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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.*

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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		1-4 2-4 3-4
31-37 years(2)	86 (28.4)	23.0	8.0	30.0	χ^2=17.253	
38-44 years(3)	106 (35.1)	25.0	10.0	35.0	***p*=0.001**	
≥45 years(4)	50 (16.6)	21.5	9.0	31.0		
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	χ^2=2.622 p=0.454	
11-15 years	37 (12.3)	24.0	16.0	30.0		
16-20 years	74 (24.5)	23.5	8.0	30.0		
≥20 years	91 (30.1)	24.0	9.0	35.0		

Departments						
Internal departments(1)	99 (32.7)	24.0	16.0	31.0	χ^2=31.315 ***p*=0.000**	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		5-3
Intensive care unit(5)	31 (10.3)	23.0	14.0	32.0		6-3
Policlinic(6)	52 (17.2)	24.0	9.0	35.0		7-3
Other(7)**	12 (4.1)	24.0	17.0	30.0		
Duration of working at the department						
≤1 year(1)	82 (27.2)	24.0	11.0	30.0	χ^2=14.848 ***p*=0.000**	1-5
2-5 years(2)	147 (48.7)	24.0	10.0	35.0		2-5
6-9 years(3)	43 (14.1)	22.0	8.0	29.0		
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	χ^2=6.644 p=0.084
In-service training	14 (12.4)	22.5	13.0	27.0	
School & in-service training	24 (21.2)	23.0	14.0	29.0	
Sufficiency of the training received (n=113)					
Sufficient	42 (37.2)	23.0	16.0	31.0	χ^2=1.342 p=0.511
Partially sufficient	57 (50.4)	24.0	9.0	35.0	
Insufficient	14 (12.4)	23.0	14.0	28.0	

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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Research Article

PREVALENCE AND RISK FACTORS FOR DIABETIC RETINOPATHY IN TURKEY: A SCREENING PROGRAMME USING NON MYDRIATIC CAMERA CONCISE TITLE: USING NON MYDRIATIC CAMERA FOR DIABETIC RETINOPATHY

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Abstract*: Early identification of patients at risk for diabetes mellitus (DM) and associated morbidities such as diabetic retinopathy (DR) is essential for effective lifestyle intervention and treatment. Large-scale, cost-effective, and minimally invasive screening programs are critical for this purpose. This study evaluated the prevalence and history-based risk factors for DR and whether the non-mydriatic fundus camera is a useful screening method in Turkey at local health centers. A total of 5182 adults 40 years and older were invited to local health centers in rural Eskisehir, Turkey, for DR risk factor assessment and screening by fundus examination. Fundal images were graded on-site by trained ophthalmology assistants for DR and diabetic macular edema (DME). Patients with DR and DME were referred to the tertiary center for follow-up. The severity of DR was associated with female sex, older age, longer duration of DM, insulin usage, lower body mass index (BMI), lower educational level, higher systolic and diastolic blood pressure, and poor control of blood glucose. DR was not associated with alcohol intake or smoking. DME was associated with DM duration and age. Identifying DR prevalence and risk factors is essential for disease control. Non-mydriatic fundus camera imaging proved useful for large-scale DR screening.*

Keywords*: Diabet, diabetic retinopathy, non-mydriatic fundus camera, diabetic macular edema, screening program*

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1.Introduction

It is projected that 592 million patients with DM will be living in worldwide in 2035 [1]. DR is the most common complication of the DM with microvascular damage. All patients with diabetes are at risk of developing DR [2].

DR classification into non-proliferative and proliferative DR. If the burden changes the macula, macular edema can occur [3] One-third of diabetic patients have DR[4] and account for 5 % of all blindness [1].

Because of both economic damage and preventable cause of blindness, almost the working-aged group indicate the importance of early diagnosis and treatment of DR[3-5]. Regular eye examination and effective treatment are essential for DM and DR management [6].

Although it is known risk factors of DR, the mechanism and progression have not been fully understood, so prompt diagnosis is essential through efficient screening [7].

Approximately 50 % percent of the diabetes patients are not diagnosed, or diagnosed patients are not follow up and regularly treated [8]. Therefore inexpensive, easily accessible, and highly diagnostic devices can be better for us to follow up.

The aim of the study to evaluate risk factors of DR in the area by non-mydriatic fundus camera and its efficacy for DR follow up.

2. Materials Subjects and Methods

This research was supported by the faculty with a research project named 'Evaluation of the relationship between intraocular pressure and demographics, ocular and systemic factors in the population over 40 years of age in Eskişehir area'. This study was designed by the glaucoma department of Osmangazi university medical faculty. For the screening program, those who live in that area were informed before the study begins. The participants were invited to family health centers. Five thousand one hundred eighty-one patients who applied for screening in health centers were examined. A questionnaire was first applied to the participants. Questionnaires consisted of two parts. As shown in the form, the first part of the questionnaire questioned demographic information. The second part was also interrogating DM.(tobacco and alcohol usage, education level, etc.)

The diagnosis of diabetes was made according to the patients' anamnesis and the medication they used. The photographs of the patients who answered the questions thoroughly were taken by the assistant of ophthalmology. When retinal photographs were taken, Kowa (Kowa, Nagoya, Japan) nonmydriatic fundus camera was used. Pupils were not dilated. AAO Preferred Practice scheme [9]was used for Diabetic Retinopathy monitoring and treatment. Participants who have DR and DME were directed to the tertiary care center. Patients did not undergo an additional examination.

Ethical statement

This is a cross-sectional study of all procedures conformed to the tenets of the Declaration of Helsinki, and the study was approved by the Osmangazi University institutional ethical review board. (Date:31.10.2006 //Approval number:2006-03).

2.1.Inclusion criteria

Over 40 years of age
Living in the Eskişehir province
Adapting to Fundus photography

2.2.Exclusion criteria

Patients whose retinal photographs could not be evaluated clearly.

In the present study, fundus photographs of diabetic patients were scanned retrospectively. 415 photos of 643 DM patients could be evaluated clearly.

All procedures conformed to the tenets of the declaration of Helsinki, and the local ethics committee approved the study.

2.3. Statistical Analysis

Pearson chi-square, Mann Whitney U tests, Kruskal Wallis H test, One Way Analysis of Variance (ANOVA) was used. Kolmogorov-Smirnov and Shapiro-Wilk tests of normality were used to check the normality of variable distributions. The SPSS 22.0 program was used in all the analyses. A value of $p<0.05$ was accepted as significant.

3.Results

A total of 5182 cases participated in the study were 3680 women (71%) and 1501 men (29%). Four hundred ninety-six women (9.5%) and 147 men of the participants had diabetes (2.8%). The rate of diabetes was 12.4% in the study. There was a statistically significant difference between male and female gender ($p <0.001$). DM was seen more in women. The frequency of DR was found to be 21% in the participating diabetic community, while the frequency was found to be 2% when all participants were included. DR was found more frequently in the female gender ($p <0.05$). The demographic data and risk factors of DR and DM was shown in Table 1.

Table 1. Characteristics of participants in the study

	DM -	DR-	NPDR	PDR
Age (years)	55.43±0.15	58.98±0.47	57.96±1.1	63.11±2.91
Gender Male (n) Female (n)	 1415 3351	 66 262	 17 61	 3 6
BMI (kg/m^2)	28.16±0.4	29.04±0.24	28.87±0.7	27.03±2.01
Tabaco use (n)	1022	50	4	2
Alcohol use (n)	305	11	1	0
SBP (mmHg)	139.69±1.46	140.14±1.28	143.17±4.36	142.15±3.25
DBP (mmHg)	80.87±0.17	82.72±0.6	83.87±0.6	82.69±2.15
DME (n)	-	-	17	2
Insulin usage	-	15	7	3
BGLC	-	292	53	9

n, number of the participant; BMI, Body Mass Index; SBP, Systolic Blood Pressure (SBP); DPB, Diastolic Blood Pressure; DME, Diabetic Macular Edema; BCGL, Blood glucose control at every six months.

In the study, the prevalence of non-proliferative DR (NPDR) and proliferative DR (PDR) in DM patients, 16% and 5%, respectively.

In the diabetic group, the mean age was found to be higher and statistically significant. ($p<0.001$). Although the mean age in the PDR group was higher than the NPDR group that was not statistically significant.

Participants' SBP and DBP values were as in the table. Both SBP and DBP were higher in both the diabetic patients and the patients had DR.

Participants were analyzed for BMI. BMI was higher in patients with diabetes and DR and it was statistically significant ($p < 0.05$). But there was no difference between the patients with NPDR and PDR in terms of BMI ($p > 0.05$).

The medication used by DM patients was investigated. Insulin usage increased as the severity of the DR increased. ($p < 0.05$)

In the present study, diabetic patients without DR measured blood glucose more frequently than the others ($p < 0.05$).

The presence of DME in diabetic participants was investigated. Nineteen of diabetic patients had DME. 16 cases were women and 3 cases were men. There was a statistically significant difference between proliferative and non-proliferative groups in terms of the presence of DME ($p < 0.001$). In the non-proliferative group, DME was higher.

The relationship between the duration of diabetes mellitus and DR was evaluated, as shown in table 2. The incidence and severity of diabetic retinopathy were increasing as the duration of the disease increases ($p<0.001$).

Table 2. Duration of diabetes mellitus associated with diabetic retinopathy.

	5 years	6-10 years	11-15 years	16-20 years	21 years
Non-proliferative DR (n)	11	27	10	4	4
Proliferative DR (n)	1	1	1	3	3
Non-DR (n)	149	113	37	16	12

n: number of the participant; DR, Diabetic retinopathy.

Participants were assessed for diabetic retinopathy and education level, as shown in Table 3. The education level was higher in the group which had not DR ($p<0.05$). However, there was no difference between the non-proliferative group and the proliferative group for education.

Table 3. Education level association with diabetic retinopathy.

	Uneducated	Primary education	High school	University
Nonproliferative DR (n)	10	64	2	1
Proliferative DR (n)	2	5	2	-
Non-DR (n)	48	264	11	4

n, number of the participant; DR, Diabetic retinopathy.

4. Discussion

The prevalence of DR varies widely among geographic regions and demographic groups. Further, estimates within populations have differed markedly across studies. For instance, the rate of DR among DM patients was reported to be 9.6% in India10 but 43.1% in Indonesia.[11] In the present study, DR was identified in 21% of diabetic participants (2% of the entire participant cohort), an estimate consistent with one previous study of DR prevalence among DM patients in Turkey (23.6%) but substantially lower than two others (36% and 32.7%) [12−14]. These differences among studies may be caused by

insufficient sample size, leading to variation in risk factor distributions (e.g., age and disease duration) and (or) to the methods used for fundus examination [15].

In the current study, DR was significantly higher in diabetic females, in contrast to several previous studies reporting no significant sex difference in DR [16−19] or greater prevalence in males [4,20−23]. Participants were examined during working hours on weekdays, which may have increased the participation rate of women who do not work full time. Furthermore, most previous trials were hospital-based, so the frequency and severity of DR were higher. Also, the greater mortality of male diabetics may have influenced these hospital-based estimates. Thus, sampling bias may influence the relative prevalence of DR between sexes. Also, sex differences in lifestyle factors and genetic predisposition may contribute [21]. A wide-scale epidemiological study with careful sampling control is required to determine conclusively whether there is a female preponderance for DR among DM patients in Turkey and other regions.

Longer duration of diabetes and older age were associated with DR in the present study, consistent with several previous studies [4,21,24,25]. However, the presence of DR could not be attributed to participant age, as in some studies [21,24] even if diabetic patients were elderly [15,19]. Differences in other risk factors, such as body weight, blood pressure, and life span (i.e. earlier mortality in one population compared with another) may have obscured an effect of age alone.

Previous studies have reported an association between severe retinopathy and insulin treatment [19, 24, 26] by the current study. Also, using a hypoglycaemic agent was associated with DR [27]. Alternatively, a study in Hong Kong found a relatively high prevalence of microvascular complications despite a low insulin usage rate [28]. The years of initiation of insulin and the level at which the disease has started have not been explicitly stated in studies. This result suggests that the evaluation of only one factor associated with DR development may lead to a failure to follow disease progression.

Hypertension treatment has been associated with a higher incidence of DR [24], and high SBP, in particular, predicted a significantly greater incidence of DR [4,15,18,19,21,25,27,29]. These results were verified in the present study.

Although DME can be observed at any stage of DR, it is related to DR severity [30−32]. In the current study, however, DME was more common in patients with DR, but was not related to the severity of DR. This the result may be due to fewer proliferative DR participants, who are usually monitored more often.

Several studies have reported a direct relationship between DR and alcohol use [4, 27, 33], whereas others have not found such an association. [19,26,34,35] In one meta-analysis of studies, it was argued that some alcoholic beverage types protect against the development of retinopathy [5]. In the present study found no relationship between alcohol use and DR but did not record frequency and type of alcoholic beverages consumed and other dietary or social factors. This issue warrants further analysis [5]. The current study also evaluated the association between smoking and DR, and the absence of a relationship is in accord with several previous studies [4, 19, 26] but the contrast to another [22]. The most important limiting factor in our study was that a large proportion of the participants were non-alcoholic and non-smoking females. Also, the amount of alcohol and the number of cigarettes consumed and how long they were used before stopping was not recorded. Glycaemic control is among the most important risk factors for DR [2,3,7,21,36]. In agreement with the current study, a previous investigation found that intensive glucose control reduced DR, although not all-cause mortality [37].

This study also revealed a significant relationship between low BMI and DR. Although there is strong evidence for an association of DR with BMI, the direction of the relationship has been inconsistent across studies, with several in accord with our findings[15,28,38] and others reporting a significant relationship between DR and high BMI [19,21,22,39]. These inconsistencies may stem from differences in the proportion of adipose tissue, diabetes severity, ketosis presence, and insulin secretion among study groups [1]. Finally, lower educational attainment was a significant risk factor for DR as in other studies [19,28,40]. Better communication on lifestyle choices and the importance of self-care (such as intensive glucose control) may improve DM management among this population.

Complications of diabetes, such as retinopathy, can be prevented by reducing lifestyle-related risk factors. Moreover, early diagnosis can increase the chances of slowing disease progression and successful treatment. Knowing the risk factors will help patients make appropriate choices and aid in the screening of high-risk populations. Regular screening is essential for these goals, so it is also important that the diagnostic methods are easily accessible, cost-effective, and minimally invasive to increase the reach of screening, such as a non-mydriatic fundus camera. These criteria are achieved using non-mydriatic fundus camera imaging.

Many of the aforementioned studies were hospitals based, and eyes were dilated during fundus imaging. Nonetheless, results were similar to the present study; when the information mentioned in this study is compared with the literature, there is a close resemblance, and these were done by evaluating only the photographs taken with a non-mydriatic fundus camera and patient information. Suggesting that the non-mydriatic fundus camera can also be used safely for screening and follow-up, especially in areas where access to a doctor is difficult and also non-mydriatic fundus camera with machine-learning programs will be able to reach wider audiences in the future.

We also had restrictive factors in our study. In the present study could not measure the participant's blood glucose levels, not use OCT and fundus fluorescein angiography in evaluating macular demand retinopathy and not evaluate vision

5. Conclusion

Complications of diabetic retinopathy is a health problem that can be detected and prevented. Knowing the risks of diabetic retinopathy, informing patients, and screening patients with these risks is important for survival. Patients with risk factors should be screened more often. The fact that most of the risk factors are changeable helps prevent the progression of the disease. So, it is also important that the screening methods are easy and accessible in terms of reaching many patients, such as non-mydriatic fundus cameras. In a short time, in the present study was screened a large group of participants with a non-invasive method. This study can be a pioneer for deep learning and machine learning-based programs. So, it can help an extensive health screening with less budget in the future. If the non-mydriatic fundus camera can be used with machine- learning, it seems that this will lead to significant public health.

Conflict of interest

The authors declare that they have no conflict of interest.

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The data used to support the findings of this study may be provided upon request and the data should be submitted as an additional information file with email interaction.

Help for English editing was received from 'Enago' service.

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

Ethical statement

This is a cross-sectional study of all procedures conformed to the tenets of the Declaration of Helsinki, and the study was approved by the Osmangazi University institutional ethical review board. (Date:31.10.2006 //Approval number:2006-03).

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Research Article

INVESTIGATION OF OECD COUNTRIES WITH MULTI-DIMENSIONAL SCALING ANALYSIS IN TERMS OF TRAFFIC ACCIDENT INDICATORS

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Abstract: *This study tries to compare similarities and differences in Organisation for Economic Co-operation and Development (OECD) countries in terms of traffic accidents utilizing Multidimensional Scale Analysis (MDS), and one of Multivariate Statistical Analysis Techniques. In the study, MDS analysis was carried out utilizing basic indicators such as the number of injuries, deaths and the number of accidents resulting in material damage in the traffic accidents that happened in 2017. As a result of the analysis, stress values and R^2 (correlation coefficient) values turned out to be 0.0000 and 1.0000, respectively. That the stress value has resulted as zero shows that there is no inconsistency, and the fact that R^2 value has been found to be 1 indicates that the accuracy rate of this analysis is high and the values are in excellent coherence. According to results obtained from the analysis, it is seen that Malta and Liechtenstein, in particular, have appeared to be in a very different position from other countries when the countries are compared in terms of traffic accidents. When the matrix of the differences is examined; Turkey and Liechtenstein have seemed to be the two countries very different from each other. It is clear that traffic accidents, a global public health problem, have great impacts on individuals, societies and national economies. Particularly, it will be possible to decrease human and economic losses to minimum levels when the countries with similar traffic accident indicators come together, develop national and international projects and apply them.*

Keywords: *OECD countries, traffic accidents indicators, multivariate statistic, multi-dimensional scale*

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1. Introduction

In the developing world, traffic density and traffic accidents have increased due to the increasing number of vehicles, especially in parallel with the rapid increase in population in recent years. Traffic accident is an important problem in terms of their frequency, health aspect and economic consequences that affect society and individuals deeply. These accidents cause deaths and injuries as well as huge amounts of material damage. Although it is possible to compensate for economic losses, it is not possible to compensate for social losses. Due to these consequences of traffic accidents, human life is deeply affected. Traffic accidents, which are among the most important causes of death in the world, should be a priority issue in terms of public health [1-10].

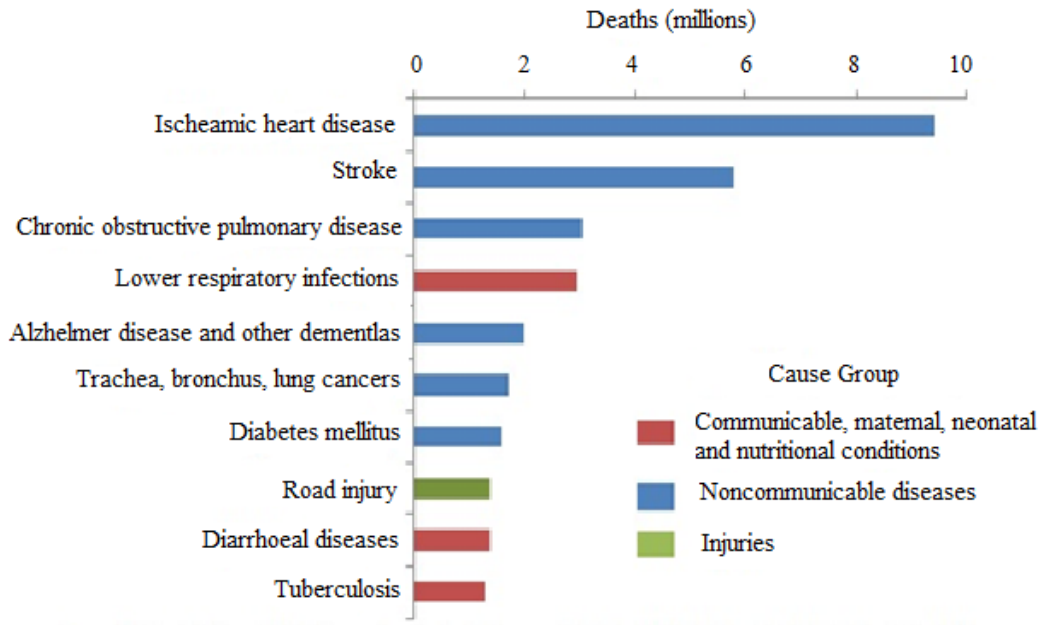

Figure 1. The most important death causes in the world 2000-2016 [11].

Figure 1 shows that traffic accidents take place in the 8th rank among the most important causes of death in the world.

Approximately 1.35 million people lose their lives in traffic accidents in the world every year. Besides this, from 20 to 50 million people are injured and most of them are disabled. As for Turkey, about 10.000 people lose their lives every year due to traffic accidents [11]. Although the great majority of those who lose their lives are drivers and passengers, the share of pedestrians is also considerable. Injuries occurring as a result of traffic accidents cause significant economic losses for families and nations [4].

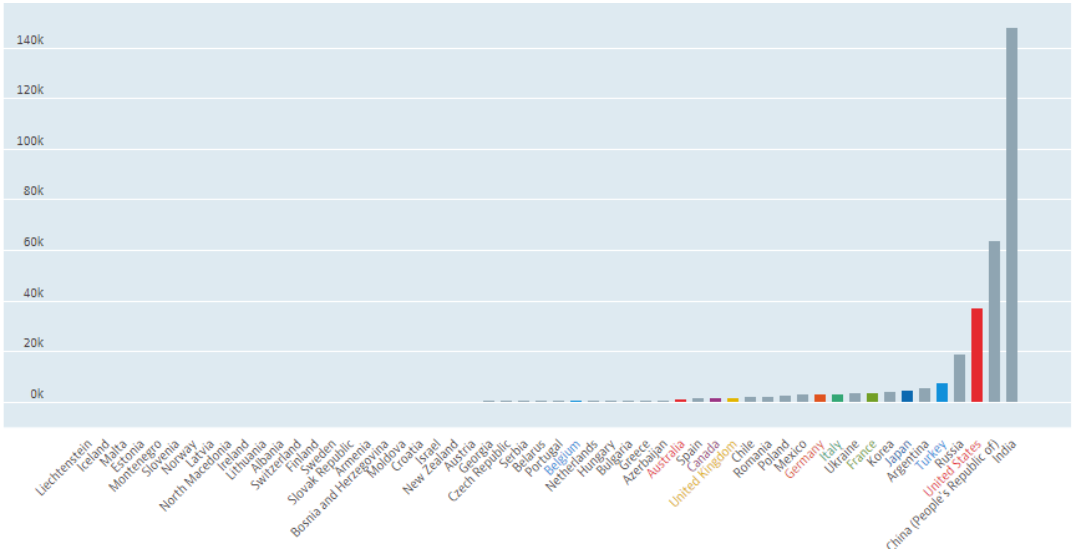

Figure 2. Distribution of traffic accidents in OECD countries in 2017 by the number of deaths [12]

Figure 2 shows that the countries which have the highest number of deaths in the traffic accidents in 2017 are India, China, the USA, Russia, Turkey, Argentina, Japan, and Korea, respectively.

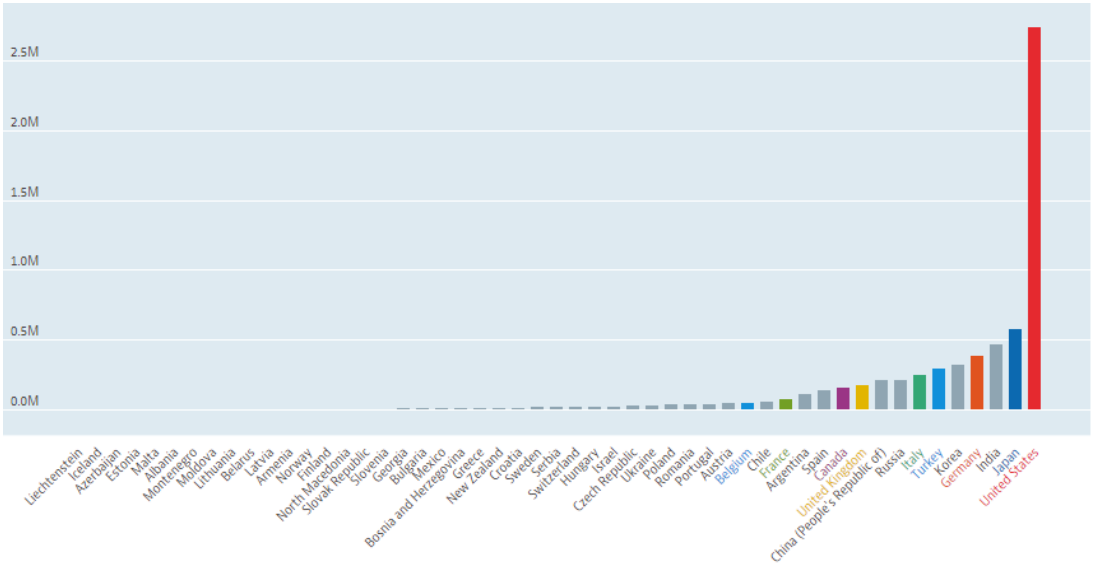

Figure 3. The distribution of the number of injured people in traffic accidents occurring in 2017 in OECD countries [12].

Figure 3 shows that the countries with the highest number of injured in traffic accidents in 2017 are the US, Japan, India, Germany, Korea, and Turkey; however, the least injured countries are Liechtenstein, Ireland, Estonia, Azerbaijan, and Malta.

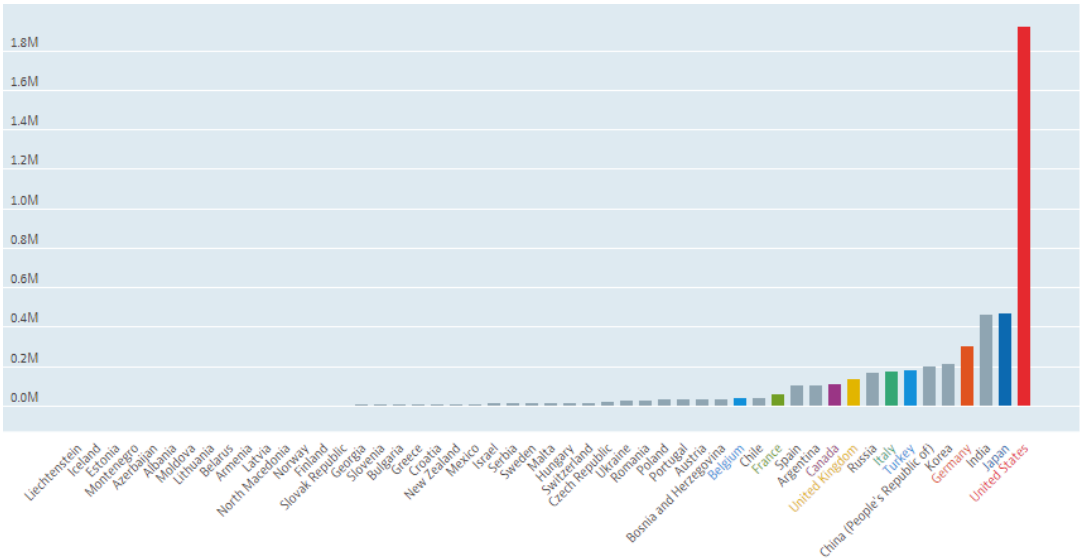

Figure 4. The distribution of the number of material damages in traffic accidents occurring in 2017 in OECD countries [12].

Figure 4 shows that the countries with the highest number of material damages are the US, Japan, India, Germany, Korea, China, and Turkey, while the countries with the least material damages are Liechtenstein, Ireland, Estonia and Azerbaijan, and Malta.

The motorway is mostly preferred in transportation in Turkey. Traffic accidents occurring on motorways in the world and Turkey are among the most important causes of death [13-16]. In 2017, a total of 1,202,716 traffic accidents occurred in Turkey. Of these accidents, 1,020,47 were materially damaged and 182,669 were fatal or injured traffic accidents. In 2017, 74.4% of fatal or injured traffic accidents occurred in the city and 25.6% of them occurred outside the city. As a result of these accidents, 7,427 people were killed and 300,383 people were injured [14]. When compared with OECD countries

in terms of the number of deaths, injuries and the number of material damages in traffic accidents in 2017, Turkey, unfortunately, ranks at the top [13-14].

Traffic accident statistics in Turkey belonging to 2008-2017 are given in Table 1.

Table 1. Statistics of Traffic Accidents in Turkey 2008-2017

Years	The number of total accidents	The number of positive, injury accidents	The number of material damage accidents	The number of deaths			The number of injured
				Total	At the scene of the accident	Post-accident (1)	
2008	950,120	104,212	845,908	4,236	4,236	-	184,468
2009	1,053,345	111,121	942,224	4,324	4,324	-	201,380
2010	1,105,201	116,804	988,397	4,045	4,045	-	211,496
2011	1,228,928	131,845	1,097,083	3,835	3,835	-	238,074
2012	1,296,634	153,552	1,143,082	3,750	3,750	-	268,079
2013	1,207,354	161,306	1,046,048	3,685	3,685	-	274,829
2014	1,199,010	168,512	1,030,498	3,524	3,524	-	285,059
2015	1,313,359	183,011	1,130,348	7,530	3,831	3,699	304,421
2016	1,182,491	185,128	997,363	7,300	3,493	3,807	300,812
2017	1,202,716	182,669	1,020,047	7,427	3,534	3,893	300,383

(1) It includes the people who died within thirty days due to accidents sent to the health centers after they were injured in traffic accidents [17].

Table 1 provided that between the years of 2008-2017, 11 million and 739 thousand and 158 traffic accidents occurred in Turkey. It can be observed that 49,656 people were killed, while 2,596,001 people were injured in the accidents happened. Also, it is understood that the number of deaths and injuries in traffic accidents occurring in recent years has nearly doubled compared to the previous years.

It is known that there are numerous studies dealing with traffic accidents in Turkey. Sungur et al. [3] investigated the problem of road security and traffic accidents in Turkey. Kuşkapan et al. [4] studied the traffic accidents caused by pedestrians in Turkey. Eşiyok et al. [8] handled the traffic accidents and their shortcomings in Turkey. Kırmızıoğlu and Tuydes Yaman [14] carried out a study about the literacy of drivers of traffic signs in Turkey. Çodur and Tortum [6] employed Artificial Neural Network (ANN) to estimate traffic accidents of the Erzurum province of Turkey. Çelik and Oktay [16] investigated the risk factors affecting injuries related to traffic accidents happened in Erzurum and Kars provinces of Turkey. Tortum et al. [5] tried to determine the effects of road factors on traffic security employing the Linear Regression method. Erdoğan [7] compared the traffic accidents and death rates in the provinces of Turkey using the Explorative Spatial Analysis method. Bektaş and Hınıs benefitted from the Logistic Regression method to determine factors having an influence on traffic accidents. Similarly, Karacasu et al. [13] tried to estimate the causes of traffic accidents applying Discriminant Analysis and Logistic Regression analysis to the data in Eskişehir province. Murat and Şekerler [19] tried to establish the reasons causing accidents by using Cluster analysis and modeling traffic accident data. Eygü [20] used Structural Equation Modelling in establishing the factors affecting traffic accidents. Likewise, Cansız [21] employed Logarithmic Regression and Artificial Neural Network methods in order to estimate death numbers in traffic accidents. Tercan and Beşdok [22] established the relations between parameters that affect traffic accidents and by using the Biplot method. Tercan et al. [23] modeled the data of traffic accidents by utilizing Evolutionary Data Clustering and Resilient Neural

Network methods. Uçar and Tatlıdil [24] made use of the Ordered Orbit Model so as to determine the factors affecting the severity of the accident. Acı and Yılmaz [25] developed a model called Adaptive Network-Based Fuzzy Logic Inference System to find out the sensitive defect in traffic accidents with property damage. Arı [26] investigated the data of traffic accidents using the Log-Linear method. Güler [27] developed an Accident Analysis Segments model for traffic accidents. Doğrul et al. [28] investigated the data of traffic accidents with the help of Association Rules analysis, one of the data mining techniques. Similarly, Söylemez et al. [29] analysed the data of traffic accidents using Association Rules. While several different statistical analyses were used in the above-mentioned studies, no study was encountered where Multi-Dimensional Scaling analysis was employed. When literature scanning was carried out, the limited number of studies were found in terms of traffic accident indicators of OECD countries [30, 31]. However, there are a number of studies where MDS analysis, the method used in this study as well, was used. Tokçuoğlu [32] and Gürçaylar Yenidoğan [33] measured the brand perception of university students employing MDS analysis. Büyüker İşler [34] benefited from MDS analysis to establish the process of brand locating of gas stations. Ekiyor [35] determined the perception maps of hospitals by employing MDS analysis. Ersöz [36] benefitted from MDS analysis to compare the health levels and health expenditures of Turkey and OECD countries. Acar [37] compared with OECD countries and Turkey in terms of basic indicators of the labor market with the help of the MDS method. Tüzüntürk [38] used the MDS method so that they could establish the similarities and differences of 81 provinces in Turkey in terms of crime types. Similarly, Etikan et al. [39] investigated judicial statistics of provinces through MDS. Ersöz et al. [40] benefitted from MDS analysis to compare biomass energy production in OECD countries. İhtiyaroğlu [41] investigated similarities and differences between provinces in Turkey in terms of student placement in the associate degree, undergraduate and open education faculties of universities. Finally, Akın and Eren [42] benefitted from the MDS method to compare education indicators of OECD countries.

2. Materials and Methods

MDS analysis is a multivariate statistical analysis method that shows the relationships between objects by reducing the size, revealing the positions of these objects in one or multidimensional space based on the distances between n objects or units determined according to the p variable [34-35,37-38, 43-44]. In the graphical representation, points representing similar objects in space are close to each other, dissimilar ones are far from each other [47]. Although MDS analysis, which is considered as a data reduction analysis, was developed as an alternative to Factor Analysis, there are differences between the two methods. While applying factor analysis, some assumptions such as normality, linearity etc. should be provided, while the MDS analysis does not have any assumptions. In factor analysis, the variance-covariance matrix or correlation matrix is used to see the relationships between variables, while the distance matrix is used to see the relationships between units in the MDS [32, 36-37, 44,48-49]. MDS is used when the relationships between units or objects are not absolutely known and the distance matrix can be obtained [50]. The MDS analysis provides an analytical layout that shows the relationship structure of the data in multi-dimensional space very close to the original position in order to better understand the similarities/dissimilarities between the variables [38,51]. MDS analysis was first developed by Householder and Young in the 1930s and later developed by Tagerson et al. [31,36]. MDS was born in the field of psychometry, its use was not limited to psychology, though. It is widely used in fields such as medicine, science and social sciences, education, economics, archaeology and so on

[27,33]. MDS analysis is frequently used in the analysis of data such as religious beliefs, behaviours, and expectations of individual preferences [36,52-53].

The techniques applied according to the scale and data type used in the MDS analysis differ. In this analysis, the Ordinal Scale, Interval Scale, and Ratio scale can be applied to various data types [34].

The data to be used in MDS analysis are multivariate data. Data with many variables including the number of variables p and number of observations (measurements) n are shown as follows:

$$X = \begin{bmatrix} x_{11} & x_{12} \dots \dots & x_{1n} \\ x_{21} & x_{22} \dots \dots & x_{2n} \\ \vdots & \vdots \cdots & \vdots \end{bmatrix} = [x_1, x_2, \dots . x_n]_{pxn} \quad (1)$$

This matrix is called a data matrix. Here, for j = 1,2,..., p; i = 1,2,...,n, i^{th} is the observation result over ji x : j^{th} variable. As the variables can be in different scale types and different measurement units, the analysis results may be affected. Therefore, it is recommended to convert the values to score values or standard values to reduce the effects [43]. In the data sets obtained with range and proportional scale; Euclidean distance, Square Euclidean distance, Chebychef, City-Block, Minkowski distances can be selected. In MDS analysis, the most important point is to determine the distance measure; and the distance acquisition methods appropriate to the data types should be preferred. In binary scale data types; Euclidean distance, Square Euclidean distance, Pattern difference, Lance Williams distance can be preferred [43].

In MDS analysis, the most known and prevalently used distance measurement is Euclid distance. This distance is calculated by taking the square root of the sum of the squares of the differences between the observation vectors. The City-Block distance, also known as the Manhattan distance, is equal to the sum of the absolute differences between the units' variables. As this distance measure is used, the effect of the differences decreases since the difference is not squared. Chebyshev distance is a metric distance measure that takes the difference in size with the maximum difference between the two observation vectors as the distance between the two observation vectors. Minkowski distance is a general and metric measure and is one of the distance functions used for quantitative data [44]. One of the most important problems when performing the MDS analysis is to decide the number of dimensions. The number of dimensions in which the resulting graphical representation is easier to understand and interpret should be preferred. Usually, two and three-dimensional ones are used. The stress value is used to determine whether the number of dimensions to be used is appropriate.

Stress statistics are used to determine the number of dimensions as a result of size reduction. Stress statistics converge to a certain value as a result of iterations. The number of dimensions belonging to the converged value can be selected. Apart from this method, the number of dimensions can be decided by using the eigenvalues of the positive half-defined B matrix obtained by the product of the raw data matrix and the transposition [47].

Compliance between original distances and display distances is measured by Kruskal stress statistics. Stress measurement is calculated via the following formula [43].

$$\boldsymbol{S} = \frac{\left[\sum_{i<k}(\boldsymbol{d_{ik}} - \widehat{\boldsymbol{d}}_{ik})^2\right]^{\frac{1}{2}}}{\sum_{i<k}(\boldsymbol{d_{ik}})^2} \quad (2)$$

Kruskal tolerance ratios are used to interpret the configuration distances according to the magnitude of stress values. These tolerance ratios are as follows:

Table 2. Consistency Level according to Stress Values

Stress Value	Consistency
≥ 0.20	Inconsistency representation
0.10 - < 0.20	Low consistency
0.05 - < 0.10	Good consistency
0.025 - < 0.05	Excellent consistency
0.000 - < 0.025	Full consistency

A high-stress value indicates a high inconsistency; while a low-stress value indicates a low inconsistency [38, 43, 54].

In MDS, the square of the correlation coefficient (R^2) is often used as a consistency index. R^2 is a measure determining how much MDS model is compatible with the data. If R^2 is 1, it is understood that the compatibility is complete. In the analysis, it is generally acceptable that R^2 is greater than 60%, but it can be said that as R^2 value gets bigger, the consistency becomes better [47].

Depending on the type of MDS analysis data, metric MDS and non-metric MDS are used. Metric MDS is applied to data based on quantitative and metric distances. It is used since values obtained through measurement. In this scaling, representation and data distances are calculated by linear or polynomial function method. Non-metric MDS, on the other hand, is applied to score, order and categorical data. In non-metric scaling, the representation and data distances are calculated by the monotonic function method [43]. In practice, non-metric MDS is more preferred because it requires less assumption. Although it is known that the results obtained from the two methods are very close to each other when metric and non-metric MDS is applied to the same data set in the MDS, the approach appropriate to the distance matrix should be preferred [47].

3. Results

The aim of this study is to compare the OECD countries with the Multidimensional Scaling analysis in terms of traffic accident indicators and to determine the similarities or differences of the countries and to reveal the variables that affect the differentiation. Traffic Accident Indicators taking place in "Road Accident" database published by OECD Data were used in the study [12]. These indicators include the number of injuries in traffic accidents, the number of fatalities and the number of accidents with material damage. In this study, data from 39 countries were used since not all countries could be evaluated due to the lack of some data from OECD countries. MDS analysis, which was conducted to find similarities and differences between OECD countries in terms of traffic accident indicators, was applied to the SPSS 21.0 package program in two dimensions since it is easier to understand graphically.

Within the context of the study, the main indicators of 2017 traffic accidents of 39 OECD member countries were used. Accident Statistics of OECD Countries for 2017 are given in Table 3.

Table 3. Accident Statistics of OECD Countries for 2017

Country	Year	Number of injured	Number of accidents with material damage	Number of deaths
Argentina	2017	113173	102623	5420
Armenia	2017	5179	3535	279
Azerbaijan	2017	1719	1833	750
Belgium	2017	48451	38020	609
Bulgaria	2017	8680	6888	682
Switzerland	2017	21413	17799	230
Czech Republic	2017	27079	21263	577
Germany	2017	390312	302656	3180
Estonia	2017	1725	1406	48
Finland	2017	5576	4752	238
France	2017	73384	58613	3448
The UK	2017	178321	136063	1856
Georgia	2017	8461	6079	517
Greece	2017	12925	10647	731
Croatia	2017	14608	10939	331
Hungry	2017	21451	16489	625
India	2017	470975	464910	147913
Iceland	2017	1371	939	16
Italy	2017	246750	174933	3378
Japan	2017	580113	472165	4431
Korea	2017	322829	216335	4185
Lichtenstein	2017	87	436	2
Latvia	2017	3567	3059	136
Latonia	2017	4818	3874	191
Moldova	2017	2928	2479	302
Mexico	2017	8905	11873	2919
Macedonia	2017	6224	4019	155
Malta	2017	1854	15003	19
Montenegro Republic	2017	2648	1831	63
Norway	2017	5262	4086	106
New Zealand	2017	13892	11126	378
Poland	2017	39466	32760	2831
Romania	2017	40211	31106	1951
Russia	2017	215374	169432	19088
Slovakia	2017	21139	14691	276
Slovenia	2017	6884	5638	104
Serbia	2017	7901	6185	578
Sweden	2017	19662	14849	252
Turkey	2017	300383	182669	7427

(OECD DATA, 2017) [12].

In Table 3, the data of 39 OECD member countries take place. The data of the other countries are not included in the assessment as they do not take place in the database. When Table 3 is examined, it is seen that Japan and India are the countries that have the highest number of material damage accidents and that Argentina, Japan, Korea, India, Russia, and Turkey are the countries that have the highest number of deaths. On the other hand, it is understood that Lichtenstein is the country that has the least values in terms of traffic indicators.

Kruskal-Stress Statistics and R^2 values that are obtained as a result of the MDS analysis conducted to compare OECD countries in terms of traffic accidents are given below in Table 4.

Table 4. Results of Multidimensional Scaling analysis

Stress Statistic Results of Young		
Iteration	S-stress	Improvement
1	.0000	

When Table 4 is examined, it can be seen that iteration was halted since stress statistics for k=2 had a value of 0.00000 in the first iteration according to Stress Statistics of Young. Stress and R^2 were obtained as 0.00000 and 1.00000, respectively. In the study, if the stress value is zero, there is no inconsistency, and if the R^2 value is 1, it means that the accuracy rate of this analysis is high and the values are in perfect agreement.

Table 5. Stimulating coordinates

Order No	Country	Countries	1.Dimension	2. Dimension
1	ARG	Argentina	.2613	.3050
2	ARM	Armenia	-.9753	-.3349
3	AZE	Azerbaijan	**1.2845**	.5706
4	BEL	Belgium	-.3425	.0422
5	BGR	Bulgaria	-.3859	.0199
6	CHE	Switzerland	-.0916	.1619
7	CZE	Czech Republic	-.3267	.0503
8	DEU	Germany	-.3842	.0208
9	EST	Estonia	-.2208	.1022
10	FIN	Finland	.0096	.2059
11	FRA	France	-.2710	.0780
12	GBR	The UK	-.4381	-.0075
13	GEO	Georgia	-.7875	-.2107
14	GRC	Greece	-.1874	.1181
15	HRV	Croatia	-.5179	-.0510
16	HUN	Hungry	-.4484	-.0131
17	IND	India	.6414	.4284
18	ISL	Iceland	-.8380	-.2430
19	ITA	Italy	-.736	-.1790
20	JPN	Japan	-.1856	.1189
21	KOR	Korea	-.9364	-.3082
22	LIE	Lichtenstein	**5.2494**	-.3212
23	LTU	Latvia	-.0260	.1907
24	LVA	Latonia	-.2730	.0770
25	MDA	Moldova	-.1302	.1445
26	MEX	Mexico	**-2.0472**	**.6378**
27	MKD	Macedonia	**-1.0818**	-.4103
28	MLT	Malta	**5.5832**	-.5687
29	MNE	Montenegro Republic	-.8670	-.2619
30	NOR	Norway	-.3971	.0141
31	NZL	New Zealand	-.2576	.0845
32	POL	Poland	-.0979	.1591
33	ROU	Romania	-.4464	-.0120
34	RUS	Russia	-.3177	.0548
35	SVK	Slovakia	-.1593	.1312
36	SVN	Slovenia	-.3589	.0339
37	SRB	Serbia	-.8368	-.2423
38	SWE	Sweden	-.4797	-.0300
39	TUR	Turkey	**-1.2732**	-.5559

When Table 5 is analysed, it is seen that Liechtenstein and Malta are the most important disintegrants in this dimension as the countries with the highest positive value in the first dimension. That is to say, it is understood that these countries are perceived to be similar in terms of the number of deaths, number of injuries and number of daily accidents in traffic accidents. Also; it is seen that Azerbaijan is different from other countries with a positive value above 1 and that Mexico, Macedonia, and Turkey seem to be the most diverse countries because they have high negative values above 1. In the second dimension, countries do not have positive load values above 1. However, Mexico, with a value of 0.6378 as the positive value closest to 1, can be considered the most important separator for this dimension.

The difference matrix obtained after the excitation coordinate table is given below. In this matrix, it can be said that countries with values close to 0 are similar and countries with values above 1 are different from the others. Since this matrix, where the distances between the 39 countries are calculated, is large, it is given below part by part.

Table 6. Differences matrix

	ARG	ARM	AZE	BEL	BGR	CHE	CZE	DEU	EST	FIN	FRA	GBR	GEO
ARG	0.000												
ARM	.682	0.000											
AZE	.517	1.199	0.000										
BEL	.322	.360	.839	0.000									
BGR	.346	.336	.863	**.024**	0.000								
CHE	.187	.495	.704	.136	.160	0.000							
CZE	.314	.368	.831	**.009**	**.032**	.127	0.000						
DEU	.345	.337	.862	**.023**	**.002**	.159	**.032**	0.000					
EST	.256	.426	.773	**.066**	**.090**	**.069**	**.058**	.089	0.000				
FIN	.133	.549	.650	.190	.214	**.054**	.181	.213	.123	0.000			
FRA	.283	.399	.800	**.039**	**.063**	**.097**	**.030**	**.062**	**.027**	.151	0.000		
GBR	.375	.307	.892	**.053**	**.029**	.188	**.061**	**.030**	.119	.242	.092	0.000	
GEO	.572	.110	1.090	.250	.226	.386	.259	.227	.316	.440	.289	.197	0.000
GRC	.238	.444	.755	**.084**	.108	**.051**	**.076**	.107	**.018**	.105	**.045**	.137	…
HRV	.419	.263	.936	**.097**	**.073**	.233	.106	**.074**	.163	.287	.136	**.044**	…
HUN	.381	.301	.898	**.058**	**.034**	.194	**.067**	**.035**	.124	.248	**.097**	**.006**	…
IND	.196	.878	.322	.518	.542	.382	.509	.541	.452	.328	.479	.570	…
ISL	.602	**.080**	1.119	.279	.256	.415	.288	.256	.346	.469	.318	.227	…
ITA	.543	.139	1.060	.221	.197	.357	.229	.198	.287	.411	.260	.168	…
JPN	.237	.445	.754	**.085**	.109	**.051**	**.077**	.108	**.019**	.105	.046	.138	…
KOR	.659	**.023**	1.176	.337	.313	.473	.345	.314	.403	.527	.376	.284	…
LIE	2.443	3.120	1.933	2.762	2.786	2.628	2.754	2.785	2.697	2.574	2.724	2.815	…
LTU	.151	.531	.669	.171	.195	.035	.162	.194	.105	**.019**	.132	.223	…
LVA	.284	.398	.801	**.038**	**.062**	**.098**	**.029**	**.061**	**.028**	.152	.002	.091	…
MDA	.207	.475	.724	.115	.139	**.021**	.106	.138	**.049**	**.075**	**.076**	.168	…
MEX	.888	1.570	.371	1.210	1.234	1.075	1.202	1.233	1.144	1.021	1.171	1.263	…
MKD	.746	**.064**	1.263	.423	.399	.559	.432	.400	.490	.613	.462	.371	…
MLT	2.617	3.279	2.123	2.929	2.952	2.797	2.921	2.951	2.865	2.745	2.891	2.980	…
MNE	.618	**.064**	1.136	.296	.272	.432	.305	.273	.362	.486	.335	.244	…
NOR	.352	.330	.869	**.030**	**.006**	.166	**.039**	**.007**	**.096**	.220	**.069**	**.023**	…
NZL	.276	.406	.793	**.046**	**.070**	**.089**	**.038**	**.069**	**.020**	.144	**.007**	**.099**	…
POL	.190	.492	.707	.132	.156	**.003**	.124	.155	**.066**	**.057**	**.093**	.185	…
ROU	.379	.303	.897	**.057**	**.033**	.193	**.066**	**.034**	.123	.247	**.096**	**.005**	…
RUS	.309	.373	.826	**.014**	**.037**	.122	**.005**	**.036**	**.053**	.176	**.025**	**.066**	…
SVK	.223	.459	.740	**.099**	.123	**.036**	**.091**	.122	**.033**	**.090**	**.060**	.152	…
SVN	.331	.351	.848	**.009**	**.015**	.145	**.018**	**.014**	**.075**	.199	**.048**	**.044**	…
SRB	.601	**.081**	1.118	.279	.255	.414	.287	.256	.345	.468	.318	.226	…
SWE	.398	.284	.915	**.076**	**.052**	.211	**.084**	**.053**	.142	.265	.115	.023	…
TUR	.862	.180	1.380	.540	.516	.676	.549	.517	.606	.730	.579	.488	…

Its continuation

Table 6. Differences Matrix

	GEO	GRC	HRV	HUN	IND	ISL	ITA	JPN	KOR	LIE	LTU	LVA	MDA	MEX
GEO	0.000													
GRC	.334	0.000												
HRV	.153	.181	0.000											
HUN	.192	.143	.039	0.000										
IND	.768	.434	.615	.576	0.000									
ISL	.029	.364	.182	.221	.797	0.000								
ITA	.029	.305	.124	.163	.739	.058	0.000							
JPN	.335	.002	.182	.143	.433	.364	.306	0.000						
KOR	.087	.421	.240	.279	.855	**.058**	.116	.422	0.000					
LIE	3.011	2.679	2.859	2.820	2.250	3.040	2.982	2.678	3.097	0.000				
LTU	.421	**.086**	.268	.229	.347	.450	.392	.086	.508	2.593	0.000			
LVA	.288	**.046**	.135	.096	.480	.317	.259	**.047**	.375	2.725	.133	0.000		
MDA	.365	**.031**	.212	.173	.403	.394	.336	**.030**	.452	2.648	**.056**	**.077**	0.000	
MEX	1.461	1.126	1.307	1.269	.693	1.490	1.431	1.125	1.547	1.571	1.040	1.172	1.095	0.000
MKD	.173	.508	.326	.365	.941	.144	.202	.508	**.086**	3.183	.594	.461	.538	…
MLT	3.172	2.847	3.023	2.986	2.429	3.200	3.144	2.846	3.257	1.060	2.763	2.892	2.817	…
MNE	**.046**	.380	.199	.238	.814	**.017**	**.075**	.381	.041	3.057	.467	.334	.411	…
NOR	.220	.114	**.067**	**.028**	.548	.249	.191	.115	.307	2.792	.201	**.068**	.145	…
NZL	.296	**.038**	.143	.104	.472	.326	.267	**.039**	.383	2.717	.125	**.008**	**.069**	…
POL	.382	**.048**	.229	.191	.386	.412	.353	**.047**	.469	2.631	**.038**	**.094**	**.017**	…
ROU	.193	.142	.040	**.001**	.575	.222	.164	.142	.280	2.819	.228	**.095**	.172	…
RUS	.264	**.071**	.110	**.072**	.504	.293	.234	.072	.350	2.749	.157	**.024**	.102	…
SVK	.350	**.015**	.196	.158	.418	.379	.320	**.014**	.436	2.664	**.071**	**.061**	**.016**	…
SVN	.241	**.093**	**.088**	**.049**	.527	.270	.212	**.094**	.328	2.771	.180	**.047**	.124	…
SRB	**.029**	.363	.182	.220	.797	.004	**.058**	.364	**.058**	3.039	.449	.317	.394	…
SWE	.174	.160	**.021**	**.017**	.594	.204	.145	.161	.261	2.837	.246	.114	.191	…
TUR	.290	.625	.443	.482	1.058	.261	.319	.625	.203	3.300	.711	.578	.655	…

Its continuation

Table 6. Differences Matrix

	MEX	MKD	MLT	MNE	NOR	NZL	POL	ROU	RUS	SVK	SVN	SRB	SWE	TUR
MEX	0.000													
MKD	1.634	0.000												
MLT	1.776	3.341	0.000											
MNE	1.507	.127	3.217	0.000										
NOR	1.240	.393	2.958	.266	0.000									
NZL	1.164	.470	2.884	.342	**.076**	0.000								
POL	1.078	.556	2.801	.429	.162	**.086**	0.000							
ROU	1.268	.366	2.984	.239	**.027**	.103	.190	0.000						
RUS	1.197	.437	2.916	.310	**.043**	**.033**	.119	**.071**	0.000					
SVK	1.111	.523	2.832	.396	.129	**.053**	**.033**	.157	**.086**	0.000				
SVN	1.219	.414	2.938	.287	**.021**	**.055**	.141	**.048**	**.023**	.108	0.000			
SRB	1.489	.145	3.200	**.018**	.249	.325	.411	.221	.292	.378	.270	0.000		
SWE	1.286	.348	3.002	.221	**.046**	.122	.208	**.018**	**.089**	.175	**.067**	.203	0.000	
TUR	1.751	.117	3.455	.244	.510	.586	.673	.483	.554	.640	.531	.262	.465	0.000

It is seen that countries display similarities in terms of traffic accidents. They have values close to 0 in the differences matrix given above. For example; Armenia has close values as Iceland, Korea,

Macedonia, Montenegro Republic, and Serbia. Belgium has close values as Bulgaria, Czech Republic, Germany, Estonia, France, The UK, Greece, Croatia, Hungry, Japan, Latvia, Norway, New Zealand, Romania, Russia, Slovenia, Slovakia, and Sweden. Bulgaria has close values with Czech Republic, Germany, Estonia, France, the UK, Croatia, Hungry, Latvia, Norway, New Zealand, Romania, Russia, Slovenia, Sweden, and Switzerland has close values as Estonia, Finland, France, Greece and Japan; and Latvia, Latonia, Moldova, New Zealand, Poland, and Slovakia. Czech Republic has close values as Germany, Estonia, France, the UK, Greece, Japan, Latonia, Norway, New Zealand, Romania, Russia, Slovenia, Slovakia, and Sweden. Germany has close values as Estonia, France, the UK, Croatia, Hungry, Latonia, Norway, New Zealand, Romania, Russia, Slovenia, and Sweden Estonia has close values as France, Greece, Japan, Latonia Moldova, Norway, New Zealand, Poland, Slovenia, and Slovakia. Finland has close values as Latvia, Moldova, Poland, and Slovenia. France has close values as Greece, the UK, Hungry, Japan, Latonia Moldova, New Zealand, Poland, Romania, Russia, Slovakia, Slovenia, and Sweden the UK has close values as Croatia, Hungry, Latonia, Norway, Romania, Russia, and Slovenia. Georgia has close values as Iceland, Italy, Montenegro Republic, and Serbia. Greece has close values as Japan, Latonia, Latvia, Moldova, New Zealand, Poland, Russia Slovenia, Slovakia and Croatia and Hungry, Norway, Romania, Slovenia, and Sweden. Hungry has close values as Latvia, Norway, Romania, Russia, Slovenia, and Sweden. Iceland has close values as Italy and Korea, Montenegro Republic and Serbia. Italy has close values as the Montenegro Republic and Serbia. Japan has close values as Montenegro Republic, New Zealand, Poland, Russia Slovenia, and Slovakia. Korea has close values as Macedonia, Montenegro Republic, and Serbia. Latvia has close values as Moldova. Latonia has close values as Montenegro Republic, Norway, New Zealand, Poland, Romania, Russia, Slovakia, and Slovenia. Moldova has close values as New Zealand, Poland and Slovakia; and the Montenegro Republic with Serbia; and Norway with New Zealand, Romania, Slovenia, and Sweden. Romania has close values as Russia, Slovenia, and Sweden. Russia has close values as Slovakia, Slovenia, and Sweden.

When the differences matrix is analysed, it is understood that Turkey and Malta are the most diverse countries. On the other hand, it is seen that Lichtenstein and Turkey; Sweden, Korea, Georgia and Macedonia, and furthermore Malta and Georgia, Armenia, Croatia, Iceland, and Korea are countries that are very different from each other due to the high difference values.

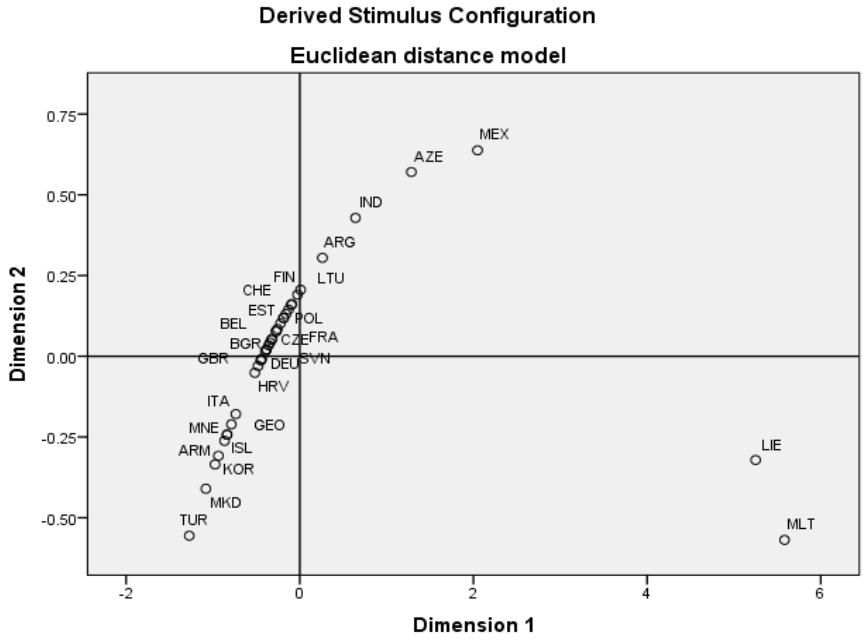

Figure 4. Linear Relation between Distances and Differences

When Figure 4 is examined, it is seen that similar OECD countries are gathered together. As a result of the MDS analysis examined in Figure 5, it is seen that countries are collected in three different groups in two-dimensional space according to the traffic accident indicators of interest. While Liechtenstein, Malta emerges in a separate group, and Turkey, Macedonia, Korea, Iceland, Armenia, the Republic of Montenegro, Italy, Georgia, Croatia, Germany emerge in another group, and the rest of the countries emerges as another group.

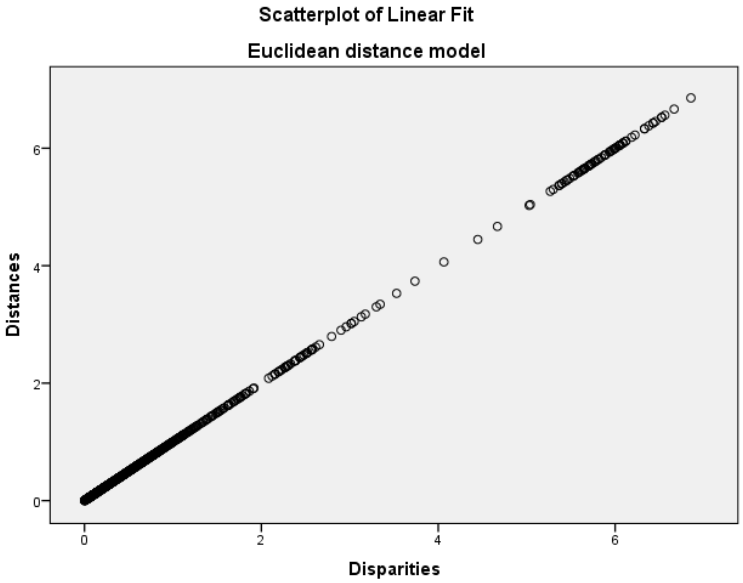

Figure 5. Euclidean Distance Model

When Figure 5 is examined, it is determined that the number of dimensions and distances and the differences are in a linear relationship.

4. Conclusions and Recommendations

In this study, it is aimed to examine the position of 39 OECD member countries in terms of traffic accident indicators and to reveal the similarities or differences between countries with Multivariate Statistical Techniques, which is one of the Multidimensional Scaling Techniques. As a result of the analysis, it is seen that the OECD countries are similar to each other in three-dimensional locations in two-dimensional space. In the first dimension; Liechtenstein and Malta are the most important parsers and appear to be in a very different position from other countries. In the second dimension, countries do not have positive load values above 1. However, Mexico, which has a value of 0.6378 as the positive value closest to 1, can be considered the most important parser for this dimension. It is seen that Liechtenstein and Malta are similar, but appear to be taking place at a location different from other countries. It is seen that Turkey, Macedonia, Korea, Iceland, Armenia, the Republic of Montenegro, Italy, Georgia, Croatia, and Germany are similar to each other and form a separate group, while the rest are located in a different group. When the differences matrix is examined; it is understood that Turkey and Malta are the most different countries from each other among the OECD countries.

It is obvious that traffic accidents, a global public health problem, have a huge impact on individuals and communities and national economies. The countries especially, those which take place on the top with regard to the traffic accident indicators, such as the US, Japan, India, Germany, Korea, and Turkey should come together and confront this problem and develop national and international projects. In addition, taking serious measures on a local basis (infrastructure services, increasing traffic fines, and training, etc.) will help minimize human and economic losses. Thanks to these measures, reducing traffic accidents, which are among the most important causes of death in our country and some other countries, will have a positive effect on both individual and public health.

The compliance to the Research and Publication Ethics: This study was carried out in accordance with the rules of research and publication ethics.
Ethical Process: Ethics committee approval is not required for this study.

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Research Article

CAPABILITY MODEL AND COMPETENCE MEASURING FOR SMART HOSPITAL SYSTEM: AN ANALYSIS FOR TURKEY

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Abstract: *Today, rapidly developing technological innovations affect and change all sectors. Health sectors are inevitably involved in a digital transformation. In this transformation, IoT technology plays an important role, which enables many devices to connect and work together. IoT converts systems into intelligent systems that work together using sensors, connection methods, internet protocols, databases, cloud computing and analytics as infrastructure. In this respect, it is necessary to establish the related technical infrastructure and generate a suitable environment for the establishment of intelligent hospitals. Finally, a capability model has been developed to measure the digital performance of Turkey. For Turkey health sector, the technology assessment report is presented based on survey results and HIMMS EMRAM data.*

Keywords*: Smart Hospital, Capability Model, HIMMS EMRAM*

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1. Introduction

It has taken many years for the concept of IoT to emerge. With the increased computational power of devices, new methods and technologies allowed to be developed. The development and stages of digital computing over the years can be seen in Figure 1. With the rapid development, following the invention of the Turing Machine was described caused to use new methods of research and discovery that have emerged in the calculation methods used when working with a large data set. Digital computing used in today's computers gained importance in the 1950s with Alan Turing's intelligence computing machinery and intelligence abstract. One of the issues mentioned in the article is whether the machines can think and not play. In the 1960s, the cluster computing system came up. A computer network of multiple computers is a set of connected computing devices that work together in many respects. Each node in this network is designed to perform the same task through compatible software and is in a controllable and re-plannable form.

In the 1970s, the Stanford Artificial Intelligence Laboratory (SAIL) was established and continued with artificial intelligence and calculations. A knowledge-based appeared in the 1980s and definition of a complex software system that reasons and uses a knowledge base to solve complex and many different tasks. This knowledge-based explicit and reasoning system allows driving new technology. In the 1990s grid computing which is a method of distributed computing for dynamic and geographically determined

in organizations comes from sharing computing, applications, network resources, and data warehousing. [1].

In the early 2000s, cloud computing, one of the foundations of IoT, has become an important issue. Cloud computing plays an important role in the unification of many resources. Cloud computing utilizes an easy, multiple, ad-hoc network permissions for configurable IT resources that can be quickly managed and released with minimal management effort or service provider interaction [2].

Then IoT based applications are becoming increasingly widespread and it is being forecasted that the IoT scenarios and applications will be increased to 20 billion units by 2020, up from 0.9 billion in 2009 [3,4]. Finally, fog computing is similar to cloud computing as the logic of work, but in terms of slow latency, location awareness, and improves quality-of-services (QoS) for streaming and real-time applications so digital computing takes a step further [5].

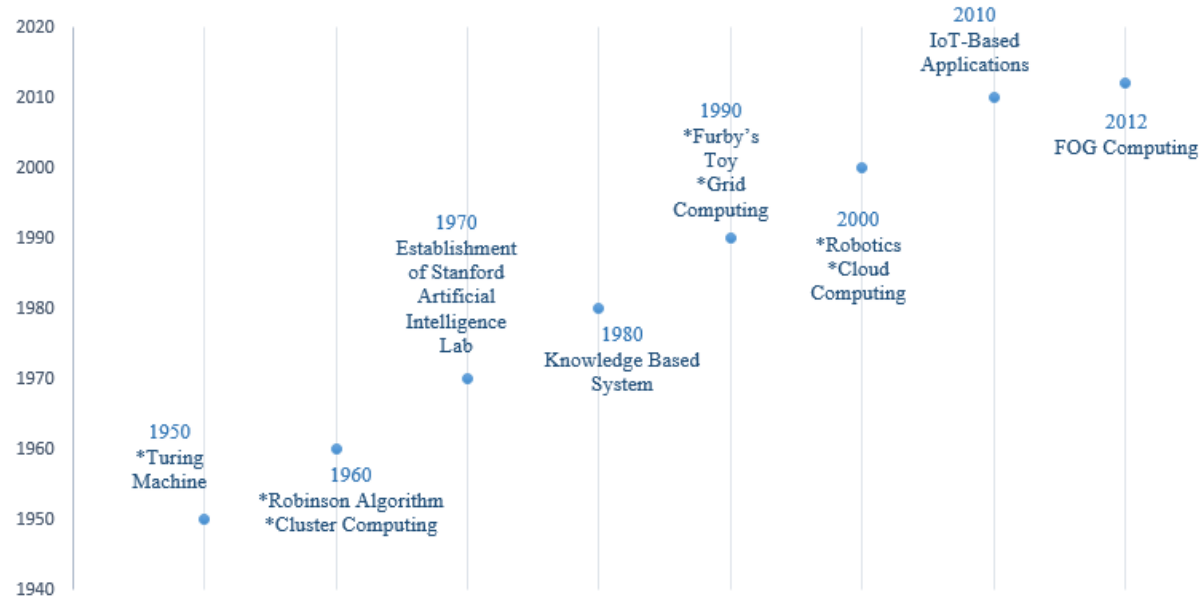

Figure 1. Digital computing and historical evolution

With these intelligent abilities, IoT technology enables information exchange between smart devices (things or objects) that satisfy a fast and accurate response to a particular problem that may occur in any of the system's stakeholders to improve Quality of Service (QoS). This information exchange is provided with continuous information flows between patients, doctors, medicine and biomedical suppliers, etc. so, IoT uses advanced IT technology to integrate the various components of a collaborative network to improve the efficiency, service capability, and flexibility between smart devices.

These smart devices can monitor and perceive their environmental conditions, measure the phenomena, the activities or the functions on the installed platforms, then convey the gathered data to a management unit/decision support system for further processing. Collected sensory data is used to understand the current situation of the system, providing information on the states of each unit in the network and the status of the complete system. and as a first step technology employs data processing technologies to transform raw data into input data. Processed input data is converted into meaningful

information using information processing techniques and finally, this information is transformed into knowledge that enables the system to provide self-action through the knowledge processing approach without the involvement of humans [6]. In other words, IoT systems provide autonomous systems to control the complex system via self-governance and self-management abilities. [7].

1.1. IoT-based smart hospital

There are 7 main characteristics that need to be built in order to develop intelligent hospital applications based on IoT technology. These are; 1. Sensing, 2. Inter-Operability, 3. Communication, 4. Connection, 5. Networking, 6. Data Analytics, and 7. Artificial Intelligence (AI) capabilities. These characteristics are shown in Figure 2 from outside to inside.

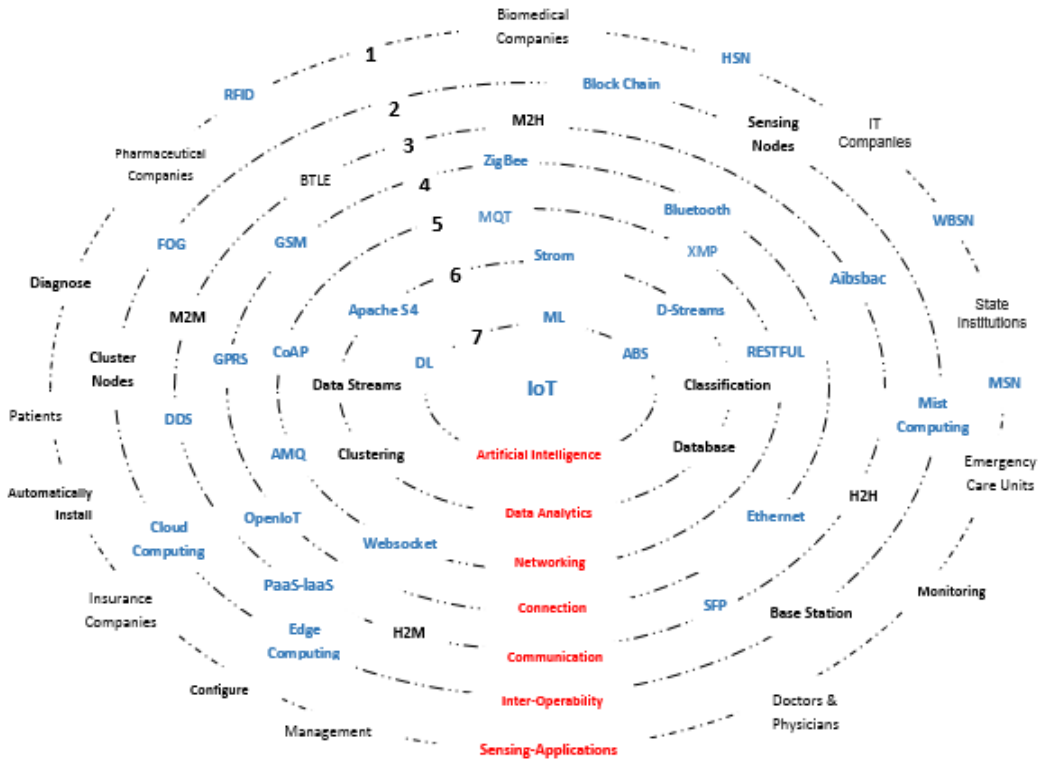

Figure 2. Seven Characteristics of IoT Technology for Smart Hospital

Sensing: Sensing capability defines the monitoring, storage, and analysis of health data by employing ubiquitous and distributed computing technology. Sensing characteristics of IoT technology define the data acquisition ability in real-time using low-energy to produce reliable messages [8].

Inter-operability: Inter-operability capability defines the ability to work with many heterogeneous devices at different scales simultaneously for a specific purpose. To build an interoperable system there is a strong need to define an efficient connection protocol and communication standard but lack of general standards leads to inefficient inter-operability [9].

Communication: IoT devices (things or objects) can communicate with each other within the same or heterogeneous networks [10]. This communication between things devices can be human to human (H2H), human to machine (H2M) or machine to machine (M2M) to analyze and produce information [11].

Connection: Connection capability defines to construct a secure channel between connected objects and base stations [12].

Network: IoT networking capability defines the selection of appropriate network protocol in order to build connections and communication between IoT devices [12].

Data Analytics – Artificial Intelligence: IoT technology undergone many changes in areas such as manual processing, mechanization, automation, information, integration, and intelligence. Especially, advances in the field of Robotics and AI (Artificial Intelligence) have emerged as key technologies in patient care and disease management [13]. Specifically, AI applications have made significant progress in personalized risk assessment, disease diagnosis and image processing for patients [14,15]. Also, the Integration of AI technologies and data analytics methods that including machine learning, game theory, optimization algorithms, and so on have enabled the creation of autonomous IoT structures that can self-repairing, self-healing, capable of protecting itself and self-organizing. And these capabilities have been used to make timely decisions to system needs [16] to a way of working is getting simpler and easier.

2. Materials and Methods

2.1. Hospital capability model and evaluation of Turkey

As a result of the digital transformation, significant changes have occurred in the health care processes of the hospitals and IoT technology has become one of the most important drivers of this change by enabling sensing, processing, and acting capability. In this rapid change, from data collection through intelligent devices to producing smart solutions there is a strong need to measure the level of digital capability of hospitals. In this chapter, the general structure of hospitals from data acquisition methods to data sharing processes was analyzed in accordance with the proposed infrastructure in chapter 2 and a capability model was created in this direction. This model aims to reveal the competency levels of the hospital in 3 levels and to identify the areas that are open to improvement in this direction. The proposed model is shown in Figure 3.

The first level is the basic level and it contains the basic characteristics of the initial level. At this level data only comes from clinical units and the local area network is used to transfer data through the system. Data collection and processing are done in central storage, cloud storage methods and systems are not used.

The second level is defined as integrated and contains partial stakeholder integration, machine-to-machine communication between biomedical equipment, local area network and partial remote monitoring in addition to the basic characteristics. The common feature of the hospitals at this level is being chained hospital group and they can provide the integration with ERP program used in their structure. Data collection and processing are done in both central storage and cloud storage methods.

The third level is the level of the smart hospital that includes a low power area network that is integrated with both machine-to-machine, human-to-machine capabilities. Another important capability of the smart hospital level is the type of data collection. In this level, data come from not only clinical nodes but also patient-generated data and transportation data are possible to collect. In addition to network capability, a knowledge-based decision-based making system, which is composed of artificial intelligence and advanced analytical solutions, is also one of the most important properties of a smart hospital.

Smart	*Patient Generated Data *Clinical Data *Transportation Data	*Location Sensor *Inertia Sensors *Ambient Sensors *Clinical Wearables *Remote Wearables	*Wide Area Network *M2M, H2M, M2H Communication	*AI Based Knowledge Management System *Distributed Storage, Combination of Cloud, FOG , Edge Computing	*High Integration with Stakeholders
Integrated	*Clinical Data *Partial Patient Generated Data	*Inertia Sensors *Ambient Sensors *Clinical Wearables *limited Remote Wearables	*Local Area Network *M2M btw Biomedical Devices	*Central Storage Cloud Based Computing *ERP Integration *Reporting *Rules Based Data Analysis *HIMSS stage 6 & 7 Accreditation	*Medium Integration with Stakeholders
Basic	*Manual Data Record *Clinical Data	*Partial Inertia Sensors *Partial Ambient Sensors *Partial Clinical Wearables	*Web Sockets *HTTP (No Communication) Personal Area Network	*Central Storage *ERP without Integration *Statistical Analysis *HIMSS Stage 5 and Lower Accreditation	*Low Integration with Stakeholder

Figure 3. Hospital Digital Capability Model

2.2. Capability Analysis Based on Survey

Based on the proposed capability model, a questionnaire was designed to evaluate the devices, network and communication methods, system design parameters and data management methods required to create the infrastructure. Each problem was intensively used in the literature and a comprehensive list was created. Identified thanks to these questions turkey in a private hospital-to-hospital survey applying the IoT system in terms of how much they have adequate infrastructure and development of open points that were examined.

Each question aims to obtain data on a different layer of the required technological infrastructure. Data pertaining to both the patient and the environment is recovered via sensors. In the questionnaire, the sensors were examined in 4 groups and defined as position sensors, wearable sensors, ambient sensors, and inertial sensors. Network systems are needed to integrate the data collected from the sensors with other systems, and different structures can understand each other through certain network protocols on these systems. Also, how often and how the data flow is done is an important issue because it plays a critical role in some scenarios and some cases create an additional system load and cost. While some of the questions are questioning whether to have an inventory or not, some questions have been determined directly to learn the design of the process and the methods used.

2.3. Implementation of the survey

Within the scope of the study, the survey was carried out with 5 different institutions in cooperation with its own IT department employees. 2 of these 5 hospitals are a group - chain hospitals, managed under a large holding. The other 2 are the research hospitals managed by the state institutions and units under the name of the university hospital. The remaining hospital is a single-branch private hospital managed by a company.

Currently, the main reason why the survey is limited to 5 is that companies that have hospitals and manage them do not accept the survey. Institutional culture is not suitable for research, the technical infrastructure is not enough and they are hesitant to occur.

Also, companies with their private universities stated that they did not look favorably at research studies from different schools. Therefore, the number of surveys was kept at this level.

3. Results

Due to the lack of enough survey data, statistical analysis is not given in the report. Instead, the findings from the survey study are listed as follows.

- In the process of collecting data, RFID is mostly used technology to collect clinical data. It has been observed that the data about the follow-up of the patients can be collected on a real-time basis. However, there is no use of sensor technology during transport or remote patient follow-up.
- In order to satisfy an intelligent communication, there is a strong need for device integration. In this case, it is observed that M2M communication has been used between biomedical devices and reports obtained from this information exchange are accessible within the hospital information management system, however, these applications only involve in-hospital data exchange.
- Hospital systems were integrated with many institutions, so they did not record home health care, prescription and medical records in the digital environment.
- A wide area network infrastructure is not used when providing a personal area network and local area network for the establishment, connection, and connection of network connections.
- No hospital institution uses analytical methods using clinical and data collected from patients. Artificial intelligence, estimation, and detection methods are not used.
- In clinical studies, ambient sensors and sensors that can be attached to the patient are widely used. Magnetic field sensor is observed from inertial sensors while others are not used. The use of position sensors has not been observed. Patient and inventory monitoring cannot be performed smartly.

3.1. Capability Analysis Based on HIMMS (Healthcare Information and Management Systems Society)-EMRAM (Electronic Medical Record Adaptation Model)

In the health sector, measuring the digitalization level based on the specified standards is very important. EMRAM (Electronic Medical Record Adaptation Model) model is developed by HIMMS has proposed an important guide through a set of standards for the measuring of the digitalization process [17];. In this guide of HIMSS-EMRAM, the digitization levels of hospitals are divided into 7 stages. The properties defined for each stage are described below.

Table 1. EMRAM stages [18].

Stage	Definition
7	Measurement of electromagnetic radiation, data sharing with different institutions, data analysis methods, ensuring business continuity, privacy, and security
6	Breast milk validity, blood products, technological medication, and risk reporting
5	Structured documentation for clinicians, fully clinical decision-making systems, device security for attacks.
4	Ordering in the electronic environment, ensuring work processes related to processes, documentation of nurses and staff
3	Routine documentation and security of nurses and in-hospital staff
2	Storage of clinical data, cooperation with different institutions and security of patient data at the basic level
1	Radiology measurement reports, laboratory test results, pharmacy and drug records are installed in the system.
0	Most basic clinical work and medical systems are carried out manually.

Stage 7, which is the top-level, is a zero paper environment. The characteristics of this stage are detailed below since it is the closest to the smart hospital structure at the clinical level;

- Patient registration, hospitalization, and other clinical procedures, consultations, and referrals are made from paper without a paper.
- E-prescription is used in the hospital.
- MR, X-ray, ECG, blood and other tests (hearing test, etc.) are done without any paper in a computer environment and the results of these requests are presented in a digital environment. Both health workers and patients can access these results via telephone and tablet.
- All data (records, results, invoices, etc.) are archived in a digital environment and information security is provided.
- Through the computer terminal in the patient rooms, nurses enter the system without any paperwork and paper, so that the pharmacy, inventory tracking and billing system can instantly record the outlets.
- In the closed-circuit drug system, the correct drug is administered at the right time with the right patient at the right dose.

3.2. Results base on the analysis of HIMSS-EMRAM Accreditation

T.C. Ministry of Health has adopted the use of HIMSS-EMRAM accreditation as a strategic decision to measure digital conversion levels of hospitals in Turkey [18]. However, in accordance with the information accessed from HIMMS's site, it was seen that there were only 2 hospitals that reached stage 7 in Turkey [17]. These are Tire State Hospital and Yozgat City Hospital.

The distribution of the countries who have stage 7 accreditation in Europe is shown in Figure 4.

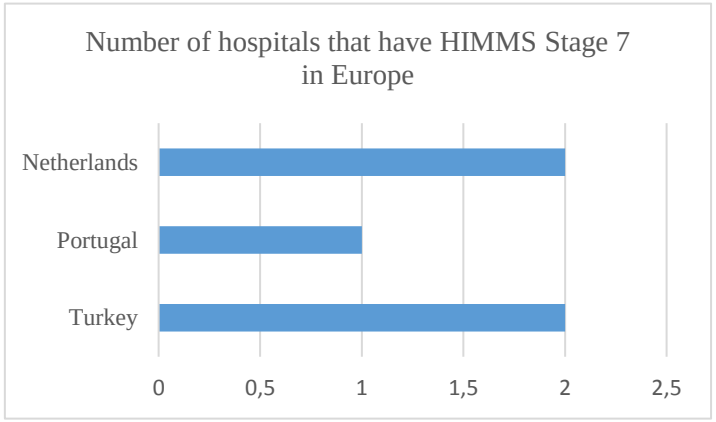

Figure 4. Distribution of Stage 7 accredited hospitals in Europe

In the analysis performed based on Step 6, it is seen that 163 accredited hospitals exist in Turkey. The distribution of the sixth stage accredited countries in Europe is shown in Figure 5.

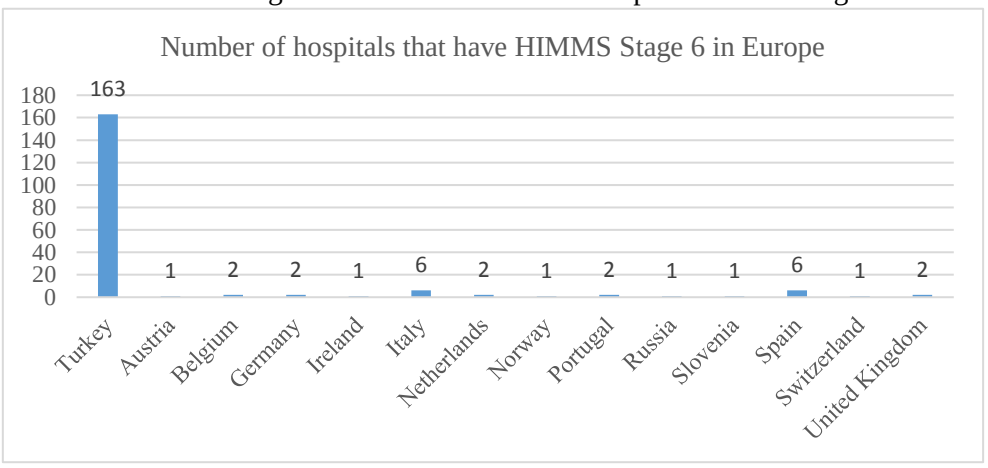

Figure 5. Distribution of Stage 6 accredited hospitals in Europe

According to data from the Ministry of Health, the number of inpatient health institutions in Turkey is approximately 1518 [19]. Considering the number of hospitals that have Stage 6 or 7, It is very clearly seen that the process of digital transformation needs to improve in many ways in Turkey. Only 0.13% of the hospitals are at the zero paper level. In addition, only 10.7% of the total number of hospitals were accredited by providing 50% digitalization in the processing of data in the clinical process.

4. Conclusions

In this study, firstly, the literature review has been done to analyze the current studies and characteristics of the IoT technology is determined. Then a questionnaire is prepared to measure the existing competencies of institutions and results are analyzed. In addition to survey results HIMMS-EMRAM digital accreditation is evaluated to analyze the capability of hospitals in Turkey. The study will be taken forward to increase the effect of IoT technology on the hospital. Findings from the project are summarized below.

I. In the process of gathering clinical data, some areas can be seriously improved in the collection and integration of data from patients.

II. In the infrastructure technology used for the integration of the data, it has been observed that the network area and local area network is used intensively, and it is seen that the necessary infrastructure works are not enough to develop the infrastructure especially in the wide-area network and low power area network systems.

III. It has been determined that the decision support systems are especially effective in the follow-up of patients by nurses, but they are important areas for the development of disease detection.

IV. It has been determined that patient intervention processes are prolonged due to lack of system integrations for data of patients in ambulance vehicles such as ambulance used in patient transportation and transportation stages and it is very clear to improve in this area.

V. It was determined that the integration with other stakeholders was the strongest infrastructure in terms of the IoT infrastructure and that integration with the pharmaceutical and biomedical firms was open to improvement.

VI. It has been determined that labor force planning can be carried out depending on the legislation, however, dynamic density is not sufficient to measure simultaneous workforce planning and there is a need for improvement in this area.

Future works within the scope of this study are it is aimed to digitize the capability model developed for the IoT-based intelligent hospital design, to present it as an open-source, and to design a more comprehensive project to obtain the wider analysis.

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

Ethical Process: Ethics committee approval is not required for this study.

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Review Article

CANCER, SIDE EFFECTS OF CHEMOTHERAPY AND NURSING CARE

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Abstract: *Cancer is a complex disease that emerges from uncontrolled cell growth as a result of genetic and environmental factors. Although there are various types of cancer and standard procedures are applied to specific types of cancers, it is also a personal disease. Cancer treatment varies depending on the cancer type, placement, stage, general health of the individual and other factors. Furthermore, cancer treatment is complex, costly and requires a long time. As the prevalence of cancer increased in societies, the application of systemic chemotherapy and the occurrence of associated side effects also increased. Early monitoring and assessment have become important for early diagnosis of side effect symptoms and reduction and prevention of complications through symptom control. Social environments and families should be taken into consideration during patient assessment. Monitoring and assessment of cancer patients by all healthcare professionals and nurses during chemotherapy are at least as important as the follow-up of the disease. In this review, we aim to assess the factors leading to cancer, chemotherapy used to treat cancer and side effects associated with chemotherapy and to examine the applicable nursing care practices.*

Keywords: *Cancer, chemotherapy, side effects, nursing care*

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1. Introduction

Cancer is a complex disease that emerges from uncontrolled cell growth as a result of genetic and environmental factors [1]. Cancer treatment varies depending on the cancer type, placement, stage, general health of the individual and other factors and cancer treatment is complex, costly and requires a long time [2].

2. Epidemiology of Cancer

'Cancer' actually refers to a group of diseases, all of which result from the uncontrolled abnormal growth of cells [3]. Its prevalence varies depending on age, gender, race, and region of residence. Cancer is the second leading cause of death in our country and in the world [4]. Cancer incidence and mortality rates for 2018 by sex and for18 age groups (0–4, 5–9,...,79,80–84, 85 and over) were estimated for the 185 countries or territories of the world having a total population greater than 150,000 in 2018 [5]. It accounts for one-sixth of deaths in the world and one-fifth of deaths in our country [6]. According to the GLOBOCAN 2018 updates, 18.1 million new cancer cases and 9.6 million cancer deaths occurred in

2018 worldwide, and, on average, there is about a 20% risk of getting cancer before age 75, and 10% of dying from it [5]. It is estimated that a total of 19.3 million new cases of cancer will occur by 2025 [7]. This increase can be stopped only by adopting a healthy lifestyle behaviour and implementing evidence-based prevention strategies [6].

Cancer may develop as a result of many factors such as environmental exposure, lifestyle, and genetics. These include smoking and alcohol consumption, infections, reproductive and hormonal factors, dietary habits and physical inactivity, occupational exposure, radiation, water, and soil pollution in the residential areas, medicinal drugs, and naturally occurring chemical carcinogens.

2.1. Smoking Consumption

Smoking is a major public health problem [8]. Every year, 5.4 million people around the world die of lung cancer, heart diseases and other diseases caused by smoking [9]. Tobacco use is decreasing in high-income countries while it is high and increasing in most of the low and middle-income countries [8]. Tobacco smoke contains more than 7000 chemical substances, most of which are known to be carcinogenic. The chemicals in tobacco smoke contribute to the formation of cancer in a number of ways [9]. Smoking is responsible for the occurrence of 94% of lung cancer cases. Smokers have 24-36 times higher risk of lung cancer than non-smokers. Factors such as the duration of smoking, the number of cigarettes smoked, the age of smoking initiation affect the formation of cancer [10].

2.2. Alcohol Consumption

Alcohol use causes such cancer types as oral cavity, pharyngeal, laryngeal, esophageal, liver, colon, rectal and breast cancer. It is known that the consumption of alcoholic drinks increases the risk of the formation of many cancer types [11].

2.3. Infections

In the last thirty years, a correlation has been found between a number of chronic infections and the formation of cancer in cancer etiology studies [12]. Table 1 shows the carcinogenic agents that cause cancer in humans and the major cancer regions associated with these agents.

2.4. Reproductive and Hormonal Factors

It is reported that reproductive and hormonal factors play a significant role in a great number of cancer etiologies in women. These factors significantly affect the formation of breast, endometrial and ovarian cancers in particular [13-15]. Although hormonal factors may have an impact on a number of cancer types in men, they are described as less likely to be correlated with cancer [13, 16].

2.5. Dietary Habits and Physical Inactivity

It is reported that dietary habits and physical inactivity increase the rate of cancer formation and the most important effect of physical inactivity on cancer formation is weight gain and obesity. Further studies are needed to understand the impact of obesity in cancer types on survival. The diagnosis stage should include a careful examination explaining the relationship between phases and the treatment details [17, 18]. Nutrients, for the metabolic requirements of the organism, provide the necessary substances such as proteins, in addition to positive on our health they also contain ingredients such as secondary metabolites with effects [19].

Tab. 1. Carcinogenic agents causing cancer in humans and main cancer sites associated with these agents [12].

Cancer site	Well-established human carcinogenic agents
Stomach	Helicobacter pylori
Liver	Hepatitis B virus
	Hepatitis C virus
	Opisthorchisviverrini
	Clonorchissinensis
Cervix	Human papillomavirus, with or without HIV
Anogenital (penis, vulva, vagina, anus)	Human papillomavirus, with or without HIV
Nasopharynx	Epstein–Barr virus
Oropharynx	Human papillomavirus, with or without tobacco use/alcohol consumption
Non-Hodgkin lymphoma	Helicobacter pylori
	Epstein–Barr virus, with or without HIV
	Hepatitis C virus
	Human T-cell lymphotropic virus type 1
Kaposi sarcoma	Kaposi sarcoma herpesvirus, with or without HIV
Hodgkin lymphoma	Epstein–Barr virus, with or without HIV
Bladder	Schistosomahaematobium

2.6. Occupational Exposure, Radiation, Residential Area

Exposure plays a significant role in cancers related to workplaces. For instance, asbestos, heavy metals, diesel motor emissions, polycyclic aromatic hydrocarbons, silica are well-known carcinogens in workplace exposures [20, 21].

The dose of radiation exposure and the duration of exposure, the type of ray, the affected tissue, the sensitivity of organ and the age of affected person determine the severity of the potential disease [22, 23].

Environmental factors include everything non-genetic. For example, exposure to soil, ground and surface waters contaminated with chemicals and air, water and food in that residential area is a result of environmental pollution in all communities [24].

2.7. Medicinal Drugs and Naturally Occurring Chemical Carcinogens

Drugs are chemical substances used in medicine with the capacity to treat, prevent or alleviate the disease. Oral contraceptives, hormone replacement therapies, and anti-estrogens are drugs with carcinogenic potential [25].

Plants, fungi, lichens and some bacteria are natural chemicals that have unique pharmacological effects. Humans are exposed to most of these natural chemicals through water and food [26].

3. Cancer Treatment

Chemotherapy, radiotherapy, and surgery are the most widely used methods to treat cancer. In addition, different treatment approaches such as hormone therapy and biological methods can be used alone or as a complementary treatment with other methods [1]. Cancer treatment varies depending on the type, placement, and stage of cancer and the individual's general health and other factors [2]. The purpose of modern medicine is to prevent cancer. As the prevalence of cancer increases, its social and financial burden also increases [1].

3.1. Chemotherapy in Cancer

Despite the advancements in cancer treatment, chemotherapy is one of the common methods used alone or with other treatment methods [27]. However, chemotherapy may damage healthy cells while preventing the growth and proliferation of cancerous cells, which is known as side effects associated with chemotherapy [28, 29]. Cancer progression, treatment, and treatment toxicity have significant local and systemic effects (intestinal and oral mucosal epithelium, hematopoietic cells in bone marrow, hair follicle cells, etc.) on all systems [30].

4. Side Effects of Chemotherapy and Nursing Care

Oral Mucositis: It is a side effect identified in the late 1980s, developing in about 40-50% of patients treated with chemotherapy, manifesting itself with the inflammation of oral mucosa and accepted as a sign of leukopenia. The term “oral mucositis” or “buccalmucositis” is used in the international literature [31]. The oral cavity is sensitive to the direct and indirect toxic effects of chemotherapy. This is induced by a number of factors including high cell-turnover rate of oral mucosa, complex and diverse microflora of oral cavity and oral tissue trauma during normal oral function [27]. Mucositis may manifest itself as erythema, edema or ulceration which can be accompanied by effects ranging from a mild burning sensation to large and painful ulcers that worsen the patient's quality of life and limit basic oral functions such as speech, swallowing of saliva or eating. Its maximum expression is observed 7-10 days after chemotherapy and erythema progresses toward ulceration. This is a period when the patient feels great pain and discomfort and requires the administration of opioids and changes in diet in most cases. Then, mucositis gradually regresses 2-3 weeks after the administration of treatment, without leaving any scars, provided that the patient does not develop bone marrow suppression [31].

The main objective of mucositis treatment is to determine the risk factors and take preventive measures. Age and gender, genetic factors, poor oral hygiene, acute or chronic periodontal disorders, infections, malnutrition, therapy-induced dryness of mouth, dysfunctional salivation, suppressed immune system and smoking-alcohol consumption are patient-related risk factors that influence the development of mucositis [32]. The purpose of care is to mitigate the effect of oral microbial flora and prevent the development of opportunistic infections. It is recommended to avoid hot or cold foods, sour or spicy foods, fizzy drinks, alcohol and smoking which may irritate mucosa [28]. Following the formation of mucositis; oral care should be continued, antiseptic and analgesic mouthwashes should be used and, in the case of severe pain, narcotic analgesics should be administered. Also, nutritional support must be given to patients with undernutrition resulting from mucositis [32]. Close follow-up and

assessment are highly important as weight loss, lack of appetite, cachexia, and dehydration may develop during the care of patients with mucositis. Patients should be evaluated within the week following the administration of chemotherapy and patients and families should be informed on the results of this evaluation [33, 34].

Nausea-Vomiting and Lack of Appetite: All fundamental factors that cause vomiting were explained in the early 1950s. Nausea-vomiting induced by chemotherapy is related to a significant reduction in quality of life, which is perceived by patients as a negative effect of the therapy [35, 36]. Nausea-vomiting induced by chemotherapy, the most commonly reported side effect, is observed in 38-80% of patients receiving cancer treatment and its severity varies from patient to patient [37]. Lack of appetite, on the other hand, refers to weight loss as a result of less intake of nutrients than an individual's metabolic needs. Lack of appetite and irregular and insufficient intake of food are among the most challenging side effects of cancer observed in about 54% of cancer patients [38]. Uncontrollable nausea and vomiting has negative effects not only on fluid and electrolyte imbalance, dehydration, anorexia, weight loss, decreased absorption and renal excretion of the drug but also on the social life, work-life, daily life activities and psychological state of the individual [33]. During patient care; antiemetic drugs should be administered following the administration of chemotherapeutic drugs and at least half an hour before each meal, fluid and well-tolerated soft foods should be provided to reduce nausea, body weight, fluids taken in and discharged out of the body and electrolyte values should be monitored, patients should be told that breathing through the mouth is better during nausea and vomiting, and relaxation techniques should be used before and during the therapy [33, 38].

Pain: Pain is one of the most common and challenging symptoms in cancer patients. Pain may result not only from cancer but the therapy may also lead to chronic pain [39]. 1/4 of diagnosed cancer patients, 1/3 of patients under ongoing treatment and 3/4 of advanced-stage patients experience pain [40]. Pain, as defined by the International Association for the Study of Pain (IASP), is "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage." [41]. Pain may cause increased discomfort, anxiety and depression, insomnia, fatigue, lack of appetite in patients and may have a severe effect on the patient's self-care skills, daily activities, and communication with family and friends [40, 42]. Since pain is subjective, "Analgesic Ladder" is frequently applied as a therapy algorithm as part of the Cancer Pain Relief program recommended by the World Health Organization [41]. In ladder therapy, the aim is to choose a step based on the severity of pain, prefer oral administration initially, and use agents that will take the pain under control throughout the day, ensure that the treatment is personal and pay attention to details. Mostly, non-opioid analgesics such as paracetamol and non-steroidal anti-inflammatory drugs (NSAID) alone or in combination are used in the first step and if this fails to relieve the pain, the next step is applied. In the second step, a mild or mild-to-moderate analgesic such as codeine is added to the treatment described in the first step. If the pain continues, the third step is applied and the mild opioid is replaced with a strong opioid such as morphine and patients are titrated to a pain-relieving dose in order to prevent the formation of pain [43, 44]. Pain management requires an evaluation with a multidimensional and multidisciplinary approach and then the use of pharmacological and non-pharmacological therapeutic strategies [42]. Because of the effect of pain on the patient's physical and psychological symptoms, functionality and comfort should be evaluated and the patient's false information and fears, if any, should be eliminated [33, 38].

Bleeding Risk: Bleeding occurs as a result of the reduced capacity of platelet production due to the bone marrow suppression caused by chemotherapy drugs [38]. The most common cause of bleeding is a reduction in the number of circulating platelets below 100,000 mm^3 and the most common bleeding sites are skin, mucous membranes, intestines, brain, urinary and respiratory tracts [33]. Patient should be monitored for bleeding signs, necessary precautions should be taken against the risk of reduction, patient and relatives should be informed on the importance of maintaining skin and mucous membrane integrity, soft toothbrushes should be used in dental care, electric shaver should be used, no invasive procedure should be performed unless necessary, non-adhesive humid wound adhesive products should be used in procedures and clothing that prevent trauma and irritation should be recommended [33, 38].

Infection Risk: An infection occurs when a microorganism enters the human or animal body in some fashion, settles and multiplies there. Organisms that cause disease are usually viruses, bacteria, rickettsia and fungi which are also the agents that often lead to infection in cancer patients. Methods applied to treat cancer patients and occasionally the disease itself cause immune insufficiency [45]. Some chemotherapy drugs damage the bone marrow functions, reduce the ability to generate new cells and the number of leukocytes decreases as a result of rapid cell death and, thus, the number of neutrophils decreases [33, 38]. Neutropenia occurs 7-14 days after the chemotherapy application [38]. A reduction in the count of neutrophils below 1000mm^3 increases the risk of infection [33]. Fever which is the most significant sign of infection is the most important and sometimes the only symptom of infection particularly in neutropenic patients [30]. During patient care; patients should stay in single rooms, if possible, and the number of visitors should be restricted, patients should be monitored for any sign of infection, skin integrity should be preserved, daily hygiene requirements should be fulfilled, aseptic techniques should be followed in all invasive procedures, daily leukocyte (especially the count of neutrophils) value should be monitored, the physician should be informed of suspicious circumstances and culture samples should be taken where necessary, precautions should be taken to prevent constipation, raw or undercooked meat, seafood, eggs, and insufficiently-washed fruit and vegetables should be avoided, patients should be helped with their deep breathing and coughing exercises, activities that are appropriate for their health status should be planned, flowers and plants should be avoided [33, 38, 45].

Constipation and Diarrhea: Constipation and diarrhea are not diseases; they are symptoms varying from person to person, described in different ways and generally developing secondarily to another disease. ***Constipation*** refers to experiencing one or more of the symptoms of hard feces, decrease in the number of defecation, need for intense straining when defecating, sensation of incomplete evacuation in bowels, insufficient defecation, pressure on the anus or near the vaginal area, insertion of fingers or spending long times in the toilet [46]. The prevalence of constipation has been reported to be 40-64% in patients with cancer receiving palliative care, and 70-100% in patients receiving cancer treatment [47]. ***Diarrhea*** is defined as abnormal, watery, lose defecation more than 3-4 times a day, whose quantity varies depending on age and dietary factors (more than 250-300 millimeters) [46]. Constipation and diarrhea develop in cancer patients due to many reasons [38]. In patient care, factors that cause both conditions should be determined and bowel habits should be assessed through regular monitoring. In constipation cases, a prophylactic bowel protocol can be initiated in patients with risk factors on doctor's advice. Rectal administration (using suppository, enema) should be avoided in neutropenic and thrombocytopenic patients and special attention should be given to hydration in patients suspected to have an intestinal obstruction. In diarrhea cases; its onset, frequency, content,

and duration should be followed up and fluid-electrolyte losses, abdominal pain, debility and fever signs of patients should be evaluated, daily weight and vital signs of patients should be monitored and patients should be informed on emergencies (fever above 38°C, bloody stool, acute abdominal pain and cramps, occurrence of distension, sensory loss, dizziness, debility, confusion, excessive thirst, dark urine, potential dehydration signs) [38, 46].

Disturbance of Sleep Pattern and Fatigue: Sleep is the most important indicator of overall health and well-being [48]. ***Insomnia*** is defined as difficulty in falling asleep, frequent night-time awakenings, early waking in the morning, having nightmares, difficulty in getting out of bed and may affect the problem-solving skills of individuals, hinder their positive coping strategies and impair their adaptation to new circumstances [49]. The frequency of sleep disorders in cancer patients is reported to be between 30-58% [50]. Another symptom related to sleeplessness is fatigue. ***Fatigue*** is a problem that has a physical, emotional and cognitive impact on the individual and prevents them from carrying out daily life activities [51]. Reported fatigue rate of 80% for patients receiving chemotherapy [52]. Cancer-induced fatigue is a more serious problem compared to the fatigue experienced by healthy individuals. The patient does not feel relaxed after resting, which is one of the symptoms observed in cancer patients as a result of the disease and the treatment [49, 53]. Fatigue is often associated with the type and quantity of the treatment administered, anemia, weakness in muscles, other concurrent diseases, insomnia, emotional problems and pain [51, 53]. One of the most significant factors in this chapter is to identify insomnia and fatigue problems [49, 51]. In insomnia management, patients and their relatives should be informed on the effect of treatments on the sleep pattern, importance of maintaining the sleep hygiene, management of symptoms that cause insomnia (such as pain, nausea, vomiting), use of body-mind practices that are effective in coping with insomnia (massage, reflexology, music therapy, art therapy, progressive muscle relaxation exercises, yoga, warm shower and tools to help with sleep (such as cool thin pillows used by breast cancer patients) and in which cases they should go to a health institution [49]. In the management of fatigue, the care should be planned by taking the patient's individual characteristics into consideration and the patient should be taught the necessity and importance of being active during the day, having a regular sleep pattern, consuming an adequate and balanced diet, learning to cope with stress and negative feelings using relaxation techniques, maintaining the social relationships and attending various activities and going to a health institution in challenging circumstances [51,53].

Alopecia: Chemotherapy affects both carcinogenic and non-carcinogenic cells. Alopecia occurs as a result of a change in hair follicles and although not life-threatening in chemotherapy patients, it affects their body image, self-confidence, family and social life and is one of the most common symptoms [53, 54]. Hair is an object associated with personal maturity and stages of life for many individuals and plays a major role in sexual life. Hair loss is associated with the aging process as well as the loss of sexuality, decreased personal attractiveness, being sick and dying. Socially, hair loss leads to the loss of sense of self, lower social status and destruction of personality and may cause such thoughts and feelings as anger, sadness, embarrassment, and fear of getting rejected [53]. Hair loss generally starts 2-3 weeks following chemotherapy and hair regrows within 8 weeks after the end of therapy [33]. Patients should be advised to cut their hair as short as possible and told that hair loss is a temporary side effect, their hair will regrow and only its structure might be different. Their thoughts and opinions about it should be received, they should be given the opportunity to express themselves and supported in

controlling and dealing with signs such as sadness and hopelessness that may be felt due to the change in body image [53]. The use of wigs can be recommended [54].

Extravasation: It is a condition that occurs when the intravenously infused chemotherapy agent inadvertently leaks to the surrounding tissues rather than the intravenous space. Extravasation may occur with either a peripheral catheter or central venous tools and may lead to more injury [54]. Tissue injury due to extravasation is affected by such factors as the intensity of the chemotherapy agent, the amount of fluid leaked into the tissue, the duration of tissue's exposure to the drug and the site of extravasation. In addition to these factors, the patient's characteristics, as well as many other factors related to the clinical process, affect the development of extravasation [55]. Especially patients and their caregivers should be informed on monitoring and reporting the local pain, swelling, temperature increase, changes in the skin that may be observed on the intravenous administration site. Patients should be followed up by taking the chemotherapeutic agent's necrotizing capacity into consideration (if vesicant extravasation has developed, the site should be monitored for 24 hours at 8-hour intervals and the follow-up should continue for a week until the symptoms subside). Furthermore, the nurse should evaluate the patient-induced problems and the patient's anxiety level and plan the procedures. In addition, the chemotherapy follow-up should be recorded in the nurse observation chart and protocols for hot and cold applications after potential extravasation should be prepared and hung in places easily accessible to everyone. Leaflets explaining what can be done in the first 48 hours of extravasation and phone numbers to receive consultancy should be available in the therapy units. Nurses and healthcare professionals in charge of the treatment and management of cytotoxic agents should have up-to-date information to manage the risk of vesicant and irritant drugs. Standards should be developed and a risk management procedure should be organized for the management of vesicants [55]. Patients with extravasation should avoid wearing tight clothes, shoes, socks, belts, accessories and rough fabric and walking outside in open shoes or barefoot. Dressings should not be too tight, extremely adhesive bandages should not be used and patients should be trained to not use strong chemical detergents and bleaches, irritant detergents and bleaches and other chemical agents, utilize protective gloves if chemicals have to be used, protect their hands in physically demanding activities, avoid direct contact with vapour, protect the protruding bone sites against any frictions, use sunscreens before going out, consume at least 8-12 glasses of water daily per day unless there is a hindrance and eat food rich in protein, B and C vitamins [38].

***Changes in Behaviours-Mood*:** Cancer is one of the leading health problems of our age. Cancer is perceived as a chronic disease that involves helplessness and ambiguity, brings to mind death in suffering and pain, arouses the feelings of guilt and anxiety, panic and chaos [56]. Although the survival rates of patients have increased thanks to the advancements in the diagnosis and treatment of cancer, physical and psychosocial disorders impair the adjustment mechanism of patients and have a negative impact on their expectations regarding the future [53, 56]. Psychological symptoms observed in patients treated with chemotherapy affect the individuals negatively and decrease their well-being [53]. Changes in behaviours and moods of cancer patients may result from a great number of factors including admission to the hospital, surgical intervention, progression of the disease, prolongation of the treatments, lack of social support, living alone, having conflicts with family members, financial problems, inadequate access to healthcare services, having a young/dependent child, having disease or treatment-induced symptoms. Such problems should be detected in the early stages and managed effectively before they become chronic [57]. It is highly important to determine how the cancer patients perceives their disease and the factors affecting this perception in order to mitigate the patient's

psychological anxiety and pain, ensure their adaptation to the therapy, increase their quality of life, help them to express their feelings and support them in coping with the multidimensional crisis caused by the disease in a healthy manner [58]. Individuals should be supported to share their anxiety and fears about the disease and the future, they should express positive feelings about themselves, they should be given strength to cope with their illness and associated negative feelings, social support systems should be used, they should be encouraged to participate in motivating activities, the appropriate conditions should be established to help them to live their religious beliefs and share them whenever they wish [38, 56]. Since disagreement is present among patients, patient's relatives and doctors carrying out the treatment about informing the patients on their medical diagnosis, there are still ongoing discussions on this problem [58].

Sexual Problems: Sexuality is a concept with biological, psychological and sociological aspects that are affected by the cultural structure. Individual's perceptions of sexuality and sexual behaviours are influenced by family, society, value judgments, customs, and traditions [59]. Sexual health refers to the state of physical, psychosocial and sociocultural well-being in relation to sexuality, free expression of sexuality, having and maintaining an informed, safe and responsible sexual life based on mutual respect in sexual relations [60]. In cancer cases, the four important components of sexual health which are body image, gender role function, sexual functions, and reproductive ability may be impaired due to the disease and the treatment [61]. The side effects of cancer drugs may limit the sexual activity and cause such problems as reduced sexual desire, sexual arousal disorder, difficulty in orgasm, erectile dysfunction and ejaculation problems in men and dyspareunia associated with vaginal dryness in women [60]. All patients diagnosed with cancer should be informed about the changes in sexuality starting from the diagnosis until before the therapy is started. Sexuality is a highly sensitive subject that should be approached with a non-judgmental attitude in cancer patients. The main objective should be to increase the quality of life of the patient and his/her spouse. In order to help the patients, healthcare professionals should identify their own thoughts and feelings, values and beliefs regarding sexuality and be careful to not reflect their feelings toward the patients [59]. It should be remembered that each patient and their family is unique, a strong communication based on mutual trust should be established with the patients and their spouses, and they should be assured that the confidentiality and secrecy of their meetings and medical records will be maintained. Since the patient’s culture, beliefs and values affect his or her sexuality and sexual functions, healthcare staff should be knowledgeable thereon, the history of sexual function should be obtained in a suitable environment after the approval of both spouses is received [38, 60].

5. Conclusion

In a detailed literature review, it has been observed that cancer patients generally do not have sufficient knowledge about their condition and are not actively engaged in their own care. Cancer patients are often faced with new needs that are beyond their skills and knowledge throughout the therapy process and thus need training and advice more than ever. Nurses should help patients to learn the healthcare practices so that they can regain and maintain their health, determine the patient's needs and arrange the care schedule to ensure that the patients can cope with their limitations and improve their existing skills, and have the patients engaged in their own care. The patients' self-care ability will contribute to their adaptation to the therapy.

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6. References

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Review Article

SOCIAL DETERMINANTS AFFECTING UTILIZATION OF MATERNAL HEALTH SERVICES IN AFRICA: A NARRATIVE REVIEW OF THE EVIDENCE

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Abstract: *Despite improvements in maternal health, Sub-Saharan Africa countries still experience high maternal deaths. The provision of quality maternal health services has been adopted as a key strategy to reduce maternal mortality. However, low utilization rates and inequitable access to maternal health services across the region continue to hinder progress. The objective of the study was to synthesize evidence on the social determinants of maternal health services utilization in sub-Saharan Africa. A narrative review of peer-reviewed articles published between 2010 and 2019 was conducted. Peer-reviewed published studies were electronically searched from databases using search terms covering access and use, social determinants, maternal health services, and sub-Saharan Africa. Data were qualitatively analyzed, and results summarized using the World Health Organization's Social Determinants of Health Framework. A total of 36 studies were reviewed. The study identified several social determinants that act as barriers or facilitators to maternal health utilization. Factors identified include socioeconomic status, educational level, women's autonomy, urban residence, gender norms, geographical proximity, access to media, high social capital, social support, exposure to media and functional health system. Maternal healthcare utilization is still low in sub-Saharan Africa and it reflects disparities according to socio-economic status and rural/urban residence. Programs and interventions to improve maternal health should target social determinants that create inequalities in society.*

Keywords*: Sub-Saharan Africa, maternal health, utilization, social determinants*

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1. Introduction

Globally approximately 303, 000 women died in 2017 as a result of complications from pregnancy and childbirth[1]. Sub-Saharan Africa accounts for the largest proportion of global maternal deaths. In 2017, the region alone accounted for roughly two-thirds (196 000) of all maternal deaths[1]. Furthermore, significant disparities in access and utilization of health services exist within and across countries[2]. The major causes of maternal deaths include postpartum hemorrhage, eclampsia, preeclampsia, puerperal sepsis and unsafe abortion[3]. Most of these deaths can be prevented with adequate access to quality maternal health services such as antenatal care, skilled delivery and postnatal care[1]. However, coverage of maternal health among African countries is still low. Less than half of

women in the region receive the recommended number of antenatal care visits and large disparities also exist between different population groups[1]. Achieving the 2063 Africa Agenda, the Sustainable Development Goals (SDGs) targets to reduce MMR to 70 per 100,000 live births and attaining 90% coverage of routine maternity services by 2030 will require focused strategies to address inequitable access to available healthcare services and health outcomes[1].

Although maternal mortality has declined in most sub-Saharan African countries, health disparities still exist according to socio-economic status, geographical region, ethnicity and place of residence. These factors are included in the World Health Organization's (WHO) Social Determinants of Health (SDOH) framework[4]. The framework consists of three levels(the socio-economic and political context that includes governance and public policies; social and structural determinants that include income, education, employment and ethnicity; and intermediary determinants such as health systems, distance to health facilities, social support, care-seeking practices, age and access to quality services[4]. The framework can be used to determine factors that shape inequalities in the use of maternal health services in sub-Saharan Africa. Furthermore, the framework is crucial in closing gaps and identifying areas that need intervention. This will enable the design and provision of maternal healthcare as acceptable by women from different population groups. The provision of quality maternal health services is one of the strategies to reduce maternal mortality under international agreements and is the most important part of the Sustainable development agenda to be achieved by 2030. Therefore, the purpose of this study is to synthesize current evidence on social determinants of access and utilization of maternal health services in Sub-Saharan Africa that can help in bringing the change in the existing situation.

2. Materials and Methods

A narrative literature review was conducted using the SDOH conceptual framework. Studies were retrieved from Science Direct, PubMed, Cochrane and Wiley Online Library. Full-text articles were assessed, and if found suitable were included in the review.

2.1. Search Strategy

Key terms were used to search for articles across the databases. They were grouped into four broad categories: i). terms that describe the type of maternal health services "maternal health", "antenatal care", "prenatal care", "postnatal care", "skilled birth attendant", "delivery", "obstetric care" (ii) access and utilization: "utilization", "access", "use", "barriers", " facilitators" and "decisions" (iii) terms that represent the determinants: "factors" and "determinants" (iv) terms that describe the place of study: "Sub-Saharan Africa", "Africa", "African countries". The search terms were combined using the Boolean characters "AND" and "OR".

2.2. Inclusion and Exclusion Criteria

Peer-reviewed papers on factors/determinants affecting maternal health services utilization were identified. These include antenatal, skilled delivery, postnatal or a combination of these services. Only studies done in any country and/or countries in sub-Saharan Africa per World Bank categorization were included. Studies were included in this review if they were published in the English language and after the year 2010. Qualitative, quantitative and mixed-method studies using both primary and secondary data were eligible for inclusion. Studies in a language other than English were not considered in the

review. Non-peer reviewed, commentaries, letters to the editor, theses, policy reports, conference posters, and presentations were also excluded in the analysis.

2.3. Data Extraction and Analysis/Synthesis

A template was developed in Microsoft Excel to allow for easy management and identification of selected papers. All selected papers were assigned a unique identifying number for ease of reference. Each selected article was reviewed and key findings were extracted into the template including author(s), year of publication, the country/region the study was carried out, data source, study subjects, maternal health service (antenatal, delivery or postnatal), study design and summary findings. Based on previous studies the review followed the SDOH framework to report its findings[5]. In reviewing each article social determinants of health were identified and categorized into barriers and facilitators.

3. Results

A total of 36 studies met the eligibility criteria and were included in the narrative analysis. The majority (25) focused on the socio-economic position including education and income level. Sixteen studies focused on gender and cultural factors while eleven studies focused on health system-related factors. Both material circumstances and behavioral and biological factors were discussed in a total of nine studies. Table 1 shows a summary of studies reviewed according to each social determinant. No studies on macroeconomic frameworks and political contexts were included in this review.

3.1. Structural Determinants

The SDOH conceptual model identifies education, income, occupation, gender, ethnicity, culture and societal values as structural determinants of health. According to the framework income, education and occupation shape socio-economic position. Generally, women of higher socio-economic position i.e. high educational level and income have better access to maternal health services while women with low socio-economic positions report low use of health services[6]. Most of the studies included in this review reported income, education, and occupation in a similar context, so we used education as a proxy for income and occupation

3.1.1 Education and Literacy level

Educational level is closely linked to an individual's social status through income and occupation[4]. Education influences information, knowledge and health-seeking behavior[4]. Most studies found out that women with higher education are more likely to use maternal health services[6]. A study in Uganda found out that women with secondary or higher education used maternal health services five times more than uneducated women[7]. Furthermore, in Ethiopia husbands' occupation and level of education are associated with institutional delivery[8]. On the other hand, low education and illiteracy act as barriers to maternal health service utilization. In Eritrea women with husbands without any formal education were less likely to deliver in health facilities[9].

3.1.2 Wealth status

Numerous countries in sub-Saharan Africa are offering free or reduced user fees for maternal health services to increase utilization rates. However, associated indirect costs that include food, accommodation and productive time lost from work preset high costs that result in the non-utilization of maternal health services. Belonging to a higher wealth quintile was a positive factor for utilizing

maternal health services. A study conducted in Namibia reported that high household wealth was positively associated with all indicators of maternal health services.[20] Another study reported that women from the wealthiest households were six times more likely to use antenatal care compared to women from poorer households[8]. In other studies, women from wealthier households were employed and possess health insurance which facilitated the use of maternal healthcare[7], [8], [9]–[16]. Women from families in the lower wealth quintiles, on the other hand, had higher home deliveries. A multi-country study concluded that 70% of all births from women belonging to poor households took place at home without a skilled birth attended[10]. Women from the lowest quintile experienced financial difficulties and ended up giving birth at home since they had to pay for transport, part of maternity user fees, food and accommodation[9],[12],[21].

3.1.3 Gender, Social and Cultural Values

Gender norms present barriers to women's access to maternal health services. Some African women often have limited autonomy and control over their health. Autonomy and decision making power facilitate the use of health services[12],[13],[16]–[19],[22]–[24]. Studies conducted in Ethiopia[16], Tanzania[22] and Nigeria[17] found a strong association of community-level women's autonomy and maternal healthcare service utilization while others found a weak relationship[23]. On the other hand, lack of power to make decisions[25], no one to assist at the onset of labor at night[18], heavy workloads especially in the rainy season[18], [19], gender-based violence, lack of women empowerment[18], [19], lack of spousal support, lack of support from family and community, require permission from husband or family[19], [21] and health workers' attitudes towards women[12] are gender-related barriers identified in the review. A study in northern Nigeria reported cultural norms that disempower women as contributing to the low utilization of health services[17]. Furthermore, in Africa, some cultural and traditional beliefs are contrary to modern medical practice[19], [24]. Throughout, Africa cultural practices that include child marriages[22], home deliveries[27],[28], social stigma against unmarried women[26], women unable to make decisions[25], preference of traditional healthcare[21], [27], taboo for husbands to get involved in pregnancy issues[29] and strong cultural desire for large families[29] limits women access to health services. In studies in Ghana and Gambia married women with big family sizes were overwhelmed with childcare, household and agriculture tasks which left them with inadequate time to visit health facilities[19], [37]. However, the involvement of male partners significantly increases the use of maternal health services[26].

3.1.4 Ethnicity and Religion

Studies conducted in Nigeria[13], Ghana[28] and Uganda[7] showed that Muslim women had low usage of maternal health services. Barriers faced by these women were linked to religious obligation of maintaining body sanctity through modest dressing and the avoidance of unlawful body exposure or contact with male caregivers[24], lack of privacy in health facilities [28], healthcare providers' insensitivity[30] and insufficient knowledge to meet Muslim women's maternity care needs[27]. The effect of ethnicity on maternal health services utilization showed both positive and negative effects. In a study in Nigeria, women in communities with a high proportion of women from different ethnic groups had a lower likelihood of delivering their babies in a health facility. Furthermore, women from minority ethnic groups tend to use maternal health services more than women from major ethnic groups[13].

3.2. Intermediary Determinants

According to the SDOH conceptual model, intermediary determinants include material circumstances, social capital, biological and behavioral factors, psychosocial factors and health system factors. The main intermediary factors identified in this review include poor health infrastructure, access to quality health services, distance to health facilities, poor road conditions and access to transportation, geographical remoteness, age, parity of women, marital status, spousal support, support from family, exposure to media and strong social networks.

3.2.1 Health System Factors

Several aspects of the healthcare system have an impact on women's utilization of health services. The most common health system barriers identified in the review include insufficient health infrastructure especially in rural areas[31], limited birth choices[28], facilities that close too early[36], absence of female health provider[36], lack of privacy at healthcare facilities[27], [28]. Unpleasant past experiences such as rudeness, scolding and health workers and service providers' negative attitude and behavior towards women discourage the use of health services[12], [28], [31], [34], [35]. Good quality of antenatal care services that include adequate skilled maternity services, counseling on birth preparedness, availability of transport and emergency equipment were closely related to high utilization rates[32], [33]. A study in Ghana showed that limited and unequal distribution of skilled maternity care services was an important health system barrier[28]. Health system based satisfaction factors such as less waiting times, free maternity services, availability of waiting homes, polite and friendly service providers and adequate information for women were closely associated with the use of maternal health services[31],[32]. On the other hand, poorly organized health systems that include the absence of proper referral systems deter women from delivering in health facilities[25]. Health system based costs arising from maternity user fees, blood transfusion and emergency referrals presented barriers for women especially from poor backgrounds from visiting health facilities[36]. In other studies, the removal of user-fees[12], better or perceived good quality of health services[32], friendly service providers and health staff[12] encouraged women to utilize health services.

3.2.2 Biological and Behavioral Factors

Behavioral and biological factors that include young age and low parity were closely associated with healthcare utilization[29]. A study in Swaziland reported that women aged 15-34 tend to give birth in institutions, though this trend declines as women grow older[29]. Higher parity women usually rely more on their experiences and seek maternal healthcare from traditional birth attendants[29]. On the other hand, biological factors such as high parity[36], unmarried[15], second and higher-order births[36], act as barriers to health utilization. Tsawe et al. reported that women in Swaziland with higher parity(6 or more children) were less likely to utilize maternal healthcare services[29]. Similarly, in Nigeria women aged 25–34 years and unmarried women were more likely not to use health services[15]. Cohabitating women[37] and women who use contraceptives[8] were more likely to utilize maternal health services. In some countries, maternal health services utilization was determined by women's previous experiences, for instance, women's knowledge and experience of pregnancy complications[19].

3.2.3 Material Circumstances

Material circumstances identified in the review include the place of residence, exposure to media, road networks, and transport systems. In Uganda women who lived in rural areas were more

likely to utilize maternal health services compared to those in urban areas[7]. Furthermore, the review identified distance to health facilities[25],[35], poor road networks and conditions, absence of a well-organized transport system[24], [25],[28] and indirect and direct costs[35] as barriers to accessing maternity services. Geographical remoteness, absence of appropriate care and emergency transport are the barriers to seeking maternal healthcare[8], [24], [29], [38]. Material factors that facilitate the use of maternal health services include coverage by health insurance[39], exposure to media[24], [29], [34], urban residence[38], [39] and shorter distance to clinics[7].

3.2.4 Psychosocial Factors and Social Capital

Factors such as availability of support[12], the network of friends to provide social, informational and physical support[12],[34],[40], satisfaction with health services[41], perceived quality and subjective norms[35], husband support/involvement[40], women's fear of developing pregnancy-related complications[12] positively influenced the use of maternal health services. Studies in Tanzania, Ethiopia, and Cameroon showed that women who belonged to and participate in large social networks used maternal health services frequently[22], [40],[42]. In Zambia, perceived psychosocial barriers and subjective norms concerning the quality of maternal health services are a barrier to health utilization[35].

4. Discussion

We have conducted a narrative literature review of the social determinants of maternal health services utilization in Sub-Saharan African countries. The review showed that the use of maternal health services is influenced by a complex of interrelated structural and intermediary determinants as explained by the WHO social determinants of health conceptual framework. Structural determinants that acted as facilitating factors to health utilization include high household wealth, higher education, women autonomy and advantage ethnicities[7],[10],[11]. On the other hand, structural determinants that acted as barriers to healthcare utilization include low education, illiteracy, poverty, marginalized ethnicities, unemployment and lack of decision making power within the family [24], [28],[35],[38]. Furthermore, the intermediary level determinants that acted as barriers to healthcare utilization were poorly organized healthcare systems, insufficient infrastructure, rural residence, long-distance from health facilities, poor road networks, and transport systems, rude and disrespectful service providers[8], [27],[28],[29],[34], [35]. Despite an increase in utilization rates across the region, we found strong and consistent evidence showing that the use of maternal health services is still low among the poor, uneducated, disadvantaged and marginalized women across sub-Saharan Africa[12],[20],[22],[35],[38]

The structural determinants contribute to inequalities in healthcare utilization by limiting women's access to power, money, and resources which are important to access health services[4],[6]. Access to power creates unequal social stratification in society that disempower women which leads to poor utilization of health services[4],[24],[28]. Furthermore, unequal distribution of power, trap women in a vicious cycle of intergenerational poverty limiting their access to resources which are important to access health services. The structural determinants act through intermediary factors such as inadequate health infrastructure, long distance to health facilities, poor quality of health services, poor road networks and transport systems to compound inequalities in maternal healthcare utilization[22],[35], [38].

Structural and intermediary determinants acting as facilitators and barriers are interrelated and create inequalities that influence health utilization through material circumstances, psychosocial and

individual characteristics[4]. Women from different social groups have multiple advantages and multiple disadvantages. Some cultural practices disempower women and leave them vulnerable without the power to make decisions over their health [24],[28]. Compared with rural women, urban women have better access to maternal health services as well as other resources necessary to access these services [24]. The quality of healthcare, health infrastructure, roads, transport networks is poor in rural areas thereby discouraging women from using health services[22]. Furthermore, utilization rates remain highly inequitable according to socio-economic position, geographical remoteness, distances to health facilities and access to social capital. In general, women with a high socio-economic position can afford health costs such as user fees, transport and opportunity costs associated with seeking healthcare[20]. On the other hand, women with low socio-economic position have fewer life opportunities which affect their social status, autonomy and decision-making power on when and where to get health services[16], [12].

Similar to other reviews conducted elsewhere our findings reveal the disadvantage among certain social groups across African countries[5]. This review sheds light on intersectional marginalization and identifies important programs and research gaps. This review has implications for future research and policymaking. Sub-Saharan Africa is undergoing major social, political and economic changes, however, relevant studies focusing on the impact of political and governance factors on utilization of maternal health services were not found. Future studies should look at the impact of different macro-level governance and political frameworks on the social determinants of maternal healthcare. Furthermore, there are numerous research and knowledge gaps that need to be filled to understand the context-specific drivers of inequality in different communities and to inform policy-makers. Our review was not able to estimate the extent of health inequity quantitatively since we took multiple outcome variables and included qualitative, quantitative and mixed methods studies. Future reviews should also quantitatively estimate the impact of health inequity among women from different social groups. Furthermore, our review did not consider other dimensions of maternal healthcare utilization such as tetanus injections and iron supplemental which might provide insight into inequity in healthcare.

The present evidence shows that a 'one size fits all' single approach to maternal health programming might not be a suitable approach considering the inequalities and differences among social groups throughout the region. The current maternal health program is suitable for increasing the overall coverage of health services leaving marginalized groups more disadvantaged. Therefore, more effort is needed to address the various structural and intermediary barriers to accessing healthcare utilization among the poorest, uneducated and rural women. This can be achieved through local-level interventions to promote the use of maternal healthcare services and healthcare system interventions aimed at improving quality of care, referral systems, abolishing user fees and upgrading health infrastructure. Barriers to healthcare utilization should be addressed locally considering the diversity of local communities across Africa. For instance, local governments can address social determinants through improving the road and transport networks to shorten the distance to health facilities and improving health infrastructure and systems according to their contexts.

5. Conclusion

Using the WHO SDOH framework our review has highlighted the structural and intermediary barriers women in sub-Saharan African countries face when accessing maternal health services. The

findings show that inequalities in healthcare utilization reflect inequalities in socio-economic position. Local governments should be given the mandate to develop policies to tackle the structural determinants to improve the socio-economic position of women. Policies should address education for women, local development and economic inclusion for marginalized communities. This helps to overcome practices that limit women's access to decision making power and close gaps between rural and urban areas in terms of transport and health infrastructure. Health services should be tailor-made to respond to the specific needs of women especially those from remote areas and minority groups. Finally, new programs and policies should be formulated to target these social determinants from an African perspective.

Table 1. A summary of social determinants of maternal health service utilization in Sub-Saharan Africa.

Determinants	Facilitating Factors	Barriers	Reference
Educational Level [10]	Secondary or higher education for women/ husband	Low/no education for women, illiterate women, uneducated husbands	[6-10, 18, 24, 29, 36, 45]
Wealth Quintile [15]	Belong to a wealthy family, employed women, formal employment, high income	Women from poor households, unemployed, poor women, rural women,	[7]–[21]
Gender and Cultural [16]	Women's autonomy, the power to make decision making power, desire for large families, bigger household size, availability of a female provider	No decision-making power, heavy workloads, suffer gender-based violence, polygamy, taboo to make pregnancy public husband/family did not allow, no female provider, services not part of customs	[10,11, 25– 29, 12, 15, 16, 19, 21–24]
Ethnicity and Religion [6]	Member of a major or minority ethnic group, a Christian woman	Muslim woman, Traditional African religious believer, Being in a minority ethnic group, cultural insensitivity,	[7,16,24, 27,28,30]
Health System Factors [11]	Removal of user-fees, better or perceived good quality of health services, good attitude of health staff, respectful care, politeness, and competent staffs, equipped health facilities, availability of emergency transport	Cultural insensitivity health services, long queues, limited birthing choices, poor quality of health services, bad attitude of health staff, disorganized health system, user fees, inadequate information, experiences of intimidation in healthcare facilities, lack of privacy	[15, 25, 27, 28, 31–36]
Behavioural and Biological Factors [9]	Older women, use of contraceptives, knowledge of pregnancy emergencies, use of electronic media, single women	Married, polygamous union, high parity, unmarried, experienced more than one birth	[7, 8, 12, 18, 29, 34, 36–38]
Material Circumstances [9]	Urban areas, better health facilities, shorter distance to clinics, availability of money, coverage by health insurance, availability of transport	Rural areas, long-distance from health facilities, lack of means of transport, lack of money, remote regions, expensive services, no baby clothes, poor road networks, and fewer health facilities.	[7, 8, 24, 25,28, 29, 35, 38, 39]
Psychosocial Factors and Social Capital [9]	Satisfaction with health services, husband support/involvement, fear of complications, community, and household support, large social networks exposure to media, information, higher social capital, social participation	Poor perceptions of quality (negative attitude), negative opinion (subjective norms), non- exposure to media, low social capital, unsupportive husband or family, fewer friends, small social network	[15, 24, 29, 34, 35, 40–42]

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Conflict of interests

The author declares no conflict of interest

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Case Report

48 / XXYY MALE CASE WITH PRIMARY INFERTILITY

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Abstract: *Klinefelter syndrome is a sex chromosomal aneuploidies with at least one extra X chromosome than normal male karyotype. The classic form of the 47 / XXY karyotype, the incidence of this syndrome is one in 500-1000 live male births. The incidence of 48 / XXYY male individuals with many phenotypic features of Klinefelter syndrome is extremely rare and occurs in 1: 18000 -1: 100.000 men. However, they differ from Klinefelter syndrome with serious behavioral problems, mental retardation and susceptibility to psychiatric diseases [1]. A 38-year-old man referred to our Medical Biology and Genetics laboratory for karyotype analysis with primary infertility. He had undergone varicocele surgery and had high levels of FSH, low levels of testosterone and high levels of LH. Semen analysis demonstrated azoospermia In the psychiatric examination of the patient, whose IQ level was 90, language, learning and behavior disorder were diagnosed. The patient with deep vein thrombosis was recommended angiography because of right heart failure. Karyotype analysis revealed with 48, XXYY. This rare case shows the importance of karyotype analysis in diagnosis. In this study, the clinical and laboratory findings of the case are presented with the literature.*

Keywords: *Male infertility, 48/XXYY, azoospermia, Klinefelter syndrome*

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1. Introduction

Klinefelter syndrome is the most common chromosomal abnormality observed in the presence of azoospermia in severe male infertility (%10-30) [2]. 11% of azoospermic men and 3% of infertile men have Klinefelter syndrome [3-4]. 48 / XXYY men also have more serious reproductive disorders. These men have a progressive testicular malfunction that causes atrophic testists that cannot produce sufficient testosterone. Androgen insufficiency, gynecomastia, and azoospermia are also common [5]. Most infertile men are diagnosed with infertility during adulthood. Only 10% of males with Klinefelter syndrome are diagnosed earlier than age 14 years. Clinical symptoms in Klinefelter syndrome may be due to hypogonadism caused by the disease or may also be a directly chromosomal abnormality. It can be manifested with learning disability and behavioral disorders in school-age and infertility in

adulthood. It is difficult to detect Klinefelter syndrome in patients with mild signs and symptoms. Clinical features of patients with classic Klinefelter syndrome begin to become apparent during adolescence. The most striking feature in adolescence is that the testicular volume does not increase. Testis becomes hard with the loss of germ cells and fibrosis of seminiferous tubules [6]. 48, XXYY male individuals have many phenotypic features of Klinefelter syndrome, but they are separated from Klinefelter syndrome with the accompany of common psychotic reactions, aggression and mental retardation [7]. The presence of one or more X chromosomes in male individuals results in the presence of testicular dysgenesis and hypergonadotropic hypogonadism [6]. While mental retardation is rare in Klinefelter syndrome, in 48, XXYY syndrome, 26% of the patients have mental retardation and learning disabilities in almost all of them. The IQ levels of 48, XXYY syndrome men ranged from 70 to 80 [1]. It was shown that in each additional X chromosome IQ decreased by an average of 15-16 points and there was no relationship between the extra Y chromosome and the severity of the disease [8]. Also, aggressive behaviors coincide with the psychiatric findings previously described in this syndrome [9].

2. Materials and methods

2.1. Case

A 38 year-old-male whose parents were consanguineous referred to our Medical Biology and Genetics laboratory for karyotype analysis because of primary infertility. According to the information of his family, he had three sisters and three brothers. The family history of infertility was negative. He was married for 7 years and had no children. His 36 year-old-wife had no apparent fertility problem. The couple had one unsuccessful IVF trial. On the physical examination, he was found to be 182 cm tall, weighing 82 kg. The faces of 48, XXYY individuals are generally thin. Hooded eyelids, hypertelorism, epicanthal folds, fifth digit clinodactyly, pes planus and prominent elbows with cubitus varus are other phenotypic features observed [10]. He had a high broad forehead, sloping palpebral fissures, hypertelorism, peculiar nose shape, abnormally shaped maxilla, and mandible, characterized by 'Pugilistic' facial appearance. His physical examination revealed hypertelorism, increased thickness of the neck, acne, sparse body hair, triangular pubic hair distribution, fifth digit clinodactyly, small testicles and penis, and gynecoid pelvis. The result of our patient's brain MRI was observed that the brain volume decreased, the lateral ventricles expanded and gray matter decreased in the temporal lobes. The MRI result is compatible with the literature [11].

In laboratory tests, his spermiogram was azoospermic; on scrotal ultrasonography (USG), the right testicle was atrophic (26 x 10 x 19 mm). Parenchyma was heterogeneous and hypoechoic. Diffuse thickening and heterogeneity increase in the right epididymis. The right testicular volume was measured as 3.5 ccs. The left testicle was atrophic. (23 x 10 x 17 mm). The left epididymis had a normal appearance. There was no bilateral hydrocele. Pampiniform plexuses were normal width. The reflux flow was not detected. He had the following laboratory work-up that included hormone testing: follicle-stimulating hormone: 68.01 mlU / ml (reference 1.5-12.4 mIU/ml), luteinizing hormone: 32.69 mlU / ml (reference 1.7-8.6 mIU/ml) levels and low testosterone levels 1.05 ng /mL (reference 2.18-9.05 mIU/ml). Semen analysis demonstrated normal volume azoospermia. The growth hormone level was low and insulin level was normal. The patient had never received hormone therapy. The results were suggestive for hypergonadotropic hypogonadism and KS was the most possible diagnosis. His Y chromosome microdeletion test was positive.

In the psychological examination of our patient, the Kent Egy test was applied. IQ level was measured as 90 intelligence age 13 and it was at a dull normal level. He started walking at the age of 2 and talking at the age of 3. At the psychiatric examination, language, learning, and mood disorders were noticed. Autistic behavior was not observed.

Figure 1. Facial features in 48, XXYY, syndromes Pugilistic facial appearance. Fifth-digit clinodactyly (and nail-biting), prominent elbows with hyperextensibility.

2.2. Cytogenetic analysis

Chromosomal analysis was performed on phytohemagglutinin-stimulated peripheral blood cultures using standard cytogenetic methods [2]. In the karyotype analysis of the patient with the GTG banding technique, 48, XXYY chromosome establishment was detected.

2.3. Ethical procedures:

This study is approved by Dicle University Research Ethics Committee. Approval number and date: 08/2019; 05.12.2019.

Figure 2. Klinefelter karyotype analysis [48, XXYY]

3. Discussion

The first or second maternal meiotic division may result from the chromosome not being separated or from a mitotoic defect after fertilization. It may also occur as a result of the formation of XY spermiums as a result of the first paternal meiotic division [5]. The extra X chromosome that causes the syndrome is maternal in 54% and paternal in 46% [13]. The majority of cases with maternal origin are due to errors in meiosis I. The remaining ones are mosaic cases originating from meiosis II and postzygotic mitotic errors [14].

48, XXYY individuals have low communication skills. They display an easily angered, impatient and anxious attitude [11]. In the psychological examination of our patient is compatible with the literature, IQ level was measured as 90 intelligence age 13 and it was at a dull normal level. At the psychiatric examination of our patient, language, learning and mood disorders were noticed.

48, XXYY syndrome is a form of hypergonadotropic hypogonadism characterized by long height, aggressive behavior, mental retardation and circulatory disorder [15-16]. 48, XXYY individuals develop increasing tremors with age. Our 38-year-old patient also had increased tremors at night.

Our patient had an adult height of 182 cm. The reason for the tall stature in Klinefelter syndrome is the decrease and delay in testosterone levels [17]. The patient was examined in the cardiology outpatient clinic due to dyspnea problem. Echocardiography showed enlargement in the right heart cavities. CT angiography was recommended with the possibility of a pulmonary venous return anomaly. Men affected by 48, XXYY syndrome are at risk of developing what is seen in the leg, known as deep vein thrombosis (DVD). In our case, skin ulcer formation was observed due to peripheral vein thrombosis. Enlargement and reflux flow were observed in the main, superficial and deep femoral veins.

The important topic of treatment is the treatment of hypogonadism. Especially in patients with low testosterone levels, testosterone replacement is required. It is important to diagnose the patients in the pubertal period as early as possible and start the treatment. Testosterone therapy improves muscle

mass, strength, and endurance, hair growth, bone mineral density, and libido. The patient's mood and self-confidence are significantly improved. Patients who remained untreated have a marked increase in irritability and aggressiveness, as well as weakness, unwillingness. Therefore, we started the treatment of testosterone replacement for our patients. Testosterone replacement therapy eliminates all the negative effects associated with androgen deficiency but does not affect fertility [18]. Testosterone replacement does not provide spermatogenesis. Most Klinefelter syndromes have germ cells with chromosomal abnormalities. Therefore, it is necessary to accurately predict the frequency of abnormal cells when referring to assisted reproductive techniques.

Our case was admitted due to infertile. There is no treatment to cure for spermatogenesis in Klinefelter syndrome. In vitro fertilization (IVF) with intracytoplasmic injection (ICSI) is an option for patients with mosaic Klinefelter syndrome and severe oligozoospermia [19]. In the literature, the probability of sperm extraction by testicular sperm extraction (TESE) method is reported to be between 40-50% and the probability of pregnancy after sperm injection (ISCI) is reported to be 20-25% in patients with Klinefelter syndrome [19]. Unfortunately, our patient could not benefit from assisted reproductive techniques because there was no sign of spermatogenesis.

Gynecomastia is seen in 30% of patients. Therefore, the risk of breast cancer in patients with Klinefelter syndrome increased by twenty percent. Testosterone treatment does not affect gynecomastia [20]. Aesthetic surgery and breast tissue resection should be performed in the required patients. In an adult male who referred to suffering infertility should be considered the possibility of Klinefelter syndrome. Gynecomastia is seen in 30% of patients. Therefore, the risk of breast cancer in patients with Klinefelter syndrome increased by twenty percent. Testosterone treatment does not affect gynecomastia [20]. In our patient, gynecomastia is seen as compatible with the literature.

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Information about the volunteer informed/consent form: In this study, the consent forms have been signed by volunteers.

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

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