

Nursing Guidelines Regarding Safe and Effective Practices of Supplemental Oxygen Therapy among Critically Care Patients

Gehad Fares Mohammed ¹, Hayam Ahmed Mohamed Hassan ² and Ashgan Tolba Fathy ³

(1) Clinical instructor of Medical Surgical Nursing, Faculty of Nursing, Benha University, (2) Assistant Professor of Medical Surgical Nursing, Faculty of Nursing, Benha University and (3) Lecturer of Medical Surgical Nursing, Faculty of Nursing, Benha University.

Abstract

Background: Supplemental oxygen therapy (SOT) is a lifesaving drug when used appropriately and cause harm if used inappropriately. Administering SOT has an essential role in preventing and managing hypoxemia in both acute and chronic conditions. **The aim** of the study was to evaluate the effect of nursing guidelines regarding safe and effective practices of supplemental oxygen therapy among critically care patients. **Research design:** Quasi- Experimental research design (pre-post test) was utilized to achieve the aim of the study. **Setting:** This study was conducted at Intensive Care Unit (ICU) in Benha University Hospital. **Sample:** Convenient sample of (60) nurse from both sex who working in ICU during the time of data collection and agree to participate in this study. **Tools of data collection:** Two tools were used, **Tool I:** Self-administered questionnaire which consisted of two parts to assess **A)** Nurses' demographic data. **B)** Nurses' knowledge questioners about safe and effective administration of supplemental oxygen therapy and **Tool II:** Observational checklist for nurses' practice regarding safe and effective supplemental oxygen therapy administration. **Results:** The study revealed that nurses' knowledge and practice regarding safe and effective supplemental oxygen therapy administration pre guidelines implementation was unsatisfactory level which improved post guidelines implementation, there was high significant statistical positive correlation between nurses' knowledge and their practice regarding safe and effective administration of supplemental oxygen therapy at pre and post implementation of nursing guidelines. **Conclusion:** Nursing guidelines effectively improved nurses' knowledge and practices regarding safe and effective administration of supplemental oxygen therapy. **Recommendation:** Ongoing educational and training guidelines for nurses are needed regarding safe and effective administration of supplemental oxygen therapy and apply the guidelines on large sample selected from intensive care unit at Benha University Hospital.

Key words: Nursing guidelines, Practices, Supplemental oxygen therapy, Critically care patients.

Introduction

Supplemental oxygen therapy (SOT) is administration of oxygen at concentrations greater than that in the ambient air with the intent of treating or preventing hypoxia. It is very useful in managing acutely ill patient and considered an emergency drug for

resuscitation. Oxygen administering depends on the needs of the patients' conditions. If oxygen therapy is given inappropriately, it could be fatal. Hence, patients must receive SOT in an appropriate, safe and comfortable way (*Aloushan et al .,2019*).

The British Thoracic Society guideline for emergency oxygen use in adult patients emphasized the achievement of normal or near-normal oxygen saturation level for the majority of patients in an emergency department or intensive care unit. Therefore, oxygen should be administered to achieve a target saturation of 94—98 % for most critically ill patients or 88—92 % for those at risk of respiratory insufficiency of hypercapnia (*Heartshorne et al ., 2021*).

Although oxygen therapy is lifesaving, it may be associated with adverse effects when administered for prolonged periods at high concentrations. Among these adverse effects are irritation, pain, infection and oxygen toxicity that can occur in any patient who breaths O₂ concentrations of greater than 50% for longer than 24 hours. The central nervous system, respiratory system especially lungs, and eyes are the systems primarily affected with O₂ toxicity. Also increased hospital stays length, higher referral rates to high dependency facilities and an increased risk of death are all the result of inadequate administration of oxygen therapy (*Hochberg, Semler & Brower, 2021*).

Critical care nurses play very important role while administering oxygen therapy, because they should monitor patients linked to oxygen therapy carefully and regularly. Initial investigations such as ABG, Hgb, or Hct, and An X-ray of the chest should be taken on a regular basis and evaluated carefully based on a physician's recommendation (*Lin et al., 2019*). PR, BP, RR, level of consciousness, and pulse oximetry must all be monitored. The nurses should be aware of the physician's prescription for oxygen therapy and check it in, which should include an indication,

target oxygen level, oxygen delivery system, range of oxygen flow or percentage of inspired oxygen and when oxygen is to be administered (*Yassin & Mansour, 2021*).

Significance of the study

Critical care nurses must be well-versed in the administration of oxygen to critically ill patients as well as they should have good knowledge and practice about supplemental oxygen therapy administration for optimal care of the patients in order to improve quality of life of the patient and prevent hypoxemia. The inadequate knowledge regarding oxygen therapy could worsen patient's condition and ultimate outcome especially in critical care situations (*Bizuneh et al ., 2022*).

Respiratory diseases are the leading cause of death and disability worldwide and oxygen is an essential medicine used to treat hypoxemia from respiratory diseases. Currently more than 25 million people in the United States have asthma, approximately 14.8 million adults have been diagnosed with COPD and prevalence of lung diseases has grown globally and nearly 545 million individuals currently live with a chronic respiratory condition, representing 7.4% of the world's population (*Navuluri et al ., 2021*). Also, based on a WHO report every year at least 1.4 million deaths occur due to the lack of supplemental oxygen therapy and inappropriate administration of oxygen (*Zelege & Kefale, 2021*).

In Egypt, most people with COVID-19 develop only mild or uncomplicated illness, approximately 14% develop severe disease that requires hospitalization and oxygen support, and 5% require admission to an intensive care unit. According to study done in Tanta University and Kafr El-sheikh

university isolation hospitals, the top risk variables predicting ICU admission were blood oxygen saturation. Therefore, oxygen is a critical element in the treatment process of COVID-19 patients (*Elsharawy et al., 2021*).

Statistics in Benha University Hospital revealed that patients admitted to intensive care unit during the year of 2019 ranged about 1112 patients and increased into 1184 patients in 2020 and the most of them received supplemental oxygen therapy to improve their health status. So, there is need to provide nursing guidelines to improve nurses' knowledge and practice regarding safe and effective administration of supplemental oxygen therapy (*Benha University Statistical Office, 2020*).

Aim of the study:

The study aimed to the effect of nursing guidelines regarding safe and effective practices of supplemental oxygen therapy among critically care patients.

Research hypotheses:

- 1- Nurses' knowledge score regarding safe and effective practices of supplemental oxygen therapy among critically care patients will be significantly improved after implementing nursing guidelines than before.
- 2- Nurses' practice score regarding safe and effective administration of supplemental oxygen therapy among critically care patients will be significantly improved after implementing nursing guidelines than before.

Subject and Methods

Research design:

Quasi- Experimental research design (pre- post test) was utilized to achieve the aim of the study.

Study setting:

The study was carried out in Intensive Care Unit (ICU) at Benha University Hospital. ICU locates in second floor of the medical building, there is a nurse station at the center of the ICU, it contains three rooms and four centers; each room has two beds, each center contains four beds and it has semiconscious and unconscious critically ill patients. There are another four small rooms which are nursing room, nursing supervisor's room, physicians' room and teaching room.

Sample:

A convenient sample of all available nurses (60) nurse (from both sex who were working at Intensive Care Unit (ICU) at Benha University Hospital during the time of data collection and agree to participate in this study.

Tools for data collection

Two tools were used; Self-administered questionnaire aimed to assess nurses' knowledge & observational checklist to assess nurses' practice.

Tool I - Self-administered questionnaire.

This tool used to assess nurses' knowledge regarding supplemental oxygen therapy. It was presented in simple Arabic language after reviewing recent relevant literatures and scientific references. It consisted of two parts:-

Part I: Nurses' demographic data:

Concerned with assessment of nurses' demographic characteristics related to age, gender, marital status, educational level, years of experience in the field of nursing,

attendance training courses about oxygen therapy.

Part II: Nurses' knowledge questioners: It designed by researcher in form of MCQ questions. It include general knowledge about :

- 1- Respiratory system and its functions
- 2- Factors that affect respiration
- 3- Oxygen therapy and its indications
- 4- Hypoxia and hypoxemia
- 5- Types of oxygen delivery devices
- 6- Contraindications of oxygen therapy
- 7- Risks and complications of oxygen therapy.
- 8- Precautions during oxygen therapy administration.
- 9- How to administrate oxygen therapy in safe and effective manner to critically care patients.

Scoring system: - The score distributed as: one mark for each correct answer and zero for wrong answer, The total score for knowledge was (70) marks. The knowledge scores were converted into a percent and categorized as follows:

- **Satisfactory level of knowledge:** more than or equal 80% of total score (56 marks or more).
- **Unsatisfactory level of knowledge:** Below 80% of total score (Less than 56 marks).

Tool II: - Observational Checklist for Nurses' Practice

It was adapted from (*Perry, Potter & Ostendorf, 2018*), (*Lynn, 2018*) & (*Cooper& Gosnell, 2018*) and modified by the researcher to assess nurses' practices regarding safe and effective administration of supplemental oxygen therapy. This tool was filled two times; the first time pre guidelines implementation, the second time immediate post guidelines implementation.

The observational checklist was distributed as the following: -

***Oxygen therapy administration by nasal canula** the procedure consisted of (23) steps

***Oxygen therapy administration by simple face mask** the procedure consisted of (24) steps.

***Oxygen therapy administration by venturi mask** the procedure consisted of (23) steps.

***Pulse oximeter** the procedure consisted of (18) steps.

***Nebulizer therapy** the procedure consisted of (24) steps.

*** Patient assessment during oxygen therapy** the procedure consisted of (10) steps

-Scoring system: - The score distributed as: one mark for each step correctly done, and zero for incorrectly done & not done, the total practice score was (122) marks .The practice scores were converted into a percent and categorized as follows:

- **Competent** more than or equal 85% of total score (104 marks or more)
- **Incompetent** below 85% of total score (less than104 marks)

Tools Validity

The tools were reviewed by a panel of five experts from Medical Surgical Nursing field at Faculty of Nursing Benha University to test the relevance, clarity of tools 'content, comprehension, understanding, applicability and necessary modification was done accordingly.

Reliability

The investigator used test – retest – methods to test the internal consistency of the tools, by administration of the same

tools to the same subjects under similar condition on two different occasions, testing the reliability of the tools through Cronbach alpha. Tool reliability for self-administered questionnaire that used to assess nurses' knowledge = **0.819**, tool reliability for observational checklist that used to assess nurses' performance= **0.834**.

Ethical consideration

The aim of this study was explained to all nurses and they were reassured that all information was confidential and it was used only for their benefit and for research purpose. Nurses consent to participate in the study was obtained. Nurses were informed that they were allowed to choose to participate or not in the study and they had the right to withdraw from the study at any time.

Pilot study

A pilot study was conducted on 10% of all nurses that were included in the study (6 nurses) from the total number of nurses (60) in order to test the clarity and applicability of the tools.

Fieldwork:

The processes of data collection were performed over a period of six months from beginning of March ,2022 to the end of Augusts ,2022. The process of data collection was achieved through: (pre-test): before implementing guidelines to have baseline assessment about nurses' level of knowledge and performance. (Post-test): immediately and after implementation of guidelines (knowledge& performance). The tools were filled two times; the first time pre guidelines implementation, the second time immediately post designed guidelines implementation.

The study was conducted through four phases.

Assessment phase:

Data collected at morning and afternoon shifts (long day shift) three days/week. Assessment of the nurses' knowledge through self-administered questionnaire (**Tool I**) was given to each nurse to fill it and time required for completion of the questionnaire was ranged from 25- 30 minutes for each procedure.

Assessment of the nurses' practical skills through observational checklist (**Tool II**) was done at time of oxygen therapy administration, the researcher was observing nurses' practical skills about studied procedures, The time needed to complete the checklist ranged between 30-35 minutes.

This assessment (pretest) shed- light and was given more insight about the current knowledge level to help detecting knowledge and practice deficits, as its results was obtained from nurses' self-administered questionnaire and the observational checklist, as well as, literature review.

Planning phase:

The guidelines developed by the investigator according to nurses' needs and deficiencies in their performance. It was written in Arabic language and it was reviewed by the supervisors and the validity was done.

Teaching materials was prepared e.g. discussion, demonstration, video, picture and booklet that helped in covering theoretical and practical information.

Implementation phase:

- Total number of the studied nurses was 60 nurses; they were divided into 10 groups. Each group contained six nurses in every session.
- The researcher was attended three days/week in the morning and afternoon shift.
- The researcher met every group for four sessions: Two sessions for theory and two sessions for performance. Each session ranged between 20-25 minutes, including the period of discussion.
- An orientation to the intervention and its process were presented. Each session started with a brief summary about what had been given through the previous session, then the objectives of the new topics, taking into consideration the use of simple language to suite the level of all nurses' education.
- Discussion, motivation and reinforcement during the intervention sessions were used to enhance learning. at the end of each session the researcher allowed for nurses to ask questions to correct any misunderstanding.

Evaluation phase:

The post test for nurses' knowledge through self-administered questionnaire (**Tool I**) and practice through observational checklist (**Tool II**) was done after giving the nursing guidelines to them by using the same tools of the pretest to determine the effect of implementation of the guidelines.

Comparison was done between the pretest and posttest at the end of the study to determine the effect of implementing nursing guidelines regarding safe and effective practices of supplemental oxygen

therapy among critically care patients.

Statistical analysis

Results were collected, statistically analyzed by personal Computer using Statistical Package of Social Science (SPSS) version 21. Descriptive statistics with mean and standard deviation (SD) for continuous variables and frequency for categorical variables were analyzed. Qualitative variables were compared using qui square test (χ^2) as the test of significance and independent (t) test was used to compare mean score between two groups. Correlation (r) was used to test the correlation between quantitative data.

Statistical significance was considered as the following: -

P value < 0.001 highly statistically significant relation

P value < 0.05 statistically significant relation

P value > 0.05 no statistically significant relation

Results:

Table (1): shows that, more than half 53.3% of the studied nurses aged between 25 to less than 35 years old with a mean age and standard deviation 38.1 ± 9.10 years; females were more prevalent and constituted 75% of the studied nurses. As well, more than half 56.7% of them had years of experience in intensive care unit between 5 to less than 10 years with mean experience of 9.02. Moreover, only 10% of studied nurses attended oxygen therapy courses.

Figure (1): It reveals that, less than half 41.7% of the studied nurses had technical institute of nursing and 20 % had bachelor of nursing.

Table (2): Illustrates that there was a marked improvement in all items of nurses' knowledge about oxygen therapy among critically care patients post implementation of nursing guidelines with a highly statistically significant difference at ($P= < 0.01$) between pre and post implementation of nursing guidelines.

Figure (2) : Shows that, (18.3%) of the studied nurses have satisfactory level of total knowledge about oxygen therapy among critically care patients pre implementation of nursing guidelines. Which improved to (90%) post implementation of nursing guidelines.

Table (3): Clarifies that, there was a marked improvement in total nurses' practice regarding oxygen therapy administration post implementation of nursing guidelines with a highly statistically significant difference at ($P= < 0.01$) between pre and post implementation of nursing guidelines.

Figure (3): Illustrates that, (15%) of the studied nurses had competent level of total practice regarding safe and effective administration of supplemental oxygen therapy pre implementation of nursing guidelines. Which improved to (86.7%) post implementation of nursing guidelines.

Table (1): frequency and percentage distribution of the studied nurses according to their demographic data (n=60).

Demographic data of studied nurses	No.	%
Age (years)		
< 25	12	20
25-<35	32	53.3
≥ 35	16	26.7
Mean ±SD	38.1±9.10	
Range	23-56	
Gender		
Male	15	25
Female	45	75

Table (4): Shows that, there was highly statistically significant relation between total nurses' knowledge pre and post-intervention and their demographic data as age, educational level, number of years of experience in the intensive care unit and attendance of oxygen therapy courses at ($P= < 0.01$). While, there was no statistically significant relation with their gender at ($P= > 0.05$).

Table (5): Reveals that, there was highly statistically significant relation between total nurses' practice pre and post-intervention and their demographic data as age, educational level, number of years of experience in the intensive care unit and attendance of oxygen therapy courses at ($P= < 0.01$). While, there was no statistically significant relation with their gender at ($P= > 0.05$).

Table (6): Clarifies that, there was high significant statistical positive correlation between nurses' knowledge and their practice regarding safe and effective administration of supplemental oxygen therapy at pre and post implementation of nursing guidelines at $p < 0.01$.

Number of years of experience in the intensive care unit		
<5 yrs.	15	25
5-<10 yrs.	34	56.7
≥ 10 yrs.	11	18.3
Mean ±SD	9.02±4.99	
Range	1-32	
Attending oxygen therapy courses		
Yes	6	10
No	54	90
If yes, how many training courses have been attended? (n=6).		
One	4	66.7
Two	1	16.7
Three	1	16.7
More than three	0	0.0
How long has the last training courses been taken? (n=6).		
Six months	1	16.7
More than six months	5	83.3

Figure (1): Percentage distribution of the studied nurses according to their educational level (n=60).

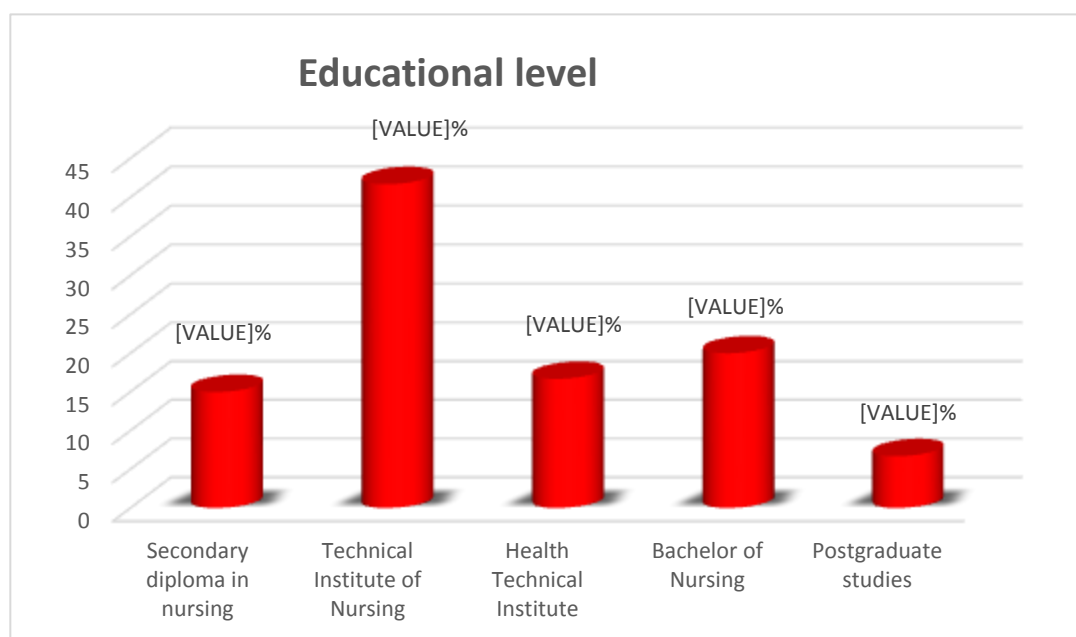


Table (2): frequency and percentage distribution of the studied nurses regarding their knowledge about oxygen therapy among critically care patients at pre and post implementation of nursing guidelines (n=60).

Total knowledge items	Pre intervention				Post intervention				X ²	p-value
	Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory			
	No.	%	No.	%	No.	%	No.	%		
Respiratory system and its functions	27	45	33	55	58	96.7	2	3.3	23.69	0.000**

Factors that effect on respiration	12	20	48	80	54	90	6	10	31.20	0.000**
Oxygen therapy and its indications	12	20	48	80	58	96.7	2	3.3	34.65	0.000**
Hypoxia and hypoexmia	5	8.3	55	91.7	51	85	9	15	27.11	0.000**
Oxygen delivery devices	6	10	54	90	51	85	9	15	26.97	0.000**
Contraindications of oxygen therapy	4	6.7	56	93.3	53	88.3	7	11.7	33.60	0.000**
Precautions during oxygen therapy administration	7	11.7	53	88.3	54	90	6	10	30.14	0.000**
Risks and complications of oxygen therapy	10	16.7	50	83.3	53	88.3	7	11.7	27.27	0.000**
How to administer oxygen therapy safely and effectively to critically care patients	11	18.3	49	81.7	56	93.3	4	6.7	30.00	0.000**
Total knowledge	11	18.3	49	81.8	54	90	6	10	36.47	0.000**
Range	4-64				36-70					
Mean SD	32.96±9.22				61.74±4.03				t=41.32	0.000**

Figure (2): Percentage distribution of total nurses' knowledge about oxygen therapy among critically care patients at pre and post implementation of nursing guidelines (n=60).

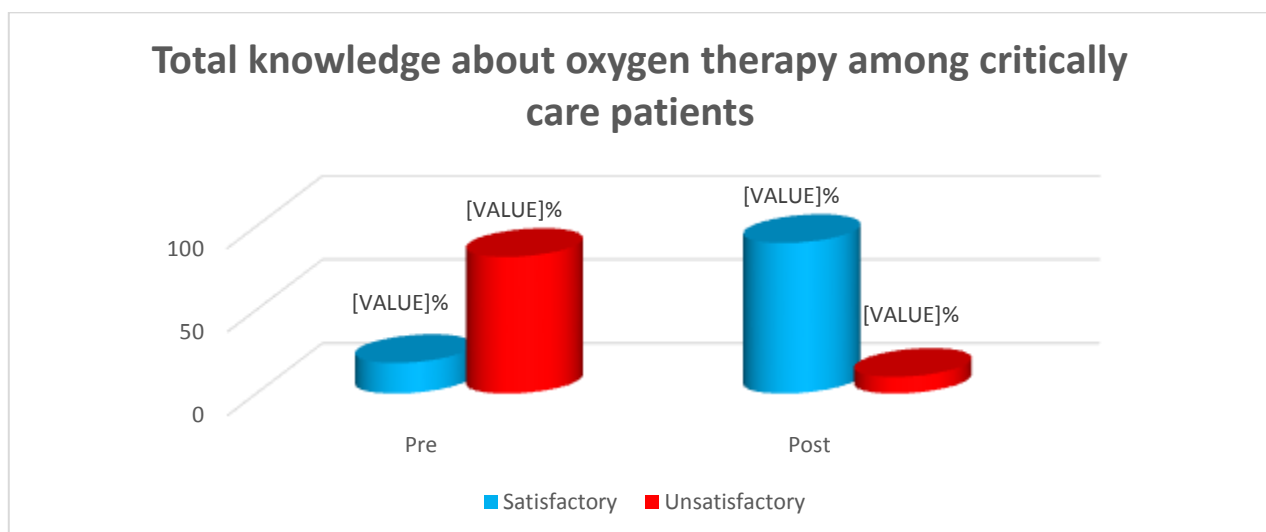


Table (3): frequency and percentage distribution of total nurses' practices regarding safe and effective administration of supplemental oxygen therapy at pre and post implementation of nursing guidelines (n=60).

Total practices items	Pre intervention				Post intervention				X ²	p-value
	Competent		Incompetent		Competent		Incompetent			
	No.	%	No.	%	No.	%	No.	%		
Oxygen administration by nasal cannula	6	10	54	90	54	90	6	10	30.20	0.000**
Oxygen administration by Face mask	12	20	48	80	55	91.7	5	8.3	26.41	0.000**
Oxygen administration by venturi mask	8	13.3	52	86.7	54	90	6	10	29.37	0.000**
Pulse oximeter	5	8.3	55	91.7	51	85	9	15	31.74	0.000**
Nebulizer therapy	10	16.7	50	83.3	55	91.7	5	8.3	31.08	0.000**
Patient assessment during oxygen therapy	8	13.3	52	86.7	50	83.3	10	16.7	26.22	0.000**
Total practices	9	15	51	85	52	86.7	8	13.3	41.71	0.000**
Range	20-108				63-120					
Mean SD	44.25±12.14				99.5±106.10				t=41.32	0.000**

Figure (3): Percentage distribution of total nurses' practice about safe and effective administration of supplemental oxygen therapy among critically care patients at pre and post implementation of nursing guidelines (n=60).

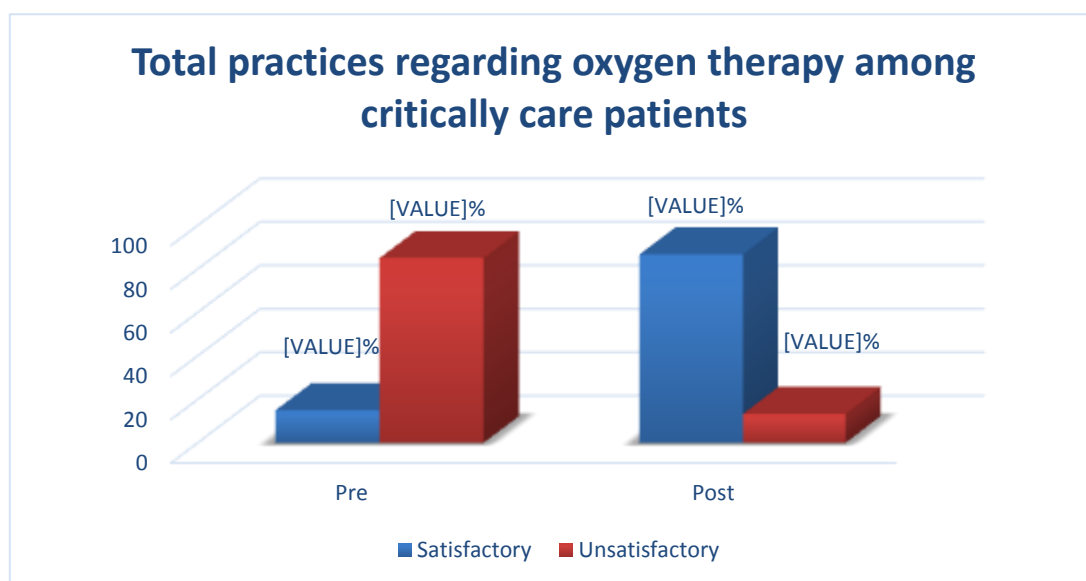


Table (4): Relationship between total nurses' knowledge and their demographic data of the studied nurses at pre and post implementation of nursing guidelines (n=60).

Demographic data of the studied nurses		Levels of total knowledge at pre intervention phase				X2	P-Value	Levels of total knowledge at post intervention phase				X2	P-Value
		Satisfactory (n=11)		Unsatisfactory (n=49)				Satisfactory (n=54)		Unsatisfactory (n=6)			
		No.	%	No.	%			No.	%	No.	%		
Age (year)	< 25	2	18.2	10	20.4	8.256	0.046*	10	18.5	2	33.3	13.69	.009**
	25-<35	7	63.6	25	51			32	59.3	0	0.0		
	≥ 35	2	18.2	14	28.6			12	22.2	4	66.7		
Gender	Male	5	45.5	10	20.4	1.003	0.893	13	24.1	2	33.3	1.117	0.820
	Female	6	55.5	39	79.6			41	75.9	4	66.7		
Education level	Secondary diploma in nursing	0	0.0	9	18.4	13.69	.005**	4	7.4	5	83.3	15.90	.001**
	Technical Institute of Nursing	0	0.0	25	51			24	44.4	1	16.7		
	Health Technical Institute	0	0.0	10	20.4			10	18.5	0	0.0		
	Bachelor of Nursing	6	55.5	6	12.2			12	22.2	0	0.0		
	Postgraduate studies	4	44.5	0	0.0			4	7.4	0	0.0		
Number of years of experience in the intensive care unit	<5	2	18.2	13	26.5	8.800	0.041*	11	20.4	4	66.7	14.08	.005**
	5-<10	8	72.7	26	53.1			34	63	0	0.0		
	≥ 10	1	9.1	10	20.4			9	16.7	2	33.3		
Attending oxygen therapy courses	Yes	6	55.5	0	0.0	14.02	.005**	6	11.1	0	0.0	14.00	.005**

Table (5): Relationship between total nurses' practice and their demographic data of the studied nurses at pre and post implementation of nursing guidelines (n=60).

Demographic data of the studied nurses	Levels of total practice at pre intervention phase				X2	P-Value	Levels of total practice at post intervention phase				X2	P-Value
--	--	--	--	--	----	---------	---	--	--	--	----	---------

		Satisfactory (n=9)		Unsatisfactory (n=51)				Satisfactory (n=52)		Unsatisfactory (n=8)			
		No.	%	No.	%			No.	%	No.	%		
Age (year)	< 25	1	11.1	10	19.6	9.005	0.039*	8	15.4	3	37.5	13.74	.005**
	25-<35	7	77.8	25	49			32	61.5	0	0.0		
	≥ 35	1	11.1	15	29.4			11	21.1	5	62.5		
Gender	Male	4	44.4	11	21.6	1.001	0.895	12	23.1	3	37.5	1.115	0.822
	Female	5	55.6	40	78.4			40	76.9	5	62.5		
Education level	Secondary diploma in nursing	0	0.0	9	17.6	14.32	.003**	3	5.8	6	75	15.98	.000**
	Technical Institute of Nursing	0	0.0	25	49			23	44.2	2	25		
	Health Technical Institute	0	0.0	10	19.6			10	19.2	0	0.0		
	Bachelor of Nursing	5	55.6	7	13.7			12	23.1	0	0.0		
	Postgraduate studies	4	44.4	0	0.0			4	7.7	0	0.0		
Number of years of experience in the intensive care unit	<5	0	0.0	15	29.4	8.824	0.040*	10	19.2	5	62.5	14.33	.005**
	5-<10	8	88.9	26	51			33	63.5	1	12.5		
	≥ 10	1	11.1	10	19.6			9	17.3	2	25		
Attending oxygen therapy courses	Yes	6	66.7	0	0.0	14.02	.005**	6	11.5	0	0.0	15.71	.001**
	No	3	33.3	51	100			46	88.5	8	100		

Table (6): Correlation between total nurses' knowledge and their practice at pre and post implementation of nursing guidelines (n=60).

Variables		Total nurses' practice	
		Pre	Post
Total nurses' knowledge	r	0.518	0.559
	p	.000**	.000**

Discussion:

As regard to age, the results of the present study revealed that more than half of the studied nurses aged between twenty-five to less than thirty-five years old. From the researcher's point of view these results may be due to the studied nurses who were working in critical area (ICU) are young age to be suitable with workload. These results agreed with *Zelege & Kefale, (2021)* in his study entitled " Nurses' supplemental oxygen therapy knowledge and practice in Debre tabor general hospital " whose results revealed that majority of the nurses' age was ranged between twenty-five to thirty years old. These results disagreed with *Demilew et al., (2022)* in their study entitled " Knowledge, attitude and practice of health professionals for oxygen therapy working in South Gondar zone hospitals " whose results revealed that majority of the studied nurses were in the age range of less than forty years old.

As regard to gender, the current study revealed that most of nurses were females. From the researcher's point of view these results may be due to most nurses who were working in Benha University Hospital were females and overall relation of male nurses to female nurses were less in the nursing profession due to dominance of women in the profession of nursing from long ago. This result is compatible with *Uwineza Didi, (2017)* in their study entitled " knowledge, attitudes and practice among nurses toward oxygen administration to the critically ill patients at UTHK (Doctoral dissertation, University of Rwanda). " whose results revealed that majority of studied nurses were females. This finding is inconsistent with *Lema & Beza, (2017)* in their study entitled " Knowledge, attitude and practice study of

oxygen therapy among emergency department nurses in Addis Ababa, Ethiopia " whose results revealed that majority of studied nurses were male.

As regard to educational level, the current study revealed that approximately two fifth of the studied nurses had technical institute of nursing and one fifth had bachelor of nursing. From the researcher's point of view these results may be due to most bachelor nurses in the governmental hospitals are working as nursing supervisor or head nurse, but technical nurses are working as bedside nurse and this incongruent with nature of intensive care unit where it requires nursing staff at high level of education to provide patient with highly qualified nursing care .This result is compatible with *Abd ElAziz, Abd Elhafez & Sayed, (2021)* in their study entitled " Effect of Nursing educational program on nurses' knowledge and practices regarding pandemic Covid-19 in isolation unit." whose results revealed that majority of studied nurses were technical institute of nursing .

This finding disagreed with *Getahun et al., (2022)* in their study entitled " Assessment of practice and barriers of oxygen therapy in critically ill patients among nurses: A survey from university of Gondar comprehensive Specialized Hospital Northwest, Ethiopia " whose results revealed that majority of studied nurses had bachelor of nursing.

As regard to nurses' years of experience, the current study revealed that more than half of studied nurses have years of experience in intensive care unit between five to less than ten years. From the researcher's point of view these results may be due to most of nurses were in young age.

These results agreed with *Jamie, (2021)* in their study entitled " Knowledge and practice of nurses towards oxygen therapy in the public hospitals of Harari region, Ethiopia " whose results revealed that majority of nurses have years of experience from four to six years. This result was inconsistent with *Yazdannik, Atashi & Ghafari, (2018)* in their study entitled " Performance of ICU nurses in providing respiratory care " whose results revealed that majority of the studied nurses had one to five years of experience.

Finally, regarding attendance of courses about oxygen therapy, the current study revealed that the majority of nurses didn't attend any courses regarding oxygen therapy. From the researcher's point of view this result may be due to those training courses specific to oxygen therapy weren't held at the hospital. These results agreed with *Yassin & Mansour, (2021)* in their study entitled " Assessment of nurse's knowledge and practice regarding oxygen therapy at teaching hospitals in Al-Nasiriya City\Iraq. Kufa " whose results revealed that more than half of the studied nurses did not have any previous training courses. This result also in the same line with *Adeniyi et al., (2021)* in their study entitled " Assessment of knowledge and practice of oxygen therapy among doctors and nurses: A survey from Ondo State, Southwest Nigeria" whose results revealed that more than three-quarters of the studied nurses had no previous exposure to formal training on oxygen therapy.

Concerning nurses' total knowledge about safe and effective administration of supplemental oxygen therapy, the current study revealed that an obvious improvement in the total knowledge scores of nurse's post

guidelines implementation as compared to pre guidelines implementation with highly statistically significant difference. This finding supported by *Mostafa, Mehany & Ahmed, (2019)* in their study entitled " Effect of educational program on nurses' knowledge and practice about oxygen therapy at Assiut university hospitals, Egypt " whose results revealed that studied nurses were at unsatisfactory level of knowledge about oxygen therapy before implementation of educational program.

The study also revealed that post guidelines implementation the majority of studied nurses had satisfactory level of knowledge score regarding safe and effective administration of oxygen therapy. These reflect the success of the implementations of the nursing guidelines in achieving the research objectives. this finding supported by *Diab et al., (2022)* in their study entitled " Effectiveness of standardized protocol for oxygen therapy on improving nurses' performance and patients' health outcome at three hospitals in Sakaka city " whose results revealed that there was improvement in nurses' knowledge related to oxygen therapy with a highly statistically significant difference post-intervention.

Also, the results were similar to findings of *Hickson et al., (2021)* in their study entitled "A quality improvement project on oxygen administration within the geriatrics COVID-19 cohort ward " whose results revealed that there was improvement in nurses' knowledge post intervention.

Additionally, this finding is in the same line with *Ahmadidarrehsima et al ., (2021)* in their study entitled " Comparing the effects of mastery learning and lectures on nurses' oxygen therapy knowledge and practice: A

quasi-experimental study in Southern Iran " who stated that nurses had poor oxygen therapy knowledge before the intervention then the study shown that oxygen therapy knowledge were significantly improved one week and three months after intervention.

Concerning nurses' total practice about safe and effective administration of supplemental oxygen therapy, the current study revealed that there was high statistically significant improvement in studied nurses' practice score about safe and effective administration of supplemental oxygen therapy post guidelines implementation compared to pre guidelines implementation. This result agreed with *ELgneid, Sherief & Nabih, (2020)* in their study entitled "Effect of implementing oxygen administration guidelines on nurses' performance caring for patients with chest disorders in Mansoura university hospital, Egypt " whose results revealed that highly statistically significance increase in nurses' practices scores regarding oxygen therapy after application of educational guidelines.

This finding is also consistent with *Thabet, Mohamed & Khalaf, (2020)* in their study entitled " Effect of implementing teaching program on nurses' performance regarding hypoxia for critically ill patients in Assiut university hospital, Egypt " whose results revealed that there was an improvement of nurses' total practice scores regarding administering oxygen therapy after implementation of the nursing educational program.

Also, this finding is in the same line with *Mahgoub et al., (2019)* in their study entitled " Impact of designed oxygenation monitoring protocol on critical care nurses' level of knowledge and practice. " whose results

revealed that there were highly statistically significant after implementation of designed oxygenation monitoring protocol in nurse's practice.

Moreover, this finding supported by *Diab et al., (2022)* whose results revealed that there was improvement in nurses' practice related to oxygen therapy with a highly statistically significant difference post-intervention.

Regarding the relation between studied nurses' total knowledge score and their demographic characteristics, in relation to nurses' level of knowledge and their age, the findings of the current study revealed that there was statistically significant relation between demographic data regarding age of the studied nurse's score and their levels of total knowledge pre and post guidelines implementation. From researcher point of view, young nurses were motivated to learn more and improve themselves to the best and the person gain more experiences as they grow older in their lives. This result in the same line with *Mayhob , (2018)* in his study entitled " Nurses' knowledge, practices and barriers affecting a safe administration of oxygen therapy in one of the educational hospitals in Cairo, Egypt " whose results revealed that there were statistically significant relations between level of knowledge of the studied sample and their age.

In relation to nurses' level of knowledge and their educational level, the findings of the current study revealed that there was statistically significant relation between demographic data regarding educational level of the studied nurse's score and their levels of total knowledge pre and post guidelines implementation. From

researcher point of view, low educational level is usually accompanied with inadequate knowledge and when individual seek for more education this lead to improve knowledge. This result in the same line with *Kalpana et al., (2021)* in his study entitled " Nursing awareness of oxygen therapy among nurses at selected district hospital in Nepal " whose results revealed that a significant association was found between the knowledge level and educational status.

In relation to nurses' level of knowledge and their years of experience in intensive care unit, the findings of the current study revealed that there was statistically significant relation between demographic data regarding years of experience of the studied nurse's score and their levels of total knowledge pre and post guidelines implementation. From the researcher point of view, the experience has a great effect on the nurses' level of knowledge and the nurses can be develop their knowledge through their experience. This result in the same line with *Hassanzad et al., (2021)* in his study entitled " Nurses' knowledge regarding oxygen therapy; a Cross-Sectional Study " whose results revealed that a statistically significant relationship was reported between nurses' related to work experience and their knowledge of the proper use of oxygen.

In relation to nurses' level of knowledge and their attendance of training courses in intensive care unit, the findings of the current study revealed that there was statistically significant relation between demographic data regarding attendance of training courses of the studied nurse's score and their levels of total knowledge pre and post guidelines implementation. From the researcher point of view , majority of studied nurses had not receive previous training courses or

guidelines about oxygen therapy and they were not updating for knowledge received during undergraduate due to they were occupied with work stress, severity of patient condition, hours of work and occupational hazards that facing them in ICU in addition to there were no motivation from the administration .This result disagreed with *Demirel & Kazan, (2020)* in his study entitled " Knowledge levels of nurses about oxygen therapy in Turkey " whose results revealed that there was no statistically significant relationship between training sessions and nurses' level of knowledge.

In relation to nurses' level of knowledge and their gender, the findings of the current study revealed that there was no statistically significant relation between demographic data regarding gender of the studied nurse's score and their levels of total knowledge pre and post guidelines implementation. From the researcher point of view, majority of studied nurses were female and this not effect on study results. This result in the same line with *Jamie, (2021)* whose results revealed that nurses' knowledge about oxygen therapy had no significant relation with gender.

Regarding the relation between studied nurses' total practice score and their demographic characteristics, the current study showed that there was statistically significant relation between studied nurses' total practice score and their demographic characteristics regarding age, educational level, years of experience in the intensive care unit and attendance of training courses about oxygen therapy pre and post guidelines implementation. While there was no statistically significant relation between studied nurses' total practice score and their gender pre and post guidelines implementation. From the researcher's point

of view, an increase in age is directly correlated with increased nurses' experience and performance that expected to improve over time as they gain more and more experience and the fact that nursing education, training courses and years of experience could improve level of practical skills among the studied nurses .While gender has no significant statistical relation with practical scores may be related to the majority of the studied nurses were females and not effect on result .

This result in the same line with *Mayhob , (2018)* whose results revealed that there was a statistically significant relation between level of practice of the studied nurses and their qualifications. Meanwhile, there were no statistically significant relations between level of practice and gender.

Also, This finding is compatible with *Goharani et al., (2017)* in their study entitled " Familiarity of physicians and nurses with different aspects of oxygen therapy " whose results revealed that there was statistically significant relationship between training sessions and nurses' level of practice.

On the other hand, this finding is inconsistent with *Shakor, (2019)* in their study entitled " Knowledge and practices of nurses regarding nebulization therapy in Kirkuk city hospitals " whose results revealed that there was no statistically significant relationship between demographic data and nurses' level of practice.

The current study showed that there were positive and highly statistically significant correlation between total knowledge and total performance scores pre and post guidelines implementation therefore the two stated research hypothesis were supported. From the researcher view of point, when the knowledge

increased, the competent nursing performance increased. This finding is consistent with *Mostafa, Mehany & Ahmed, (2019)* whose results revealed that there were highly statistically positive correlation between total nurse' knowledge and total practice after implementation of educational program .

Also, this finding is in the same line with *Ghebremichael et al ., (2019)* in their study entitled " Assessment of nurses' knowledge, attitude and practice about oxygen therapy in emergency and ICU departments of orotta National Referral Hospital " whose results revealed that there were highly statistically positive correlation between total nurse' knowledge, attitude and practice.

Additionally, this finding supported by *Cousins, Wark& Mcdonald , (2016)* in their study entitled " Acute oxygen therapy: a review of prescribing and delivery practices " whose results revealed that there were highly statistically positive correlation between nurse' knowledge and practice.

Conclusion

The majority of nurses had unsatisfactory level of knowledge and practice regarding safe and effective administration of supplemental oxygen therapy at pre guidelines implementation. Also, it revealed that the nurses' knowledge and practice regarding safe and effective administration of supplemental oxygen therapy increased post guidelines implementation and this indicate that nursing guidelines effectively improved nurses' knowledge and practices regarding safe and effective administration of supplemental oxygen therapy. Additionally, there was high significant statistical positive correlation between nurses' knowledge and their practice regarding safe and effective administration of supplemental oxygen

therapy at pre and post implementation of nursing guidelines at $p < 0.01$.

Recommendations

- 1- Designed guidelines about safe and effective administration of supplemental oxygen therapy should be revised, updated and available in intensive care unit in both Arabic and English language to be a ready reference for them.
- 2- Sufficient supervision should be provided on nurses during performing their skills practice to determine areas of mal practice and needs corrective action should be done on spot during work.
- 3- Orientation programs for new critical care nurses should include more knowledge about safe and effective administration of supplemental oxygen therapy.
- 4- Ongoing educational and training guidelines for nurses. Nurses should be encouraged to attend workshops, conferences and scientific meetings to have current knowledge and skillful practice necessary for proper safe and effective administration of supplemental oxygen therapy.
- 5- Further study is needed to apply the guidelines with larger sample size including structure and outcome guidelines in addition to process guidelines & evaluate its impact on nurses' performance regarding safe and effective administration of supplemental oxygen therapy and patients' outcomes.

References:

1. **Abd ElAziz, A., Abd Elhafez, N. G. E., & Sayed, S. Y. (2021).** Effect of Nursing Educational Program on Nurses' Knowledge and Practices regarding Pandemic Covid-19 in Isolation Unit. *Egyptian Journal of*

Health Care, 12(4), p: 48. Doi: 10.21608/EJHC.2021.198442

2. **Adeniyi, B. O., Akinwalere, O. O., Ekwughe, F. C., Ogunmodede, A. F., Kareem, A. O., Olakanye, O. D., ... & Abejegah, C. (2021).** Assessment of knowledge and practice of oxygen therapy among doctors and nurses: A survey from Ondo State, Southwest Nigeria. *Journal of the Pan African Thoracic Society*, 2(3), P: 162. Doi:10.25259/JPATS_4_2021
3. **Ahmadidarrehsima, S., Rafati, S., Jabalbarez, M., & Rafati, F. (2021).** Comparing the Effects of Mastery Learning and Lectures on Nurses' Oxygen Therapy Knowledge and Practice: A Quasi-Experimental Study in Southern Iran. *Research Square*; 2021. P: 2, DOI: <https://doi.org/10.21203/rs.3.850577>.
4. **Aloushan, A. F., Almoaiqel, F. A., Alghamdi, R. N., Alnahari, F. I., Aldosari, A. F., Masud, N., & Algerian, N. A. (2019).** Assessment of knowledge, attitude and practice regarding oxygen therapy at emergency departments in Riyadh in 2017: A cross-sectional study. *World journal of emergency medicine*, 10(2),p:88.Doi:10.5847/wjem.j.1920.8642.2019.02.004
5. **Bizuneh, Y. B., Getahun, Y. A., Melesse, D. Y., & Chekol, W. B. (2022).** Assessment of knowledge, attitude, and factors associated with oxygen therapy for critically ill patients among nurses at the University of Gondar Comprehensive Specialized Hospital

- Northwest, Ethiopia, 2021. *Annals of Medicine and Surgery*, Vol. 80, P : 155. Doi:10.1016/j.amsu.2022104334
6. **Cooper, K., Gosnell, K., (2018) :** Foundations and Adult Health Nursing, Elsevier Health Sciences, 8th Edition: p: 338, available at <https://books.google.com>.
 7. **Cousins, J. L., Wark, P. A., & McDonald, V. M. (2016).** Acute oxygen therapy: a review of prescribing and delivery practices. *International Journal of Chronic Obstructive Pulmonary Disease*, Vol. 11, p: 1067. Doi: 10.2147/COPD.S103607.
 8. **Demilew, B. C., Mekonen, A., Aemro, A., Sewnet, N., & Hailu, B. A. (2022).** Knowledge, attitude, and practice of health professionals for oxygen therapy working in South Gondar zone hospitals, 2021: multicenter cross-sectional study. *BMC Health Services Research*, 22(1), p :7 .Doi:18612913-022-08011-4
 9. **Demirel, H., & Kazan, E. E. (2020).** Knowledge levels of nurses about oxygen therapy in Turkey. *International Journal of Health Services Research and Policy*, 5(1), p: 10. Available at <https://doi.org/10.33457/ijhsrp.70015>
 10. **Diab, S. S. E. M., Ali, S. A. A., Abed, S. N., Elasrag, G. A. E. A., & Ramadan, O. M. E. (2022).** Effectiveness of Standardized Protocol for Oxygen Therapy on Improving Nurses' Performance and Patients' Health Outcome. *International Journal of Environmental Research and Public Health*, 19(10), p:119. Doi.org/10.3390/ijerph19105817.
 11. **ELgneid, H. A., Sherief, W. I., & Nabih, M. H. (2020).** Effect of Implementing Oxygen Administration Guidelines on Nurses' Performance Caring for Patients with Chest Disorders. *IOSR Journal of Nursing and Health Science*, Vol.9, Issue, P:50. Doi: 10.9790/1959-0903044955.
 12. **Elsharawy, S., Amer, I., Salama, M., El-Lawaty, W., Abd Elghafar, M., Ghazi, A., & Hawash, N. (2021).** Clinical and Laboratory Predictors for ICU Admission among COVID-19 Infected Egyptian, 11(3), p:285.DOI: 10.21608/AEJI.2021.82473.1155
 13. **Getahun, Y. A., Bizuneh, Y. B., Melesse, D. Y., & Chekol, W. B. (2022).** Assessment of practice and barriers of oxygen therapy in critically ill patients among nurses: A survey from University of Gondar Comprehensive Specialized Hospital Northwest, Ethiopia. *Annals of Medicine and Surgery*, Vol. 76, Doi.org/10.1016/j.amsu.2022.10348
 14. **Ghebremichael, F. G., Thomas, L. M., Yohannes, A., Kesete, K., & Wolday, S. (2019).** Assessment of nurses' knowledge, attitude and practice about oxygen therapy in emergency and ICU departments of Orotta National Referral Hospital. *Int J Med Health Prof Res*, 6(1), p:

104 . Doi: 10.1186/s12913-022-08011-4

15. **Goharani, R., Miri, M., Kouчек, M., & Sistanizad, M. (2017).** Familiarity of physicians and nurses with different aspects of oxygen therapy; a brief report. *Emergency*, 5(1), p: 3. PMC5325909
16. **Hassanzad, M., Ghaffaripour, H., Rekabi, M., Mirzendehtdel, M., Sadati, E., Elahimehr, N., & Derakhshanfar, H. (2022).** Nurses' Knowledge Regarding Oxygen Therapy; a Cross-Sectional Study. *Archives of Academic Emergency Medicine*, 10(1), p: 38. Available at <https://doi.org/10.22037.1553>.
17. **Heartshorne, R., Cardell, J., O'driscoll, R., Fudge, T., & Dark, P. (2021).** Implementing target range oxygen in critical care: a quality improvement pilot study. *Journal of the Intensive Care Society*, 22(1), p:17. Doi:177/1751143719892784
18. **Hickson, L.; Liu, A. K. L.; Bailey, G.; Bruce, S.; Kawafi, K.; Reid, D.; Gowda, V.(2021).**A quality improvement project on oxygen administration within the geriatrics COVID-19, *Age and Ageing* ; 50(1), p : 167. Available at ID: covidwho-1254390
19. **Hochberg, C. H., Semler, M. W., & Brower, R. G. (2021).** Oxygen toxicity in critically ill adults. *American journal of respiratory and critical care medicine*, 204(6), P: 632. Doi.org/10.1164/rccm.202102-0417CI.
20. **Jamie, A. (2021).** Knowledge and practice of nurses towards oxygen therapy in the public hospitals of Harari region, Ethiopia. *Journal of Research Development in Nursing and Midwifery*, 18(2), p:12. Doi: 10.29252/jgbfnm.18.2.1
21. **Kalpana, K., Sunita, G., Srijana, G., & Muna, B. (2021).** Nursing awareness of oxygen therapy among nurses at selected district hospital in Nepal. *RUDN Journal of Medicine*, 25(3),p:202.Doi: 10.22363/2313-0245-2021.
22. **Lema, G., & Beza, L. (2017).** Knowledge, attitude and practice study of oxygen therapy among emergency department nurses in Addis Ababa, Ethiopia. *Prehospital and Disaster Medicine*, 32(S1), p.149.Available at <https://www.cambridge>.
23. **Lin, Y., Zhang, X., Wei, M., Zhao, B., Wang, and Su, D. (2019).** High-flow nasal cannula oxygen therapy and hypoxia during gastroscopy . *Gastrointestinal endoscopy*, 90(4) , p:593 . DOI: 10.1016/ j.gie. 2019. 06.033.
24. **Lynn, P. (2018):** Taylor's clinical nursing skills, Wolters Kluwer Health, 5th Edition: p234, available at <https://books.google.com>.
25. **Mahgoub, A. A., Sayed, Z. A., Abd_Elhafez, N. G. E., & Ragab, O. H. G.(2019).** Impact of Designed Oxygenation Monitoring Protocol on Critical Care Nurses' Level of

- Knowledge and Practice. Vol. 6, Issue 3, pp: 720-728, available at: www.noveltyjournals.com.
26. **Mayhob, M. (2018).** Nurses' knowledge, practices and barriers affecting a safe administration of oxygen therapy. *Journal of Nursing and Health Science*, 7(3), p: 51. Doi :10.9790/1959-0703024251.
 27. **Mostafa, A. H., Mehany, M. M., & Ahmed, M. A. E. (2019).** Effect of Educational Program on Nurses' Knowledge and Practice About Oxygen Therapy. *Assiut Scientific Nursing Journal*, 7(18), p:98. Doi: 10.21608/asnj.2019.58142.
 28. **Navuluri, N., Srour, M. L., Kussin, P. S., Murdoch, D. M., MacIntyre, N. R., Que, L. G., ... & McCollum, E. D. (2021).** Oxygen delivery systems for adults in Sub-Saharan Africa: a scoping review. *Journal of global health*, vol.11, Doi: 10.7189/jogh.11.04018
 29. **Perry, A., Potter, P. & Ostendorf, W. (2018):** *Clinical Nursing Skills & Techniques – 9th Edition*. St. Louis, MO: Elsevier - Mosby. P: 627, available at <https://books.google.com>.
 30. **Shakor, S. Q. (2019).** Knowledge and practices of nurses regarding nebulization therapy in Kirkuk city hospitals. *Kufa Journal for Nursing Sciences*, 9(2) , p: 8, available at <https://journal.uokufa.edu.iq/index>
 31. **Thabet, M., Mohamed, M. A., & Khalaf, G. S. (2020).** Effect of Implementing Teaching Program on nurses' Performance Regarding Hypoxia for Critically Ill Patients. *Assiut Scientific Nursing Journal*, 8(22), p: 101. Doi: 10.21608/ASNJ.2020.39469.1034.
 32. **Uwineza Didi, V. (2017).** Knowledge, attitudes and practice among nurses toward oxygen administration to the critically ill patients at UTHK (Doctoral dissertation, University of Rwanda). College of Medicine and Health Sciences, thesis for master degree of critical care and trauma nursing p: 41. available at <http://hdl.handle.net/123456789/421>
 33. **Yassin, A., & Mansour, K. (2021).** Assessment of Nurse's Knowledge and Practice Regarding Oxygen Therapy at Teaching Hospitals in Al-Nasiriya City\Iraq. *Kufa Journal for Nursing Sciences*, 11(2), p: 8. Available at <https://journal.uokufa.edu.iq/index>.
 34. **Yazdannik, A., Atashi, V., & Ghafari, S. (2018).** Performance of ICU nurses in providing respiratory care. *Iranian journal of nursing and midwifery research*, 23(3), p. 178. Doi: 10.4103. IJNMR20516
 35. **Zelege, S., & Kefale, D. (2021).** Nurses' Supplemental Oxygen Therapy Knowledge and Practice in Debre Tabor General Hospital: A Cross-Sectional Study. *Open Access Emergency Medicine: OAEM*, Vol.13, p: 51. Doi:10.2147/OAEM.S299139

