February 2016 and March 2016. Firstly, the nurse of each clinic was interviewed and information about the objective of the research was given and written permission was obtained from the nurses who agreed to participate in the research by the researcher. Then an appointment was made from each nurse included in the sample and questionnaires were given to the nurses at appointment time. The nurses filled the questionnaires in an environment with the researcher, so that the nurses were not affected by each other. It took about 15-20 minutes to fill in the questionnaires. The questionnaires were then collected by the researcher.

2.5. Ethical Aspect of the Research

Ethical committee consent was obtained from the Ethics Committee of Ankara Yildirim Beyazit University (Date: 30/03/2015, Number: 53). This study was carried out with written permission from the hospital administration. Nurses who participated in the research gave verbal and written consent.

2.6. Data Assessment

Data obtained during the study were evaluated using the Statistical Package for Social Science (SPSS) 20. In the research, frequency and percentage distributions of the nurses' descriptive characteristics were given. Knowledge scores were calculated on average. The propositions in the questionnaire of nurses' knowledge level regarding oxygen therapy were grouped as true, false/don't know. The data in the descriptive characteristics of the nurses were compared with the median of knowledge score. The normality test was applied to all variables in terms of knowledge level scores by using Kolmogorov-Smirnov and Shapiro-Wilks statistics. The non-parametric statistical methods were used because not all variables were suitable for normal distribution.

In accordance with non-parametric statistical methods, the Mann-Whitney U Test (Z table value) was used for comparing two independent groups and Kruskal-Wallis H Test (χ^2 table value)

was used for comparison of three or more independent groups. The Bonferroni Correction was used for their paired comparisons. Statistical significance was expressed using *p*-values. A *p*-value of less than 0.05 ($p < 0.05$) was considered statistically significant.

3. Results

Of the participants, 89.1% were women; their average age was 37.76±7.06 (min=21, max=59). 42.7% of the participants had bachelor's degrees. 30.1% of them have a nursing career equivalent to or longer than 20 years ($\overline{X}$=15.80±8.26, min=1, max=37 years). 32.7% of the nurses worked at internal clinics, and 48.7% of them worked in the same department for 2-5 years ($\overline{X}$=4.26±3.83, min=1 year, max=15 years).

When the findings regarding the oxygen therapy performance and training status of the nurses (n=302) in our research were examined, it was observed that only 37.4% of them received training on oxygen therapy and more than half (63.7%) of them (n=113) were provided with such training during nursing school years, and half of them (50.4%) considered these training "partially sufficient". It has also been identified in the study that the majority (34.1%) of the nurses "rarely" perform oxygen therapy. It was determined that 60.2% of the nurses (n=274) who applied oxygen therapy in their clinic received an order from the physician, 33.3% of the order was verbal, 23.7% of them were sometimes verbal and sometimes written. It has been revealed in the study that the majority of the nurses who applied oxygen therapy (n=274) determine oxygen therapy method (39.4%) and oxygen flow rate (35.0%) in cooperation with the physician but a considerable amount of nurses independently (21.6% and 20.8% respectively).

As it can be seen from Table 1, the knowledge score average of the nurses regarding oxygen therapy was $\overline{X}$=22.94±4.5 (min=8, max=35). In the study, 36.4% of the nurses scored below the average, and more than half of them (63.6%) scored above the average.

Table 1. Distribution of knowledge scores of the nurses regarding oxygen therapy (*n*=302).

Knowledge Score	*n*	Mean	Median	*Min.*	*Max.*	*SS*
	302	22.94	24.0	8.0	35.0	4.5
Number of persons with lower than average score *n*=110 (36.4%)						
Number of persons with higher than average score *n*=192 (63.6%)						

In the Table 2, when the distribution of the nurses to the propositions concerning oxygen therapy answers are examined, it is seen that the nurses have provided the correct answers at the greatest for the following propositions: "Hypoxia is caused by lack of oxygen to satisfy metabolic needs of cells and tissues" (87.7%), "Use of overdose oxygen may lead to toxic effects for the patient" (86.8%) and "Oxygen humidifier should be filled with distilled water" (84.4%). On the other hand, the nurses have provided the correct answers at the lowest for the following propositions: "Providing highly-concentrated oxygen leads to decrease the creation of surfactant on lung surface" (19.9%), "Whether mouth dryness develops or not should be checked once in 6-8 hours for the patients

receiving oxygen therapy" (21.2%) and "Oxygen therapy may not be performed without the order of the physician in situations other than emergencies" (32.1 %) (Table 2).

Table 2. Distribution of answers of the nurses to the propositions regarding oxygen therapy (n=302).

Propositions	True		False / Don't Know	
	Number	%	Number	%
Oxygen therapy is defined as providing oxygen with a concentration lower than the one in the air of the hospital room for the patient.	195	64.6	107	35.4
Oxygen therapy should be performed intermittently.	223	3.8	79	26.2
2/3 of the humidifier shall be filled in order to humidify the oxygen.	231	6.5	71	23.5
Toxic effects may arise on the patient in case of the use of overdose oxygen.	262	**86.8**	40	13.2
Oxygen therapy may be performed without the order of the physician in situations other than emergencies.	97	32.1	205	**67.9**
Hypoxia is caused by a lack of oxygen to satisfy the metabolic needs of cells and tissues.	265	**87.7**	37	12.3
Hypoxemia is arterial oxygen saturation's going under 95%.	181	59.9	121	40.1
Flowmeter measures O_2 saturation in arterial blood.	116	38.4	186	61.6
A warning sign should be hanged onto the room and door of the patient receiving oxygen therapy.	102	33.8	200	66.2
Oxygen tubes should be fixed horizontally by appropriate stabilizers.	205	67.9	97	32.1
Providing highly-concentrated oxygen for more than 48 hours may lead to oxygen toxicity.	233	77.2	69	22.8
Providing highly-concentrated oxygen leads to the creation of a surfactant on the lung surface.	60	19.9	242	**80.1**
After 30-60 minutes following initiation of oxygen therapy, patients should be assessed in terms of complications.	222	73.5	80	26.5
The humidifier should be cleaned once in 24 hours in order to prevent the development of infections on the patient receiving oxygen therapy.	248	82.1	54	17.9
Whether mouth dryness develops or not should be checked once in 24 hours for the patients receiving oxygen therapy.	64	21.2	238	**78.8**
Oxygen humidifiers should be filled with tap water.	255	**84.4**	47	15.6

When the answers of the nurses to the knowledge questions are examined, it is seen that the nurses have provided the correct answers at the greatest for the following questions: "Which of the following is not one of the nursing practices that should be done before initiating oxygen therapy?" (82.1%), "Which of the following is not one of the advantages of nasal cannula?" (80.8%) and "Which of the following is not one of the indications of oxygen therapy?" (75.2%). On the other hand, the nurses have provided the correct answers at the lowest for the following questions: "How many litres of oxygen should be sent as a minimum in a minute by a simple face mask" (8.3%), "Which mask allows precise adjustment of oxygen concentration" (35.8 %) and "Which of the following masks do allow the patients to rebreather 1/3 of the breathed air?" (37.1%) (Table 3).

Table 3. Distribution of answers of the nurses to the knowledge questions regarding oxygen therapy (n=302).

Questions	True		False / Don't Know	
	Number	%	Number	%
Which of the following is not one of the indications of oxygen therapy?	229	**75.2**	73	24.2
Which of the following is not one of the complications of oxygen therapy?	196	64.9	106	35.1
Which of the following is not one of the purposes of oxygen therapy?	138	45.7	164	54.3
Which of the following is one of the late-stage symptoms of hypoxia?	134	44.4	168	55.6
Which of the following is not one of the nursing practices that should be done before initiating oxygen therapy?	248	**82.1**	54	17.9
Which of the following is not one of the symptoms expected to be observed while assessing the reaction of the patient to oxygen therapy?	171	56.6	131	43.4
Which of the following is the reason for providing humidified oxygen in oxygen therapy?	201	66.6	101	33.4
Which of the following prepositions in not correct for pulse oximetry?	163	54.0	139	46.0
Which of the following is not among the measures required to be taken to avoid fire and injury during oxygen therapy?	191	63.2	111	36.8
Which of the following oxygen therapy methods do provide the patient with the oxygen of least concentration?	140	46.4	162	53.6
Which of the following prepositions is wrong for the non-rebreather mask?	115	38.1	187	61.9
How many liters of oxygen should be sent as a minimum in a minute by a simple face mask?	25	8.3	277	**91.7**
Which mask allows precise adjustment of oxygen concentration?	108	35.8	194	**64.2**
Which of the following is not one of the advantages of a nasal cannula?	244	**80.8**	58	19.2
Which of the following masks do increase the oxygen density in the patient's blood most rapidly?	120	39.7	182	60.2
Which of the following prepositions is wrong for a simple face mask?	198	65.6	104	34.4
Which of the following is not one of the advantages of the venturi mask?	219	72.5	83	27.5
Which of the following masks do allow the patients to rebreather 1/3 of the breathed air?	112	37.1	190	**62.9**

Although not indicated in the tables, it is seen when the answers by nurses to the questions of matching oxygen therapy methods with images are examined that a great majority of the nurses correctly matched the "transtracheal catheter" (87.1%), "nasal cannula" (86.8%) and "nasal catheter" (76.8%). On the other hand, it has also been observed that the great majority of the nurses wrongly matched the "non-rebreathing mask" (71.9%), "face tent" (67.8%) and "venturi mask" (65.2%).

The distribution of median knowledge scores of the nurses by their descriptive characteristics is given in Table 4. It is seen in the table that the median knowledge scores of the nurses at the age of 45 or higher (median=21.5, min=9, max=31) are statistically significantly lower than the median of other nurses ($p<0.05$). It has been identified in the study that the median knowledge scores of the nurses working at operating room (median=17.0, min=8 max=24) are statistically significantly lower than the median of the nurses working at other units ($p<0.05$).

It has been found out by comparing median knowledge scores of the nurses regarding oxygen therapy by their length of career at their current units that the median knowledge scores of the nurses working at the same unit for 14 years or longer (median=20.0, min=17 max=27) are statistically significantly lower than the median of the nurses working at the same unit for 5 years or shorter ($p<0.05$). No statistically significant difference has been detected between the median knowledge scores of the nurses regarding oxygen therapy and their other indicative characteristics ($p>0.05$) (Table 4).

Table 4. Distribution of median knowledge scores of the nurses regarding oxygen therapy by their descriptive characteristics (n=302).

Specifications	n (%)	Knowledge Score Medians			Statistical	Paired
		Median	*Min.*	*Max.*	Assessment*	Comparison
Age						
≤30 years[1]	60 (19.9)	25.0	13.0	30.0		
31-37 years[2]	86 (28.4)	23.0	8.0	30.0	χ^2=17.253	1-4
38-44 years[3]	106 (35.1)	25.0	10.0	35.0	**p=0.001**	2-4
≥45 years[4]	50 (16.6)	21.5	9.0	31.0		3-4
Gender						
Female	269 (89.1)	24.0	8.0	35.0	Z=-0.471	
Male	33 (10.9)	24.0	10.0	29.0	p=0.637	-
Education Level						
Vocational school of health	44 (14.6)	24.0	10.0	29.0		
Associate's degree	112 (37.1)	23.0	11.0	30.0	χ^2=1.905	
Bachelor's degree	129 (42.7)	24.0	9.0	35.0	p=0.592	-
Master's degree and higher	17 (5.6)	24.0	8.0	31.0		
Length of a career as a nurse						
1-5 year(s)	42 (13.9)	24.5	10.0	30.0		
6-10 years	58 (19.2)	24.0	13.0	30.0		
11-15 years	37 (12.3)	24.0	16.0	30.0	χ^2=2.622	-
16-20 years	74 (24.5)	23.5	8.0	30.0	p=0.454	
≥20 years	91 (30.1)	24.0	9.0	35.0		

Departments						
Internal departments[1]	99 (32.7)	24.0	16.0	31.0		1-3
Surgical departments[2]	76 (25.1)	24.0	10.0	31.0		2-3
Operating room[3]	15 (5.0)	17.0	8.0	24.0		4-3
Emergency department[4]	17 (5.6)	21.0	15.0	28.0	χ^2=31.315	
Intensive care unit[5]	31 (10.3)	23.0	14.0	32.0	**p=0.000**	5-3
Policlinic[6]	52 (17.2)	24.0	9.0	35.0		6-3
Other[7]**	12 (4.1)	24.0	17.0	30.0		7-3
Duration of working at the department						
≤1 year[1]	82 (27.2)	24.0	11.0	30.0		
2-5 years[2]	147 (48.7)	24.0	10.0	35.0	χ^2=14.848	1-5
6-9 years[3]	43 (14.1)	22.0	8.0	29.0	**p=0.000**	2-5
10-13 years[4]	21 (7.0)	22.0	9.0	30.0		
≥14 years [5]	9 (3.0)	20.0	15.0	27.0		

* For non-parametric methods, Mann-Whitney U Test (Z-table value) and Kruskal-Wallis H Test (χ^2 table value) were used to compare two independent groups and compare three or more groups respectively and the median knowledge score was indicated in the form [*min-max*].
** In order to perform statistical analysis, special branch nursing and mixed unit have been unified under the title of "Other".

The distribution of median knowledge scores of the nurses regarding oxygen therapy by their status of oxygen therapy administration and training is given in Table 5. As it can be seen from the table, no significant variance has been observed among the groups in terms of the status of nurses regarding receiving oxygen therapy training, place of training, the sufficiency of the training received, frequency of performing oxygen therapy, physician order status to initiate oxygen therapy, type of order received, oxygen therapy method applied at the working place and the person determining flow rate (*p*>0.05).

Table 5. Distribution of median knowledge scores of the nurses regarding oxygen therapy by their status of oxygen therapy administration and training (n=302).

Characteristics regarding the status of oxygen therapy practicing and training	*n (%)*	Knowledge Score Medians			Statistical Assessment*
		Median	*Min.*	*Max.*	
Oxygen therapy training					
Trained	113 (37.4)	23.0	9.0	35.0	Z=-1.409
Untrained	189 (62.6)	24.0	8.0	31.0	p=0.159
Place of training (n=110)**					
School	72 (63.7)	24.0	9.0	35.0	
In-service training	14 (12.4)	22.5	13.0	27.0	χ^2=6.644
School & in-service training	24 (21.2)	23.0	14.0	29.0	p=0.084
Sufficiency of the training received (n=113)					
Sufficient	42 (37.2)	23.0	16.0	31.0	
Partially sufficient	57 (50.4)	24.0	9.0	35.0	χ^2=1.342
Insufficient	14 (12.4)	23.0	14.0	28.0	p=0.511

Oxygen therapy administration frequency					
Never	28 (9.3)	21.5	8.0	30.0	
Rarely	62 (20.5)	24.0	13.0	35.0	χ^2=7.674
Sometimes	103 (34.1)	23.0	9.0	32.0	p=0.104
Often	78 (25.8)	24.0	13.0	31.0	
Always	31 (10.3)	24.0	14.0	28.0	
Physician's order to initiate oxygen therapy (n=274)					
Those receiving order	165 (60.2)	24.0	9.0	35.0	Z=-0.994
Those not receiving the order	109 (39.8)	24.0	14.0	29.0	p=0.320
Order type (n=165)					
Oral order	55 (33.3)	25.0	9.0	35.0	
Written order	12 (7.2)	21.0	16.0	31.0	χ^2=5.291
The oral and written order	59 (35.8)	23.0	10.0	32.0	p=0.152
Oral or written order alternately	39 (23.7)	24.0	14.0	31.0	
Decision maker for oxygen therapy at the clinic (n=274)					
Nurse	59 (21.6)	25.0	13.0	28.0	
Physician	74 (27.0)	23.0	9.0	35.0	χ^2=1.675
Nurse and physician together	108 (39.4)	24.0	15.0	32.0	p=0.643
Nurse or physician alternately	33 (12.0)	24.0	14.0	31.0	
Decision maker for oxygen flow rate at the clinic (n=274)					
Nurse	57 (20.8)	23.0	13.0	28.0	
Physician	65 (23.7)	24.0	9.0	35.0	χ^2=5.685
Nurse and physician together	96 (35.0)	24.0	13.0	31.0	p=0.128
Nurse or physician alternately	56 (20.5)	24.0	14.0	29.0	

*For non-parametric methods, Mann-Whitney U Test (Z-table value) and Kruskal-Wallis H Test (χ^2 table value) were used to compare two independent groups and compare three or more groups respectively and the median knowledge score was indicated in the form [*min-max*].
**Course (*n*=1) and congress/symposium/seminar (*n*=2) have not been included in the statistical analysis as they are not sufficient in terms of numbers.

4. Discussion

It can be suggested in the study that nurses' level of knowledge regarding oxygen therapy have lower scores than expected. It was found out in a study conducted by Adipa et al. [1] that emergency nurses did not have sufficient knowledge of oxygen administration methods. It was stated in the study conducted by Esposito et al. [18] that the nurses provided correct answers less frequently for the questions regarding aerosol devices and drugs and breast physiotherapy practices. The results of these studies display similarities with our study. It is believed that this is caused by the fact that the nurses have not received sufficient training on oxygen therapy.

It has been revealed in our study that the nurses provided the correct answers most frequently for the preposition regarding the definition of hypoxia. The nurses also correctly answered the prepositions of 'Use of overdose oxygen may lead to toxic effects for the patient'' and "Oxygen humidifier should be filled with distilled water" predominantly. Similarly, the specialty of the water used for humidifying the oxygen was asked to the new-born nurses and it was stated that 95% of the

nurses provided the correct answer in the study carried out by Arslan et al. [13]. The fact that most of the nurses correctly answered these prepositions in our study is an expected finding for us. Because we can say that this information is the basic information for a nurse. However, the majority of nurses responded incorrectly to the effects of high concentrations of oxygen delivery on surfactant production and the frequency of mouth dryness assessment in the patient receiving oxygen therapy. The fact that most of the nurses could not correctly answer these prepositions indicates a lack of knowledge for them regarding these subjects.

Oxygen therapy should not be implemented without the order of the physician in situations other than emergencies [1, 14,19]. However, the nurses predominantly gave the wrong answer to this preposition in our study. In the study of Bunkenborg & Bundgaard [20], nearly half of the nurses stated that they did not agree with the statement the amount of oxygen supplied for the individual patient must be prescribed by a physician. It is believed that this misconception plays a significant role for most of the nurses to perform oxygen therapy without the order of the physician.

It has been identified that the nurses gave the correct answer most frequently for the question of "Which of the following is not one of the nursing practices that should be done before initiating oxygen therapy?" among the knowledge questions regarding oxygen therapy. It can be assumed as per these results that the nurses have a good theoretical base regarding what to do before initiating oxygen therapy. Moreover, a great majority of the nurses correctly answered the question of "Which of the following is not one of the advantages of nasal cannula?" It is thought that the reason behind most of the nurses' correctly answering this question is the fact that the nasal cannula is the most frequently used method at the clinics [3, 21].

Most of the nurses correctly answered the questions of the indications (75.2%) and complication (64.9%) of oxygen therapy. On the other hand, half (50%) and nearly half (46%) of the nurses correctly answered the questions regarding indications and complications of oxygen therapy respectively in a study conducted by Mahmoud et al. [16] Although we found higher rates in our study, they were lower than the expected knowledge level of the nurses.

In our study, the majority of the nurses gave the wrong answers to the questions regarding the masks. In our study, the nurses also displayed the least success in correctly matching the non-rebreathing mask, face tent and venturi mask among the questions regarding matching the masks with images. Similar results were obtained in certain other studies conducted on the same subject matter [14, 22, 23]. These results obtained from our study indicate an insufficient level of knowledge of the nurses for the masks. It is believed that this is caused by the fact that these methods could not be used in many clinics of the hospital where this study was carried out and the nurses were not provided with sufficient knowledge regarding different oxygen administration methods.

The knowledge scores of the nurses regarding oxygen therapy were found out to be significantly lower for those at 45 years of age or older ($p<0.05$). In addition, the knowledge level was determined to be the highest for those with a nursing career of 1-5 year(s) despite a lack of significant differences among the groups ($p>0.05$). In terms of length of working duration of the nurses at their current department, median knowledge scores were revealed to be significantly higher for those working at the same department for 5 years or less and significantly lower for those working at the same department for 14 years or more ($p<0.05$).

Therefore, it has been concluded in our study that experiences obtained from working in the same department for a long period have not to lead to an increase in the level of knowledge regarding

oxygen therapy and younger nurses tend to have more knowledge about the issue. It is thought that this is caused by the fact that knowledge accumulation of the more-recently graduated nurses is comparably higher than the older nurses.

In our study, no significant difference has been detected between the level of knowledge of the nurses having undergraduate and graduate degrees and those who graduated from vocational schools of health or associate's degree programs ($p>0.05$). This is an unexpected finding with regard to the results of our study. This result indicates that the nurses do not receive sufficient training on oxygen therapy during their undergraduate studies or after they graduate from these programs.

In our study, the nurses working in the operating room were found out to have the lowest median knowledge scores compared to those working at internal and surgical departments ($p<0.05$). It is believed that less frequent administration of oxygen therapy by the nurses working at the operating room comes into play in their relatively lower knowledge scores.

It has also been determined that the majority of the nurses have not received training on oxygen training and most of the those who have received training were educated on the issue at schools and less than half of them consider the provided training to be "sufficient". It has been strikingly concluded in the study that there is not a significant difference between the median knowledge score of the nurses regarding oxygen therapy of those who have and have not been provided with such training ($p>0.05$). When we examine the literature, a study conducted by Considine et al. [24] in order to assess the relationship between the training provided for the nurses and their clinical decisions regarding oxygen therapy practices suggests that the knowledge score of the nurses regarding oxygen therapy increased by 19.2% after they were provided with training on the issue. And this indicates that the content of the training provided for the nurses participating in our study during both academic studies and in-service training is not sufficient.

The median knowledge score was found out to be the lowest for the nurses "never" performing oxygen therapy. However, no significant difference was observed among the groups ($p>0.05$). It is a surprising finding for us that there is no significant difference between the nurses stating to perform oxygen therapy very frequently and those stating to. This indicates that the nurses performing oxygen therapy very frequently do not have sufficient knowledge of the therapy, either.

Oxygen should be regarded as a drug and oxygen therapy should be performed by the nurses upon the written order of the physician [19, 25,26]. The nurse should check the implicit order of the physician [14, 22,23] and perform oxygen therapy as per six correct principles [19]. It has been found out in our study that a significant portion of the nurses did not receive the order of the physician to initiate oxygen therapy and most of the nurses receive only oral order or alternately oral and written order. The fact that the rate of nurses performing oxygen therapy upon written order has been found out to be lower than the expected suggests that the nurses do not consider oxygen therapy as drug therapy and they more often than perform it without receiving an order. It was stated in a relevant study conducted by Brokalakia et al. [11] that nearly half (42.3%) of the nurses did not receive the order of the physician. On the other hand, it was revealed in a study carried out by Eastwood et al. [15] with a population consisting of emergency nurses that 38.7% and 52.4% of the nurses respectively "always" and "sometimes" increased oxygen dosage when oxygen saturation decreased. The results of these studies are similar to our findings.

In our study, the knowledge scores of the nurses who receive and do not receive the order of the physician for oxygen therapy were found out to be roughly equal. Moreover, although it is not

significantly different among the groups, the median knowledge scores were strikingly identified to be the highest for those receiving oral order and lowest for those receiving written order (p>0.05). These results, no matter how they receive get the order (oral or written), make us think that the nurses who performing oxygen therapy do not affect increasing their knowledge level.

The oxygen therapy method and oxygen flow rate should be determined by the physician [11, 13, 22]. In our study, the rate of the physicians determining the oxygen therapy method and the oxygen flow rate was found to be lower than the expected (27.0% and 23.7% respectively). It was concluded in the study conducted by Brokalakia et al. [11] with the nurses that the physicians mostly determined the oxygen therapy method (79.6%) and oxygen flow rate (80.0%) respectively and the case of co-decision by the physicians and nurses was pretty rare (13.3%). On the other hand, 58% of the nurses stated that they selected the oxygen therapy method as per the order of the physician in a study carried out by Mahmoud et al. [16]. The results of the aforesaid studies differ from the results of our study. On the contrary, 42.2% and 51.3% of the nurses respectively stated in a study conducted by Eastwood et al. [15] that they "always" and "sometimes" modified the oxygen flow rate and concentration according to their target SpO2 values when the physician did not specify targeted peripheral oxygen saturation (SpO2) value in their order. The results of our study suggest that some physicians do not consider oxygen therapy as a drug therapy either and thus, they ensure the performance of this therapy by giving oral order most of the time or allowing the nurses to make such decisions. In addition, no significant difference has been observed in our study among the groups with regards to the decision-maker regarding oxygen therapy method and oxygen flow rate at the clinics where the nurses work (p>0.05). This also indicates whether the physician or nurse determines the oxygen therapy method and the oxygen flow rate does not have an impact on the level of knowledge.

5. Limitations of the Research

The results of the research are limited to the hospital where the research was conducted, and it is planned to re-conduct it with a larger sample. So, this study can therefore not be generalised to other settings. Also, the level of knowledge of nurses is limited to the answers given to the questionnaire made by researchers.

6. Conclusion and Recommendations

It has been revealed in our study that the level of knowledge of the nurses regarding oxygen therapy has lower than expected and their knowledge is particularly inadequate in terms of oxygen therapy application methods. In line with these results, the following are recommended: Theoretical and applied training should be provided for the nurses during their undergraduate level to enhance their knowledge and skills regarding oxygen therapy; protocols on oxygen therapy should be created at the hospitals; in-service training programs should be organized and kept the continuity of these programs, both nursing student, nurses and physician should be made aware of the fact that oxygen therapy is drug therapy and this therapy should be applied upon written order of the physicians.

Ethics Committee's Name, approval number, and date: Ethics Committee of Ankara Yildirim Beyazit University (Date: 30/03/2015, Number: 53).

The compliance to the Research and Publication Ethics: This study was carried out in accordance with the rules of research and publication ethics.

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