

Nurses' Role Regarding Nebulization Therapy for Patients with Mechanical Ventilation in Emergency Care Unit

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Abstract:

Background: The routine incorporation of aerosol therapy in the daily responsibilities of intensive care unit (ICU) nurses, specifically in the management of patients undergoing invasive mechanical ventilation (MV), is an established practice. However, the depth of understanding regarding the clinical practices of ICU nurses in aerosol therapy remains inadequately explored. Limited studies have specifically addressed the nuanced comprehension and application of atomization safety protocols by ICU nurses during the administration of aerosol therapy to patients undergoing invasive MV. **Aim of the Study:** This study aimed to assess nurses' role regarding nebulization therapy for patients with mechanical ventilation in emergency care unit. **Subjects and Methods: Research Design:** A descriptive design was carried out in this study. **Study Setting:** The study conducted within the surgical intensive care units of Zagazig University Hospitals in Sharkia Governorate, Egypt. **Subjects:** A carefully chosen sample of 30 emergency care nurses operating within the specified setting actively participated in this research. **Data Collection Tools:** Two tools were used for data collection. The first, an interview questionnaire, aimed to assess nurses' total knowledge toward the administration of nebulization therapy. The second, an observational checklist, to assess nurses' practical skills during nebulization therapy administration. **Results:** The study brought to light a substantial percentage (80.0%) of nurses exhibiting an unsatisfactory level of total knowledge concerning the administration of nebulization therapy. Additionally, 86.7% of the nurses showed inadequate practice in administering nebulization therapy. **Conclusion:** A discernible trend emerged, pointing to the prevalent inadequacy in knowledge and suboptimal practical application among the studied nurses in the administration of nebulization therapy. Furthermore, a significantly positive correlation was established between nurses' overall knowledge and their total practice in nebulization therapy, particularly concerning mechanical ventilation. **Recommendations:** The study strongly advocates for the development of customized training programs designed to enhance nurses' understanding of nebulizer devices. Moreover, the establishment of team of professionals able to do regular assessment of nurses' comprehension of inhaler devices, Sustained educational courses, with a focus on the correct inhaler techniques for respiratory nurses, are essential to optimize the utilization of these devices.

Key words: Emergency care unit, Mechanical ventilation, Nebulization therapy, Nurses Role.

Introduction

In the realm of emergency care, patients undergoing invasive ventilation encounter challenges associated with the retention of airway secretions, exacerbated by the utilization of relatively dry gases. This circumstance prompts an upsurge in mucus production, coupled with hindrances to mucociliary secretions due to the presence of an endotracheal tube. The

impaired cough reflex, commonly associated with factors such as depressed consciousness, sedation, or muscle weakness, further complicates the scenario. To address these complexities, intensive care nurses deploy interventions, with nebulization of mucoactive agents emerging as a recognized strategy to ameliorate the

accumulation of tenacious airway secretions ⁽¹⁾.

Aerosolized medications stand as a therapeutic boon in treating pulmonary diseases; however, their efficacious delivery poses a multifaceted challenge. The elusive attainment of disease control underscores a palpable knowledge gap among clinicians, particularly concerning the meticulous selection and instructive guidance for the proper use of aerosol devices. The consequences of improper device selection and suboptimal inhaler techniques are underscored, necessitating a paradigm shift towards individualized aerosol medicine to ensure effective disease management ⁽²⁾.

Nurses, positioned at the frontline of patient care, assume a pivotal role in optimizing nebulizer therapy for mechanically ventilated patients. Their multifaceted responsibilities encompass comprehensive nursing assessments, tailored support, and meticulous instruction for patients undergoing nebulized therapy. Additionally, nurses exhibit diligence in monitoring the patient's hemodynamic state pre-nebulizer therapy, offering training in diaphragmatic breathing, ensuring continuous oral hygiene, implementing chest physiotherapy, and overseeing the rigorous cleaning and maintenance of nebulizers and compressors. The holistic approach extends to the critical evaluation of treatment effectiveness ⁽³⁾.

The intricate task of delivering aerosols to mechanically ventilated patients necessitates a nuanced consideration of factors spanning patient-related dynamics, ventilator intricacies, circuit specifications, nuances related to nebulizer functionality, and the distinctive attributes of administered medications ⁽⁴⁾. Technological advancements, including the integration of metered-dose inhalers and vibrating mesh nebulizers into ventilator circuits, showcase promise in elevating the

precision of inhaled aerosol delivery during mechanical ventilation ⁽⁵⁾.

The clinical landscape surrounding aerosol delivery to critically ill adult patients remains a subject of controversy, with complexity arising from diverse clinical scenarios and limited empirical evidence ⁽⁶⁾. The absence of standardized technical insights on inhalers for clinicians hampers effectiveness, giving rise to challenges such as heating discrepancies or suboptimal nebulization efficiency. Variations in drug concentration present an additional dimension, potentially impacting the dose remaining in the nebulizer at the conclusion of aerosol therapy and exposing patients to heightened concentrations of inhaled medications ^(7, 8).

Significance of the study:

The outcomes of a comprehensive study conducted at Ain Shams University Hospital indicated that 53.3% of the participating nurses exhibited a suboptimal level of knowledge, while 66.7% demonstrated inadequacies in their practical application of nebulization therapy ⁽⁷⁾. Similarly, a distinct investigation conducted at Alexandria Main University revealed that a significant proportion of nurses exhibited unsatisfactory performance levels in the administration of nebulization therapy ⁽⁹⁾. Motivated by the identified gaps in existing research, the current study was initiated to thoroughly assess the role of nurses in nebulization therapy for patients undergoing mechanical ventilation in the emergency care unit ⁽⁷⁾.

This research endeavors to contribute nuanced insights into knowledge, practice, and performance metrics, fostering a more profound understanding of challenges and potential areas for enhancement in the delivery of nebulization therapy by nurses in emergency care.

Aim of the study:

The aim of the study was to assess nurses' role regarding nebulization therapy for patients with mechanical ventilation in emergency care unit.

Research Question:

This study sought to investigate two primary aspects related to nebulization therapy for patients undergoing mechanical ventilation in emergency care units:

Level of Nurse's Knowledge: The first objective was to ascertain the extent of nurses' knowledge concerning nebulization therapy in the context of patients requiring mechanical ventilation in emergency care units.

Level of Nurse's Practice: The second objective involved assessing the proficiency of nurses in the practical application of nebulization therapy for patients undergoing mechanical ventilation within emergency care units.

Subjects and Methods:

Research design:

In this study, a descriptive research design was strategically employed. Descriptive research proves to be an optimal choice when the primary objective is to delineate characteristics, frequencies, trends, and categories within a given context. This design is particularly advantageous when the subject matter is not extensively explored, and there exists a need to establish foundational knowledge about the topic or problem at hand. Before delving into the investigation of causation, a comprehensive understanding of the how, when, and where becomes imperative. The descriptive research design, therefore, aligns seamlessly with the research aim of identifying and characterizing key elements associated with nurses' roles in nebulization therapy for patients undergoing mechanical ventilation in emergency care units (10).

Setting:

The study took place over a period of 6 months at two surgical intensive care units within the surgical hospital at Zagazig University Hospitals, Sharqia Governorate, Egypt.

Subjects:

A convenient sample of available emergency care nurses (30) working at the previous mentioned setting.

Tools of data collection:

Data Collection tools:

Tool I: Nurse Interview Questionnaire on Nebulization This meticulously designed questionnaire serves the purpose of assessing nurses' knowledge regarding nebulization. It comprises two distinct sections:

Section I: Demographic Information for Nurses This segment is dedicated to gathering essential demographic details through five closed-ended questions covering age, gender, level of education, years of experience, and prior participation in training programs related to nebulizer administration for patients undergoing invasive mechanical ventilation.

Section II: Nurses' Knowledge Assessment Questionnaire Crafted by the researcher based on a thorough literature review and adapted from Zhang et al ⁽¹¹⁾ in Arabic, this section consists of 16 multiple-choice questions aimed at evaluating nurses' understanding of nebulizer administration for patients undergoing invasive mechanical ventilation.

Scoring system: Responses are evaluated using a predefined scoring system. Correct answers earn one point, incorrect responses receive zero points, and "don't know" responses remain ungraded. Scores for each knowledge area are aggregated, divided by the number of items, and converted into percentage scores. Knowledge is considered satisfactory if the percentage score equals or exceeds 80%, with anything below 80% deemed

unsatisfactory based on statistical analysis.

Tool II: Observational Checklist for Assessing Nurses' Practices Derived from Eltabakh et al ⁽⁹⁾, this checklist is designed to assess nurses' practical proficiency in administering nebulization therapy. It encompasses five components, each detailing specific steps: Assessment of Patient Status (11 steps); Preparation (17 steps); Implementation (7 steps); Post Care (26 steps); Record and Report (4 steps).

Scoring System: Scores are assigned using a binary system: one for completed steps and zero for omitted ones. The total scores are then divided by the number of items, providing a mean score for each section. These scores are subsequently converted into percentages. Nurses are considered to have achieved an adequate level of practice if their total score equals or exceeds 80%. Scores falling below 80% are categorized as inadequate based on statistical analysis.

Content validity & Reliability:

Validation Process: The proposed tools underwent rigorous validation processes, encompassing both face and content validity assessments. Face validity focused on scrutinizing the items to ensure that the tools accurately measure their intended constructs. Simultaneously, content validity was executed to ascertain whether the content of the tools adequately covers the objectives of the study. This validation stage was meticulously carried out by a panel of five experts, comprising two professors and three assistant professors. The experts meticulously reviewed the tools' content, evaluating factors such as clarity, relevance, comprehensiveness, understanding, and ease of implementation. All recommended modifications were diligently incorporated.

Reliability Testing: The reliability of the tools was assessed through Alpha

Cronbach reliability analysis, yielding commendable results. The reliability coefficient for the Nurses' Knowledge Assessment Questionnaire was determined to be 0.841, indicating a high level of internal consistency. Additionally, the Nebulization Therapy Administration Observational Checklist for Nurses demonstrated a reliability coefficient of 0.829, further affirming its robust internal consistency. These reliability measures enhance the confidence in the tools' ability to consistently and accurately measure the intended constructs.

Field work:

The data collection phase spanned a duration of six months, commencing from the inception of September 2022 and concluding at the end of February 2023.

Preparatory Phase: The initial phase involved preliminary preparations conducted through meetings with the head nurse at the two ICUs, following the acquisition of official permission. These meetings were instrumental in elucidating the study's objectives and the applied methodology.

Individual Nurse Meetings: The subsequent phase involved individual meetings with each nurse, wherein a comprehensive explanation of the study's aim was provided. Nurses were formally invited to participate, and those who verbally expressed informed consent were given the interviewing questionnaire. Detailed instructions were provided during the questionnaire-filling process. Data collection occurred twice a week, specifically on Mondays and Tuesdays, from 10:00 am to 2:00 pm.

Data Collection Process:

Interviewing Questionnaire: The self-administered nurse questionnaire, tailored to each nurse's physical and mental readiness, required an estimated time of 20-30 minutes for completion.

Observational Checklist: The investigator observed nurses' practical skills related to the studied procedures during the data collection process. The time needed to complete the observational checklist for each nurse was approximately 20 minutes. The careful scheduling and methodical approach ensured efficient and comprehensive data collection, respecting the time constraints and readiness of the participating nurses.

Pilot study:

A pilot study was meticulously undertaken, involving three nurses, which constituted 10% of the overall study sample. The primary objectives of the pilot study were to assess the clarity, applicability, relevance, and feasibility of the research tools. Additionally, it aimed to identify any potential difficulties that participants might encounter during the application of these tools. Furthermore, the pilot study provided valuable insights into estimating the time required for participants to complete the data collection sheets.

Administrative and ethical consideration:

Official Permission for Data Collection: To conduct the data collection at Zagazig University Hospitals, formal authorization was obtained from the hospital administrative personnel. A formal letter from the Dean of the Faculty of Nursing at Zagazig University was submitted, elucidating the study's objectives and seeking permission and support.

The study adhered to rigorous ethical standards to safeguard the rights and well-being of participants. The research proposal received approval from both the Research Ethics Committee (REC) and the Postgraduate Committee of Zagazig University's Faculty of Nursing (M.D. ZU. R/183/13/6/2022). This endorsement

underscores the ethical integrity of the study.

Prior to participation, nurses were interviewed and provided with a comprehensive understanding of the study's goals and potential benefits. Importantly, they were informed that participation was entirely voluntary, and they could withdraw from the study at any point and for any reason. To ensure the confidentiality of participants, all collected data were coded. The researcher assured the subjects that their privacy would be maintained, and the information gathered would only be utilized for the assessment of nurses' roles in nebulization therapy for patients with mechanical ventilation in the emergency care unit.

Statistical analysis:

The statistical analysis of the collected data was conducted using Statistical Package for Social Science (SPSS) version 25 and the Microsoft Excel Program. The following methods were employed for different types of data:

Descriptive Statistics: For categorical data, frequencies and percentages were presented. For quantitative data, the arithmetic mean (\bar{X}) and standard deviation (SD) were reported.

Qualitative Variables Analysis: The Friedman test was utilized to assess qualitative variables over the three visits.

Comparison between Groups: The chi-square test (χ^2) was employed to compare qualitative variables between groups over the two visits.

Group Differences Analysis: During the first two visits, group differences were evaluated using a paired t-test. Group differences over the three visits were assessed using repeated measures ANCOVA.

Reliability Assessment: Cronbach's Alpha was utilized to assess the reliability of the study instruments, ensuring the internal consistency of the measurement tools.

Results:

In **Table 1**, a comprehensive overview of the studied nurses' demographic characteristics is presented. The age spectrum, ranging from 21 to 32, demonstrated a mean \pm SD of 24.73 ± 2.85 years. A notable majority (56.7%) identified as male, while an even more significant majority (83.3%) held qualifications from technical institutes. A staggering 93.3% bore the title of nurses, and a substantial 73.3% had garnered 1- < 5 years of professional experience, with a mean \pm SD of 3.10 ± 2.89 years. Intriguingly, a substantial portion (70.0%) had not participated in training courses related to nebulization therapy administration.

Figure I provides a visual representation indicating that 80.0% of the studied nurses exhibited an unsatisfactory level of total knowledge regarding nebulization therapy administration, whereas a noteworthy 20.0% demonstrated a satisfactory level of total knowledge.

Table 2 delves into the practical aspects, revealing that 90.0% and 80.0% of the studied nurses exhibited inadequacies in assessment and preparation, respectively. The statistics further uncovered that 93.3% displayed inadequate practices in both implementation and post-care, with an additional 86.7% showcasing inadequacies in record and report. The culmination of these aspects yielded that 86.7% of the nurses had overall inadequate practices concerning nebulization with mechanical ventilation.

Figure II visually amplifies this finding, illustrating that a substantial 86.7% of the studied nurses showcased inadequate practices regarding nebulization with mechanical ventilation. Conversely, a noteworthy 13.3% exhibited adequate practices in the same domain.

Table 3 provides an insightful analysis, establishing a statistically

significant relationship between total nurses' knowledge and demographic characteristics, including age, gender, education level, years of experience, and attendance of training courses on nebulization therapy administration ($P < 0.05$). Notably, 58.4% of studied nurses with unsatisfactory knowledge were aged between 20- < 25, and 83.3% of those with unsatisfactory knowledge did not attend training courses on nebulization therapy administration.

Table 4 builds on this foundation, highlighting a statistically significant relation between total nurses' practice and demographic characteristics such as education level, years of experience, and attendance of training courses on nebulization therapy administration ($P < 0.05$). Conversely, there was no statistically significant relation with age, gender, and job title ($P > 0.05$). Specifically, 80.8% of studied nurses who refrained from attending training courses displayed inadequate practices regarding nebulization with mechanical ventilation.

Table 5 culminates the results, indicating a highly significant positive correlation between total nurses' knowledge and their total practice regarding nebulization with mechanical ventilation ($P < 0.01$). This correlation underscores the interdependence of knowledge and practical application in the context of nebulization therapy administration.

Discussion:

In examining the characteristics of the subjects under scrutiny, our findings disclose that a significant majority, specifically 93.3% of the studied nurses, fall within the age range of 21-32, exhibiting a Mean \pm SD of 24.73 ± 2.85 years. Remarkably, this outcome aligns with the work of Saddon et al. ⁽¹²⁾ in their exploration of "Nurse' Performance Regarding Care of Patients with Chronic Obstructive Pulmonary Disease on Nebulizer Therapy" in Egypt. Their study, reporting that 83.4% of the

nurses were in the 20-30 age group with a Mean \pm SD of 26.43 \pm 4.49, mirrors the demographics observed in our research. Regarding the nurses' professional experience, our investigation unveils that approximately three-quarters possess 1-5 years of experience, a result that mirrors the findings of Shakor et al ⁽¹³⁾ in their study, "Effectiveness of an Educational Program on Nurses' Knowledge toward Nursing Management of Chronic Obstructive Pulmonary Disease (COPD) Patients at Al-Sader Teaching Hospital," conducted in Baghdad. Their work highlighted that a majority of nurses had 1-5 years of experience.

Turning our attention to the attendance of training courses on nebulization therapy administration, our study exposes that a considerable 70.0% of the nurses did not partake in such courses. This observation aligns with the research of Xie et al ⁽¹⁴⁾, who, in their study on "Nurse' Performance Regarding Care of Patients with Chronic Obstructive Pulmonary Disease on Nebulizer Therapy" in Egypt, reported that 76.7% of studied nurses abstained from attending nebulizer therapy training courses. Furthermore, Zhang et al ⁽¹¹⁾, in their study on "Knowledge and practices of nurses regarding nebulization therapy in Kirkuk city hospitals," found that 72% of participants lacked prior coaching in nebulization.

Our research exposes that a notable 80.0% of the studied nurses demonstrated an unsatisfactory level of total knowledge concerning nebulization therapy administration. This finding aligns with Fares et al ⁽¹⁵⁾, who, in their study on "Nurses in China lack knowledge of inhaler devices: A cross-sectional study," reported insufficient knowledge of inhalers among nurses. Similarly, Lyu et al ⁽¹⁶⁾, in their investigation on "Knowledge and current practices of ICU nurses regarding aerosol therapy for patients treated with invasive mechanical ventilation: A nationwide cross-sectional study,"

unveiled poor knowledge among ICU nurses regarding optimal aerosol therapy implementation. This may be attributed to factors such as the absence of in-service education, nurses' ignorance, lack of administrative supervision, and insufficient attention to supplying nurses with pertinent knowledge. It underscores the urgent need for educational programs to enhance nurses' knowledge and practice regarding nebulizer delivery, especially since 70% of the nurses in our study had not attended coaching courses on nebulizers. These factors may contribute to the suboptimal information levels among nurses.

In evaluating the overall practice of nurses in nebulizer therapy, our study disclosed that a substantial majority (86.7%) exhibited inadequate performance in this domain. This finding aligns with the work of Ameen et al ⁽⁷⁾, who, in their study on "Knowledge and Performance of Critical Care Nurses toward Nebulizer Therapy in the Intensive Care Unit," reported that 88.8% of nurses demonstrated inadequate performance in nebulizer therapy, attributing it to the absence of training courses in nebulizer therapy delivery.

Moreover, our results resonate with the findings of Zhang et al ⁽¹⁷⁾ in their study on "The utilization of aerosol therapy in mechanical ventilation patients: a prospective multicenter observational cohort study and a review of the current evidence." Zhang et al reported that only 36% (58/160) of patients received aerosol treatments consistent with optimal practice, highlighting a significant gap in adherence to best practices.

Our investigation further illuminated a statistically significant relationship between total nurses' knowledge and various demographic characteristics, including education level, years of experience, and attendance of training courses on

nebulization therapy administration. These findings align with the work of Liu et al ⁽¹⁸⁾ in their study on "Nurse Performance Regarding Care of Patients with Chronic Obstructive Pulmonary Disease on Nebulizer Therapy" in Egypt. Liu et al similarly identified a significant relationship between the level of nurses' total knowledge and educational level, years of experience, and participation in training courses.

Additionally, Singla et al ⁽¹⁹⁾, in their extensive study conducted across 433 secondary and tertiary hospitals in 92 cities in China on "Knowledge and current practices of ICU nurses regarding aerosol therapy for patients treated with invasive mechanical ventilation: A nationwide cross-sectional study," found that respondents with a higher professional title, longer working experience, and those who had received more atomization training exhibited higher atomization knowledge scores. This underscores the impact of professional development and training on enhancing nurses' knowledge and practices in aerosol therapy, resonating with the emphasis on continuous education in our study.

Regarding the association between total nurses' practice and demographic characteristics such as age and gender, this study reveals no statistically significant correlation. This finding aligns with the results reported by Xie et al ⁽¹⁴⁾ in their study on "Knowledge and practices of nurses regarding nebulization therapy in Kirkuk city hospitals," where no significant differences were observed (P-value > 0.05). This suggests that, in our study, the nurses' practice in nebulization therapy does not show significant variations based on age or gender.

Moving on to the correlation between total knowledge and total practice, a highly significant positive correlation was identified between total nurses' knowledge and their overall

practice concerning nebulization with mechanical ventilation. This outcome corresponds with the findings of Santambrogio et al ⁽²⁰⁾ in their study on "Hospital staff practical skills and theoretical knowledge in inhaled aerosol therapy: a single center cross-sectional observational study." Their research revealed a lack of knowledge and practical abilities in aerosol therapy among healthcare professionals in a large Italian teaching hospital. It emphasizes that deficient knowledge and skills in administering nebulizer sessions can potentially limit patient responses to such sessions.

Furthermore, the positive strong correlation between knowledge and performance regarding nebulizer therapy, as evidenced by Fares et al ⁽¹⁵⁾ in their study on "Knowledge and Performance of Critical Care Nurses Toward Nebulizer Therapy in the Intensive Care Unit," reinforces the notion that a higher level of knowledge is associated with improved performance ($r=0.277$, $p=0.013$). This underscores the importance of enhancing nurses' understanding of nebulization therapy to positively impact their practical skills in administering such treatments.

Conclusion:

In summary, a predominant proportion of the surveyed nurses exhibited inadequate levels of both total knowledge and practical skills in the administration of nebulization therapy. The research unveiled compelling evidence indicating statistically significant relationships between total nurses' knowledge and various demographic characteristics, including age, gender, education level, years of experience, and attendance of training courses on nebulization therapy administration. Similarly, a robust statistical connection was identified between total nurses' practice and demographic factors such as education level, years of experience, and

participation in training courses on nebulization therapy administration. Furthermore, a noteworthy revelation emerged, demonstrating a highly significant positive correlation between total nurses' knowledge and their overall practice concerning nebulization with mechanical ventilation. This correlation underscores the integral link between nurses' understanding of nebulization therapy and their proficiency in its practical application. Notably, the holistic knowledge and practice of nurses regarding nebulization with mechanical ventilation exhibited a profoundly significant positive association. This finding underscores the critical importance of a comprehensive understanding of nebulization therapy, as it directly impacts the nurses' adeptness in administering such treatments with mechanical breathing support.

Recommendations:

In light of the principal findings delineated by this study, the ensuing recommendations are formulated. It is strongly advised to institute targeted training initiatives tailored for nurses, aimed at augmenting their proficiency in handling nebulizer devices.

Furthermore, it is imperative for researchers to institute a specialized team of professionals tasked with systematically evaluating nurses' comprehension of inhaler devices. A recurrent assessment regimen, coupled with continuous education sessions on the accurate inhaler technique, is indispensable for respiratory nurses. This approach is deemed essential to optimize the utilization of inhaler devices by nurses, ensuring adherence to best practices.

Moreover, it is recommended that institutions consider and implement relevant improvements. These enhancements may encompass updated protocols, refined infrastructure, and streamlined processes conducive to fostering an environment wherein optimal device utilization by nurses is not only encouraged but also seamlessly integrated into the institutional framework. In conclusion, these recommendations aspire to empower nurses with an elevated understanding of nebulizer devices and to establish a culture of continuous learning, assessment, and institutional support that ultimately contributes to the refinement of respiratory care practices.

Table 1: Frequency and percentage Distribution of The studied Nurses based on Their Demographic traits (n=30).

Nurse's demographic Characters	No.	%
Age (Years)		
20-<25	15	50.0
25-<30	13	43.3
≥ 30	2	6.7
Mean ± SD= 24.73 ± 2.85 Max= 32 Min= 21 Range=11		
Gender		
Male	17	56.7
Female	13	43.3
Educational Qualification		
Diploma	2	6.7
Technical Institute	25	83.3
Bachelor of Nursing	3	10.0
Job title		
Nurse	28	93.3
Nursing supervisor	2	6.7
Years of experiences		
1-< 5	22	73.3
5-<10	6	20.0
≥ 10	2	6.7
Mean ± SD= 3.10± 2.89 Max= 1 Min= 10 Range=9		
Attending a training course on nebulization therapy administration		
Yes	9	30.0
No	21	70.0

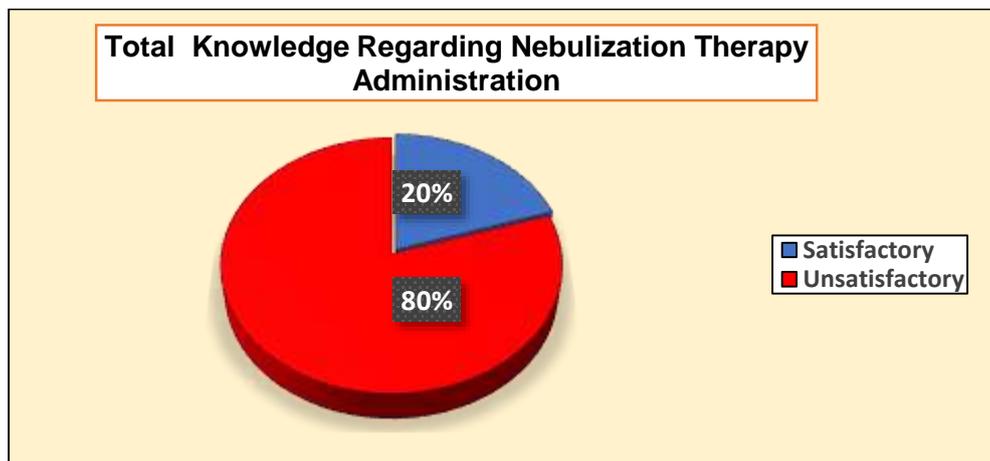


Figure I: Percentage Distribution of The surveyed Nurses According to their Total Knowledge Regarding Nebulization Therapy application (n=30).

Table 2: Percentage and Frequency Distribution of The studied Nurses depending on Their Practice as regards Nebulization with Mechanical Ventilation (n=30).

Nurse's practice regarding nebulization with M. V	Adequate		Inadequate		Mean ± SD
	No.	%	No.	%	
Assessment	3	10.0	27	90.0	3.43±2.4
Preparation	6	20.0	24	80.0	10.8±2.06
Implementation	2	6.7	28	93.3	0.53±1.7
Post Care	2	6.7	28	93.3	7.20±4.13
Record and report	4	13.3	26	86.7	1.96±0.99
Total practice score	4	13.3	26	86.7	23.92±10.3

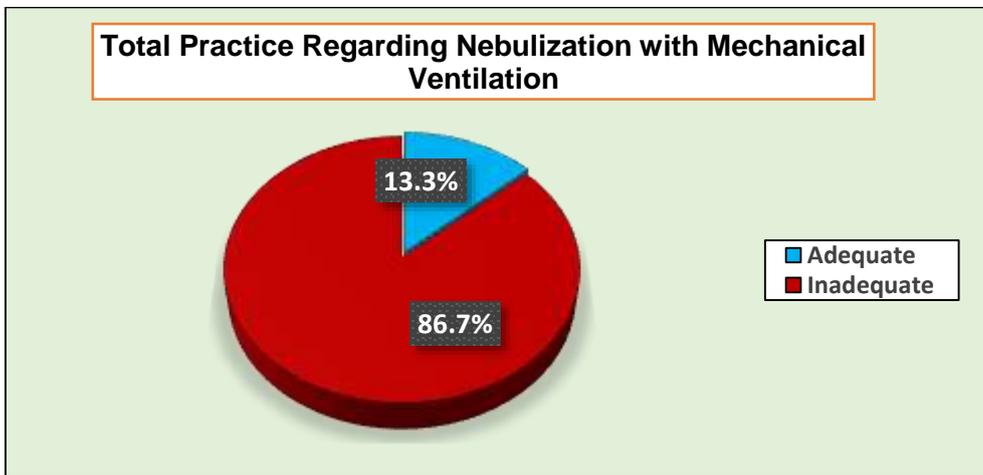


Figure II: Percentage Distribution of The Studied Nurses According to their Total Practice Regarding Nebulization with Mechanical Ventilation (n=30).

Table3: Relation between Demographic Characteristics of the Studied Nurses and Their Knowledge Regarding Nebulization with Mechanical Ventilation (n=30).

Demographic Characteristics	Levels of total knowledge				X ²	P-Value	
	Satisfactory (n=6)		Unsatisfactory (n=24)				
	No.	%	No.	%			
Age (years)	20-<25	1	16.7	14	58.4	4.936	< 0.05* (S)
	25-<30	5	83.3	8	33.3		
	≥ 30	0	0.0	2	8.3		
Gender	Male	1	16.7	16	66.7	4.887	< 0.05* (S)
	Female	5	83.3	8	33.3		
Education grade	Diploma	0	0.0	2	8.3	4.883	< 0.05* (S)
	Technical Institute	4	66.7	21	87.5		
	Bachelor of Nursing	2	33.3	1	4.2		
Job title	Nurse	5	83.3	23	95.8	1.205	> 0.05 (NS)
	Nursing supervisor	1	16.7	1	4.2		
Years experiences	1-< 5	4	66.7	18	75.0	4.990	< 0.05* (S)
	5-<10	2	33.3	4	16.7		
	≥ 10	0	0.0	2	8.3		
Attending a training course on nebulization therapy administration	Yes	5	83.3	4	16.7	5.018	< 0.05* (S)
	No	1	16.7	20	83.3		

Table4: Relation between Demographic characteristics of the studied Nurses and Their Practice concerning Nebulization with Mechanical Ventilation (n=30).

Demographic Characteristics	Levels of total practice				X ²	P-Value
	Adequate (n=4)		Inadequate (n=26)			
	No.	%	No.	%		
Age (years)	20-<25	3	75.0	12	46.2	1.243 > 0.05 (NS)
	25-<30	1	25.0	12	46.2	
	≥ 30	0	0.0	2	7.6	
Gender	Male	2	50.0	15	57.7	1.000 > 0.05 (NS)
	Female	2	50.0	11	42.3	
Education level	Diploma	0	0.0	2	7.7	8.308 < 0.05* (S)
	Technical Institute	2	50.0	23	88.5	
	Bachelor of Nursing	2	50.0	1	3.8	
Job title	Nurse	3	75.0	25	96.2	2.493 > 0.05 (NS)
	Nursing supervisor	1	25.0	1	3.8	
Years of experiences	1-< 5	4	100.0	18	69.2	4.678 < 0.05* (S)
	5-<10	0	0.0	6	23.1	
	≥ 10	0	0.0	2	7.7	
Attending a training course on nebulization therapy administration	Yes	4	100.0	5	19.2	4.739 < 0.05* (S)
	No	0	0.0	21	80.8	

Table 5: Correlation Between the Studied Nurses' Knowledge and Practice Regarding Nebulization with Mechanical Ventilation (n=30).

Variables	Total practice value	
	r	p-value
Total knowledge rate	0.628	0.000**

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