Cognition and Perception of Critical Care Nurses Regarding Non-Invasive Positive Pressure Ventilation

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ABSTRACT

Background: The use of non-invasive positive pressure ventilation (NIPPV) has increased substantially in the last three decades as it moved from critical care to ward settings and became an essential tool to manage respiratory failure. To provide a good standard of care, it is crucial that nurses providing NIPPV care to patients have knowledge and a positive attitude within their area of competence. **Objective:** To determine the level of knowledge and attitude of nurses who provide NIPPV patient care and to associate the findings with the selected demographic variables. **Methods:** A descriptive cross-sectional study was carried out from May to June 2023 with 280 nurses working at various critical care units in a tertiary-level hospital, selected through convenience sampling technique. Data was collected using a questionnaire prepared by the researchers and analyzed using SPSS version 27. Descriptive and inferential statistics were employed for the analysis. Normality of the data was ensured by using the Q-Q plot and the Shapiro-Wilk test. The Fisher exact test was used to compute association with demographic variables. The level of statistical significance was set at ≤ 0.05 for all analyses. **Results:** The majority (68.9%) of nurses had inadequate knowledge of NIPPV with an overall knowledge mean score of 13 ± 3.45, and the majority (69.3%) maintained a neutral attitude, with 27.1% expressing negativity and a small proportion (3.6%) of nurses demonstrating a positive attitude. Notably, none of the participants had attended critical care training. There was a significant association found between knowledge levels and attitude with age (*p* value 0.035) and the total years of experience (*p* value <0.001) in nursing. There was a negative correlation found between knowledge and attitude, computing a Karl Pearson correlation coefficient of -0.248 (*p*<0.001). **Conclusion:** The study findings emphasize the necessity for targeted in-service education and interventions to ensure a comprehensive and positive approach to enhance the quality of care provided by the nurses in the context of patients receiving non-invasive positive pressure ventilation therapy.

Keywords: Attitude; Knowledge; Non-Invasive Positive Pressure Ventilation; Nurses

INTRODUCTION

Non-invasive positive-pressure ventilation (NIPPV) is the delivery of mechanical ventilation without using an invasive artificial airway to inflate the lungs directly, by using a snugly fitting face mask connected to a machine without an endotracheal tube or tracheostomy. Furthermore, it produces the same physiological benefits, such as eased breathing with increased arterial oxygenation and ventilation, as invasive mechanical ventilation, while avoiding the potentially fatal hazards associated with the use of an artificial airway, including ventilator-associated pneumonia (Scala & Pisani, 2018; Akoumianaki *et al.*, 2021). Hence, this is a safe and useful method of enhancing gas exchange for the severely ill with various well-defined causes of acute respiratory failure, COPD, congestive heart failure, and obstructive sleep apnea (Tarhan *et al.*, 2015). Furthermore, NIPPV lowers patient pain and procedural difficulties, enhances treatment quality, eases the

burden on critical care units, saves money compared to mechanical ventilation (Hyzy & McSparron, 2023; Carron *et al*., 2013), and also leads to better outcomes, shorter hospital stays, and lower rates of morbidity and mortality (Hoo, 2018; Raurell-Torredà *et al*., 2015). Although NIPPV therapy was confined to critical care settings earlier, it has now been adapted to be used in alternative ward settings with appropriate resources and expertise (Spiteri, 2022; Sanchez *et al*., 2014).

Using non-invasive ventilatory strategies is of major importance in COVID-19 patients with hypoxic respiratory failure and dyspnea, as it helps avoid numerous life-threatening complications associated with intubation (Tobin, Laghi & Jubran, 2020; Withers *et al*., 2021; Ahmalia, Aljaberi & Said, 2024). The European Respiratory Journal reveals dramatic benefits with the use of continuous positive airway pressure in COVID-19 patients managed outside the intensive care unit. Although NIPPV is highly beneficial, failure rates can range from 5% to 60% among treated individuals due to several factors, including the severity of the illness, low patient interface tolerance, team experience, and the level of care intensity in the environment (Scala & Pisani, 2018). Among healthcare professionals, nurses play a vital role in monitoring, caring for, educating, and identifying patients at risk of developing complications during NIPPV. However, nurses are frequently reluctant to operate the NIPPV equipment because they are unaware of the settings that need to be adjusted and the particular attention and care these patients require (Annarani *et al*., 2017).

The lack of nurses' knowledge and competence leads to scarce application in clinical settings (Bambi *et al.*, 2023; Nyalla 2018; Correa *et al*., 2015). However, nurses with adequate knowledge, attitude, and skill to manage NIV patients are the clinical key to achieving positive patient outcomes (Tobin, Laghi & Jubran, 2020; Tobin, Jubran & Laghi, 2021). According to the available literature, nurses involved with NIPPV have limited knowledge, and there is a high demand for assessment and education to follow evidence-based guidelines and avoid contraindications (Kim & Lee, 2019; Salmond & Echevarria, 2017).

Moreover, appropriate therapy through a multidisciplinary team approach with an adequate nurse-patient ratio is essential to ensure the success of NIPPV patient care. However, in non-critical care settings, the nurse-patient ratio is higher compared to critical setups. Thus, the efficacy and close monitoring of patients with NIPPV may be compromised by inadequate knowledge and attitude. All staff must receive training in the theoretical and practical skills relevant to their positions to deliver high-quality care (Davies *et al*., 2018; Goel *et al*., 2020). Hence, it is crucial to ensure adequate knowledge, attitude, and skill to manage NIPPV patients, along with effective support systems, locally set protocols, audits, and regular training for nurses (Tobin, 2020; Tobin, Laghi & Jubran, 2020; Tobin, Jubran & Laghi, 2021).

According to Davidson *et al*. (2016), the British Thoracic Society recommends that a nurse working with patients on NIPPV should be proficient in supporting patient mobility and rehabilitation, monitoring the patient while on NIPPV (including observing compliance, synchrony, and adequate ventilation), and initiating the process of palliation on NIPPV. They are essential in identifying patients who are deteriorating and require either escalation of care through endotracheal intubation or optimization of NIPPV-related factors as they continuously provide close patient care (Annarani *et al*., 2017; Tarhan *et al*., 2015). Eventually, patient compliance and progress can be tracked through nursing care.

In the setting of this study, physicians and nurses initiate and monitor patients during NIPPV therapy. However, very few studies have been conducted in India to assess the cognition and perception of nurses regarding NIPPV. Therefore, this study is necessary to identify the gaps in knowledge and attitude, which will help to inform, direct, and support the development of training programs meant to enhance NIPPV nursing care practices in hospital settings. Moreover, the present study is relevant to clinical nurses, educators, and nurse administrators. Additionally, it is also imperative to enhance the limited amount of internationally available research on nurses' understanding of NIPPV.

Objectives

1. To assess the knowledge and attitude of nurses regarding NIPPV therapy.

2. To associate the findings of knowledge and attitude with the selected demographic variables.

3. To correlate the relationship of knowledge and attitude of nurses regarding NIPPV therapy.

METHODOLOGY

Research Design, Setting and Participants

This is a cross-sectional descriptive study conducted from 01/05/2023 to 30/06/2023 at a tertiary-level hospital in New Delhi, India. The convenience sampling method was employed due to the practical availability of nurses in each shift. To address potential biases, the questionnaire was individually administered by the researcher to each participant. Subsequently, 280 nurses from the eight critical care units were recruited. Nurses who consented to participate in the study and were available at the time of data collection were enrolled. Those who were unwilling to participate or were on leave at the time of data collection were excluded (Kothari, 2004; Polit & Beck, 2008).

Research Tool

The developed tool for the study was based on a literature review of original articles, review articles, and guidelines from several databases (PubMed, Cochrane Library, EMBASE, Google Scholar, CINAHL, and published research), as well as discussions with practicing nurses in the critical care units. The information from the databases was retrieved using keywords (Anderson & Krathwohl, 2001).

The Tool Comprised of three Sections

Section A: Demographic variables consisting of 8 items, including age, gender, designation, professional nursing qualification, working area, total years of experience in nursing, total years of experience in ICU, and training attended on critical care nursing.

Section B: Structured knowledge items (25) in a multiple-choice questionnaire. Participants provided responses by selecting the correct option, with a correct response being assigned 1 point and an incorrect response receiving 0 points. The total score ranged from 0 to 25.

Section C: Consists of 10 statements using a 5-point Likert Scale, including both positive and negative statements, with responses ranging from Strongly Agree (score 5) to Strongly Disagree (score 1). Reverse scoring was applied to the negative statements. The maximum total attitude score ranged from 10 to 50.

Interpretation of Knowledge Scores

The scores were categorized according to Bloom Scoring Criteria

- Adequate knowledge: 80-100 %
- Moderately adequate: 60-79%
- Inadequate knowledge: < 59%

Interpretation of Attitude Scores

- Positive attitude: 80-100%
- Neutral attitude: 60-79%
- Negative attitude: < 59%

The content validity of the tool was ensured by submitting it to four nursing experts, two medical experts, and one statistician. The content validity index score was found to be 0.97. The reliability of the tool was calculated using Cronbach's alpha, with a result of $\alpha = 0.82$, indicating good internal consistency (Adams, 2015).

After obtaining administrative approval from the hospital authority, data was collected. The researcher met the participants on-site, explained the purpose of the study, and obtained written informed consent from the participants. A try-out and pilot study were conducted on the first day with 5 and 10 samples, respectively, and the questionnaire was further refined based on their feedback. The tool was provided only in the English language.

Sample Size Calculation

The sample size was initially determined using Cochran's formula for an infinite population, considering a 5% margin of error, a 95% confidence interval, and a 50% response distribution. It was then adjusted for the

finite population, resulting in a final sample size of 280.

Data Analysis

The collected data were analyzed using SPSS for Windows, Release version 27.0, and Microsoft Office Excel 365. Descriptive and inferential statistics were employed for the analysis. The normality of data distribution was assessed using the Normal Q-Q Plot and the Shapiro-Wilk test. The Fisher Exact Test was computed to ascertain associations between knowledge and attitude across groups concerning selected demographic variables. The correlation between knowledge and attitude was analyzed using the Karl Pearson correlation coefficient test. The level of statistical significance was set at $p < 0.05$ for all analyses.

Ethical Consideration

For the present study ethical approval was obtained from the Ethical Committee of Amity University, India with reference number IEC/VMMC/SJH/Project/2022-04/CC-259 on 28th August, 2022.

RESULTS

1. Demographic Characteristics

Of the 280 participants, the majority (76.4%) were female, predominantly in the 21-30 years age range (52.1%). Nursing Officers constituted the largest group (85.7%), with 66.8% holding a B.Sc. Nursing degree. The participants worked in diverse settings, with a notable presence in the Medical Intensive Care Unit (ICU) (28.2%), Critical Care Unit (CCU) and Cardiothoracic and Vascular Surgery Intensive Care Unit (CTVS-ICU) (23.6%). Experience-wise, a significant proportion had 1-5 years of nursing experience (48.2%) with a mean of 8.5 ± 7.14 years. The majority (81.1%) had five or fewer years of experience in an ICU setting, with a mean of 3.94 ± 2.95 years. Notably, none of the participants had attended Critical Care Nursing training (100%) (Table 1).

Table 1: Demographic Characteristics of the Participants (n=280)

Demographic Characteristics	Frequency (f)	Percentage (%)
Age (in Years)		
21-30	146	52.1%
31-40	93	33.2%
41-50	28	10.0%
51-60	13	4.6%
Gender		
Male	66	23.6%
Female	214	76.4%
Designation		
Nursing Officer	240	85.7%
Sr. Nursing Officer	37	13.2%
ANS	3	1.1%
Professional Nursing Qualification		
GNM	80	28.6%
B.Sc. Nursing	187	66.8%
M.Sc. Nursing	13	4.6%
Working Area		
Medical ICU	79	28.2%
Surgical ICU	24	8.6%
Neurology ICU	29	10.4%
Nephro-urology ICU	25	8.9%
CCU & CTVS-ICU	66	23.6%
General ICU	17	6.1%
HDU	40	14.3%

Total years of Experience in Nursing (Mean – 8.5 ± 7.14)		
1-5	135	48.2%
6-10	84	30.0%
11-15	16	5.7%
More than 15	45	16.1%
Total years of Experience in ICU (Mean – 3.94 ± 2.95)		
≤ 5	230	81.1%
> 5	50	17.9%
Training Attended in Critical care Nursing		
Yes	0	0.0%
No	280	100.0%

Table 2 depicts the overall knowledge level of participants, indicated by a mean score of 13.25 ± 3.45. The majority, 68.9% of nurses (mean score of 12 ± 2.00), possess "Inadequate knowledge." A significant portion, 25.4% (mean score of 16 ± 1.00), falls within the category of "Moderately adequate knowledge." Only 5.7% of nurses exhibit "Adequate knowledge," as evidenced by a higher mean score of 22 ± 1.00.

2. Level of Knowledge

Table 2: Overall Distribution of Knowledge Level of Participants (n=280)

Level of Knowledge*	f (%)	Mean	Mean%	SD
Inadequate	193 (68.9)	12	48.0%	2.00
Moderately adequate	71 (25.4)	16	64.0%	1.00
Adequate	16 (5.7)	22	88.0%	1.00
Overall knowledge	280 (100)	13.25	53.0%	3.45

Scores were categorized according to Bloom's cut-off points as 80–100% (Adequate), 60–79% (Moderately Adequate), and ≤59% (Inadequate).

In Table 3, the highest competence of participants was observed in "Nursing Care in NIPPV," with a mean score of 4.57 ± 1.649, while the lowest average knowledge was in "Pre-Application Considerations for NIPPV," scoring 1.16 ± 0.843.

Table 3: Distribution of Category Wise Knowledge Scores of Participants (n=280)

Category of NIPPV Therapy	Max Score	Range (Min-Max)	Mean	Mean%	SD
Fundamentals of NIPPV therapy	8	0-8	4.51	56.38%	1.536
Pre-Application considerations for NIPPV	3	0-3	1.16	38.67%	0.843
Patient monitoring in NIPPV	6	0-6	3.00	50.00%	1.356
Nursing care in NIPPV	8	0-8	4.57	57.13%	1.649
Overall, Knowledge Score	**25**	**2-24**	**13.25**	**53.00%**	**3.455**

Figure 1: Item Wise Analysis of Knowledge Level of the Participants (N=280)

Figure 1 depicts a detailed item-wise analysis of the participants' knowledge levels, highlighting notably lower comprehension in areas such as ensuring proper mask fit using the "2-finger rule" (21.43%) and assessing signs of pressure injury related to the NIPPV mask (33.93%). Additionally, interpreting ABG values presented a challenge, with only 38.57% of responses being correct.

3. Attitude of Participants Regarding NIPPV Therapy

Table 4: Attitude of Participants Regarding NIPPV Therapy (n=280)

Attitude	F	%
Negative	76	27.1
Neutral	194	69.3
Positive	10	3.6

In this study, 27.1% of participants expressed a negative attitude, while the majority (69.3%) maintained a neutral stance, and a smaller proportion (3.6%) demonstrated a positive attitude regarding NIPPV therapy (Table 4).
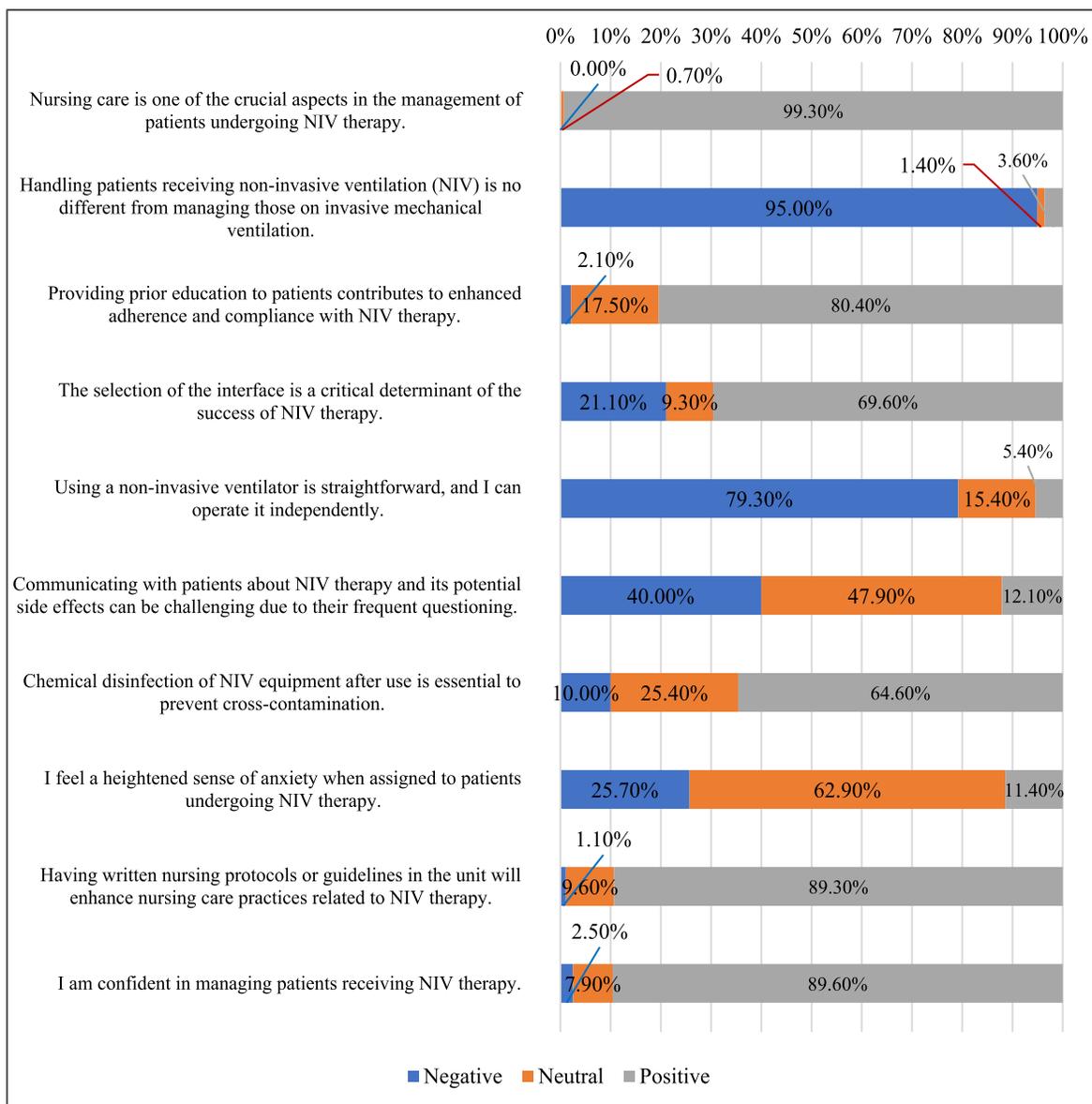

Figure 2: Item Wise Attitude Levels of the Participant towards NIPPV Therapy (n=280)

Figure 2 exhibits overwhelmingly positive attitudes regarding the importance of nursing care, with 99.30% of participants recognizing its crucial role. The positive impact of education on patient adherence is highlighted by 80.40%, and the majority (89.60%) express confidence in managing patients undergoing NIPPV therapy. Participants generally view handling NIPPV patients as comparable to those on invasive mechanical ventilation (95.00%), and communication challenges are met with a neutral stance (47.90%).

However, there are concerns in specific areas, including interface selection (21.10%) and participants' confidence in independently operating a non-invasive ventilator (79.30%). Despite endorsing the necessity of chemical disinfection (64.60%), a notable proportion report heightened anxiety regarding NIPPV-related responsibilities (25.70%). Written protocols are widely supported for enhancing care practices (89.30%), though some participants feel anxious (11.40%) and express reservations about communication challenges (12.10%).

There was a significant association between knowledge and both age and total years of experience in nursing ($p = 0.035$, $p < 0.001$). A significant association was also found between the level of attitude and variables such as gender, designation, working area, and total years of experience in nursing ($p = 0.024, 0.003, <0.001, 0.005$, respectively). Additionally, there was a noticeable trend towards an increased negative attitude in the older age groups. Gender differences revealed that males had a higher negative attitude compared to females (Table 5).

Table 5: Association between Knowledge and Attitude towards NIPPV Therapy and Demographic Characteristics of Study Participants (n=280)

Demographic Characteristics	Knowledge Level			p†	Attitude			p†
	Inadequate	Moderately Adequate	Adequate		Negative	Neutral	Positive	
	n (%)	*n* (%)	*n* (%)		*n* (%)	*n* (%)	*n* (%)	
Age (in years)								
21-30	98 (67.1)	45 (30.8)	3 (2.1)	0.035*	30 (20.5)	111 (76.0)	5 (3.4)	0.066
31-40	63 (67.7)	20 (21.5)	10 (10.8)		31 (33.3)	57 (61.3)	5 (5.4)	
41-50	22 (78.6)	4 (14.3)	2 (7.1)		8 (28.6)	20 (71.4)	0 (0.0)	
51-60	10 (76.9)	2 (15.4)	1 (7.7)		7 (53.8)	6 (46.2)	0 (0.0)	
Gender								
Male	51 (77.3)	13 (19.7)	2 (3.0)	0.276	25 (37.9)	41 (62.1)	0 (0.0)	0.024*
Female	142 (66.4)	58 (27.1)	14 (6.5)		51 (23.8)	153 (71.5)	10 (4.7)	
Designation								
Nursing officer	165 (68.8)	64 (26.7)	11 (4.6)	0.116	55 (22.9)	175 (72.9)	10 (4.2)	0.003*
Sr. nursing officer	26 (70.3)	7 (18.9)	4 (10.8)		19 (51.4)	18 (48.6)	0 (0.0)	
ANS	2 (66.7)	0 (00.0)	1 (33.3)		2 (66.7)	1 (33.3)	0 (0.0)	
Professional Qualification								
GNM	59 (73.8)	17 (21.3)	4 (5.0)	0.662	29 (36.3)	50 (62.5)	1 (1.3)	0.161
B.Sc. Nursing	126 (67.4)	49 (26.2)	12 (6.4)		43 (23.0)	135 (72.2)	9 (4.8)	
M.Sc. Nursing	8 (61.5)	5 (38.5)	0 (0.0)		4 (30.8)	9 (69.2)	0 (0.0)	
Working Area								
Medical ICU	50 (63.3)	23 (29.1)	6 (7.6)	0.460	20 (25.3)	59 (74.7)	0 (0.0)	<0.001*
Surgical ICU	17 (70.8)	5 (20.8)	2 (8.3)		15 (62.5)	9 (37.5)	0 (0.0)	
Neurology ICU	21 (72.4)	7 (24.1)	1 (3.4)		10 (34.5)	19 (65.5)	0 (0.0)	
Nephrourology ICU	18 (72.0)	4 (16.0)	3 (12.0)		2 (8.0)	23 (92.0)	0 (0.0)	
CCU & CTVS-ICU	48 (72.7)	16 (24.2)	2 (3.0)		19 (28.8)	46 (69.7)	1 (1.5)	
General ICU	8 (47.1)	8 (47.1)	1 (5.9)		1 (5.9)	15 (88.2)	1 (5.9)	
HDU	31 (77.5)	8 (20.0)	1 (2.5)		9 (22.5)	23 (57.5)	8 (20.0)	
Total Experience in Nursing								
01-05 Years	92 (68.1)	40 (29.6)	3 (2.2)	<0.001*	27 (20.0)	104 (77.0)	4 (3.0)	0.005*
06-10 Years	54 (64.3)	24 (28.6)	6 (7.1)		21 (25.0)	57 (67.9)	6 (7.1)	
11-15 Years	11 (68.8)	0 (00.0)	5 (31.3)		7 (43.8)	9 (56.3)	0 (0.0)	
More than 15 Years	36 (80.0)	7 (15.6)	2 (4.4)		21 (46.7)	24 (53.3)	0 (0.0)	
Total Experience in ICU								
≤ 5 Years	156 (67.8)	61 (26.5)	13 (5.7)	0.627	58 (25.2)	164 (71.3)	8 (3.5)	0.245
> 5 Years	37 (74.0)	10 (20.0)	3 (6.0)		18 (36.0)	30 (60.0)	2 (4.0)	

Intensive Care Unit (ICU), Critical Care Unit (CCU), Cardiothoracic and Vascular Surgery Intensive Care Unit (CTVS-ICU)
Assistant Nursing Superintendent (ANS), General Nuraing and Midwifery (HNM), High Dependency Unit (HDU)

Correlation between the Participants Knowledge and Attitude Regarding NIPPV Therapy

A negative correlation was found between knowledge and attitude, with a Karl Pearson correlation coefficient of -0.248 ($p < 0.001$) (Table 6).

Table 6: Correlation among Participants Knowledge and Attitude Regarding NIPPV Therapy (n=280)

Variables	Mean	SD	Pearson Correlation Coefficient	*p*-value
Knowledge	13.25	3.455	-0.248	<0.001*
Attitude	32.16	3.229		

* - Significant at p≤0.05

DISCUSSION

In this study, the majority of participants (76.4%) were female and in the age group of 21-30 years (52.1%). Nursing officers constituted the largest group (85.7%). These results are supported by studies from Aziz and Abdul-Hamza (2017), Annarani *et al*. (2015), Lomnyack *et al*. (2021), Chaudhary, Perera and Natha (2022), and Goktas *et al*. (2017). There were no significant associations found between knowledge and demographic variables except for age and total years of experience in nursing. In relation to the number of years of experience in nursing, 48.2% of the participants had 1-5 years of service. These results agree with Aziz and Abdul-Hamza (2017), Hammod and Mohammed (2016), and Elsobkey and Amer (2018).In this study, it is found that none of the participants had attended any training regarding NIV therapy. These results were consistent with the findings of Gírio and Sousa (2024), Chaudhary, Perera and Natha (2022), Annarani *et al*. (2017), Lomnyack *et al*. (2021), and Merve Trehan *et al*. (2015). Thus, it is clear that the development of teaching modules and related training programs is required in this field.

Regarding Overall Knowledge Scores

The study observed that 68.9% of nurses possess inadequate knowledge related to non-invasive positive-pressure ventilation (NIPPV), with a neutral to negative stance of attitude. Similar findings are supported by other studies including Gírio and Sousa (2024), Annarani *et al*. (2017), Raurell-Torredà *et al*. (2015), Aziz and Abdul-Hamza (2017), Chaudhary, Perera and Natha (2022), Goktas *et al*. (2017), and Lomnyack *et al*. (2021). The findings from this study show a dire need for structured training for nurses, which would not only increase knowledge but also positively change attitudes regarding NIPPV therapy. Additional training, such as in-service training programs for nurses, would be helpful for better provision of care with NIPPV therapy. Therefore, it is important to encourage nurses to pursue higher education to ensure the highest quality of care.

In the present study, the association between total years of experience in nursing and knowledge levels regarding NIPPV therapy was highly significant ($p < 0.001$). These findings were similar to those of Bahia Siam, Alenazi a*nd Mahmoud (2023) and Terhan et al. (2015), while they contradicted the findings of Lomnyack et al*. (2021) the experience and educational status of participants had no association with knowledge level.

In this study, nurses in the medical ICU displayed moderately adequate knowledge (29.1%) as compared to other ICUs, with no statistically significant difference ($p = 0.460$). These findings were further supported by Tarhan *et al*. (2015). This result suggests that units caring for patients with higher acuity (Medical ICU, CTVS ICU, & CCU) had slightly higher NIPPV knowledge than those caring for patients with lower acuity (Surgical ICU & Neurology ICU), though the difference was not statistically significant.

Participants displayed varying proficiency levels in distinct aspects of Non-Invasive Positive-Pressure Ventilation (NIPPV) therapy. The lowest average knowledge was *in "Pre-Application Considerations for NIPPV," scoring 38.67%. These results are consistent with Tarhan et al*. (2015), who found that 22.4% of nurses did not know any of the issues considered during the pre-NIPPV administration. Overall, participants in the study achieved an average score of 13.25 ± 3.455 out of 25 (53.00%), indicating diverse proficiency levels across various aspects of NIPPV therapy. This suggests a reasonable overall understanding, with room for improvement in certain areas.

In this study, a detailed item-wise analysis highlighted challenges in understanding certain aspects. Notably, a lower level of comprehension was observed in ensuring proper mask fit using the "2-finger rule" and in assessing signs of pressure injury related to the NIPPV mask. These results are consistent with the findings of Raurell-Torredà *et al*. (2019), where very few (11.7%) nurses were able to identify proper mask fit using the "2-finger rule." The reason for the interruption of NIPPV was correctly answered by 59.29% of the participants. Saltürk *et al*. (2012) reported that during NIPPV application, under the supervision of experienced personnel, patients removing the mask of their own accord and being off the mask for a short time does not hinder the success of NIPPV; instead, it increases patient adaptation.

In this study, the distribution of attitudes revealed noteworthy patterns, with the majority (69.3%) of participants maintaining a neutral stance and a smaller proportion (3.6%) demonstrating a positive attitude. These results were similar by the findings of Schmidt *et al*. (2016), nurses generally reported more negative feelings and low willingness providing NIPPV treatment compared to other categories ($p < 0.05$) and only 32% of nurses reported high willingness towards NIPPV therapy. The observed neutral and negative attitudes could be due to a lack of formal training in NIPPV therapy during basic nursing education and on-the-job training, as none of the participants received any training on NIPPV. Therefore, focused interventions are necessary to guarantee a thorough and constructive approach to NIPPV treatment. In future training programs, knowledge acquisition and attitude-shaping activities, such as role play and real-life scenarios, can be incorporated. Additionally, creating a supportive environment and encouraging nurses to reflect on their knowledge and attitudes will ensure feedback and self-assessment. Furthermore, the negative correlation between knowledge and attitude in this study may warrant future research into the underlying factors influencing the relationship between knowledge and attitude in the context of the study.

The present study's findings reveal that the overall knowledge level of nurses regarding NIPPV was low. Participants scored average on questions about clinical practice, moderately on device equipment, and poorly on theoretical issues, such as indications. This shows that the nurses were not aware of what application is performed for what purpose. Performing an application without knowledge represents a failure to comply with an evidence-based nursing approach. If the basic principles that provide the basis for health, disease, or treatment are not understood, holistic nursing is not possible. This lack of knowledge may result from not receiving NIPPV training during school or on the job. There are very few published studies that evaluate nurses' understanding of NIPPV therapy, both nationally and globally. Consequently, it would be suggested to carry out similar research in a variety of contexts.

The strength of the study lies in the adequacy of the sample size and the selection of nurses from various critical care units.

Limitations

The study was restricted to a single center due to a delay in obtaining ethical clearance, representing a notable constraint of this study.

CONCLUSION

The role of nurses in providing NIPPV therapy is crucial, and they should receive specialized training in NIPPV therapy. The study underlines that nurses' cognition and perception of NIPPV therapy should be improved to attain the maximum efficacy of the therapy. Considering the differing levels of cognition and perception among nurses regarding NIPPV, the authors recommend future prospects such as developing evidence-based NIPPV clinical nursing guidelines and nursing care protocols to maintain a high quality of patient care. Furthermore, the organization should also facilitate nurses in pursuing further studies to update their knowledge and develop a positive attitude in the relevant field, thereby elevating the quality of service in critical care units. Hence, investing in the advancement of critical care nurses has the potential to improve patient outcomes, mitigate complications, optimize resource allocation, and ultimately maintain a high quality of care to save lives. In addition, the authors recommend regular continuing education programs for critical care nurses regarding NIPPV therapy. Consequently, active participation in NIPPV therapy in critical care settings will serve as a catalyst, enhancing critical care nurses' comprehension and perception, thereby fostering improved patient care.

Recommendation

For effective clinical practice, it was recommended that regular in-service training for critical care nurses, as they are at the forefront of caring for patients requiring non-invasive positive pressure ventilation (NIPPV). Additionally, it is important to have nursing care protocols, e-learning modules, and nursing care guidelines in place to ensure that standardized nursing care is provided to all patients through comprehensive knowledge and positive attitude. Furthermore, it would be beneficial to replicate the same study in multiple settings using a quantitative-qualitative approach with a large sample size, so that the findings can be generalized for a larger population.

Conflict of Interest

The authors declare that they have no competing interests.

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REFERENCES

Adams, N. E. (2015). Bloom's taxonomy of cognitive learning objectives. *Journal of the Medical Library Association (JMLA), 103*(3), 152. https://doi.org/10.3163/1536-5050.103.3.010

Ahmalia, R., Aljaberi, M. A., & Said, M. S. M. (2024). Adoption of Information and Technology Communication in Ulcer Pressure Prevention: A Narrative Review. *International Journal of Advancement in Life Sciences Research, 7*(1), 15-23. https://doi.org/10.31632/ijalsr.2024.v07i01.002

Akoumianaki, E., Ischaki, E., Karagiannis, K., Sigala, I., & Zakyn-Thinos, S. (2021). The Role of Noninvasive Respiratory Management in Patients with Severe COVID- 19 Pneumonia. *Journal of Personalized Medicine, 11*(9), 884. https://doi.org/10.3390/jpm11090884

Anderson, L. W., & Krathwohl, D. R. (2001). *A Taxonomy for Learning, Teaching, And Assessing: A Revision of Bloom's Taxonomy of Educational Objectives: Complete Edition*. Addison Wesley Longman, Inc, US. 352 pages https://eduq.info/xmlui/handle/11515/18824. Accessed on 18th January, 2024.

Annarani, A., Chacko, S., Lucas, A., Rebekah, G., Umesh, S., Ann, S., & Ravi, V. (2017). Knowledge of nurses regarding Non Invasive Ventilation (NIV) therapy. *International Journal of Science and Research, 6*(5), 925-928. https://www.ijsr.net/archive/v6i5/ART20173390.pdf. Accessed on 20th January, 2024.

Aziz, A. R., & Abdul-Hamza, M. A. (2017). Effectiveness of an Educational Program upon nurses' knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit at Al-Diwanyia City Hospitals. *International Journal of Scientific and Research Publications, 7*(8), 460-468. https://www.ijsrp.org/research-paper-0817/ijsrp-p6856.pdf. Accessed on 21st January, 2024.

Bambi, S., Parente, E., Bardacci, Y., Baldassini Rodriguez, S., Forciniti, C., Ballerini, L., ... & Lucchini, A. (2022). The effectiveness of NIV and CPAP training on the Job in COVID-19 acute care wards: A Nurses' self-assessment of skills. *Nursing Reports, 13*(1), 17-28. https://doi.org/10.3390%2Fnursrep13010002

Carron, M., Freo, U., BaHammam, A. S., Dellweg, D., Guarracino, F., Cosentini, R., ... & Esquinas, A. (2013). Complications of non-invasive ventilation techniques: a comprehensive qualitative review of randomized trials. *British Journal of Anaesthesia, 110*(6), 896-914. https://doi.org/10.1093/bja/aet070

Chaudhary, A, S. Perera A. S., Natha, H. (2022). A study to assess effectiveness of skill competency programme regarding on HFNC & non-invasive ventilation in terms of knowledge & practice among staff nurses in selected

hospital, at Meerut, Uttar Pradesh. *Journal of Nursing and Health Science, 11*(6), 21-24. https://doi.org/10.9790/1959-1106042124

Correa, T. D., Sanches, P. R., de Morais, L. C., Scarin, F. C., Silva, E., & Barbas, C. S. V. (2015). Performance of non-invasive ventilation in acute respiratory failure in critically ill patients: A prospective, observational, cohort study. *BMC Pulmonary Medicine, 15*(144), 1-8. https://doi.org/10.1186/s12890-015-0139-3

Davies, M., Allen, M., Bentley, A., Bourke, S. C., Creagh-Brown, B., D'Oliveiro, R., ... & Setchfield, I. (2018). British Thoracic Society Quality Standards for acute non-invasive ventilation in adults. *BMJ Open Respiratory Research, 5*(1), e000283. https://doi.org/10.1136/bmjresp-2018-000283

Davidson, C., Banham, S., Elliott, M., Kennedy, D., Gelder, C., Glossop, A., ... & Thomas, L. (2016). British Thoracic Society/Intensive Care Society Guideline for the ventilatory management of acute hypercapnic respiratory failure in adults. *BMJ Open Respiratory Research, 3*(1), e000133. https://doi.org/10.1136/bmjresp-2016-000133

Elsobkey, F. A., & Amer, S. A. M. (2018). Effect of educational guidelines program about nursing care of neonates receiving continues positive airway pressure. *IOSR Journal of Nursing and Health Sciences, 7*(3),16-26. https://doi.org/10.9790/1959-0703091626

Gírio, R., & Sousa, J. S. (2024). An educational intervention impact in improving nurses' knowledge of noninvasive ventilation. *Revista de Investigação & Inovação em Saúde, 7*(2), 1-11. https://doi.org/10.37914/riis.v7i2.370

Goel, N. N., Owyang, C., Ranginwala, S., Loo, G. T., Richardson, L. D., & Mathews, K. S. (2020). Noninvasive ventilation for critically ill subjects with acute respiratory failure in the emergency department. *Respiratory Care, 65*(1), 82-90. https://doi.org/10.4187/respcare.07111

Goktaş, S., Kıraner, E., Dogan, P., & Tunalı, B. (2017). Effects of provided trainings regarding non-invasive mechanical ventilation on the knowledge level of nurses. *Eurasian Journal of Pulmonology, 19*(1), 19-24. https://doi.org/10.5152/ejp.2016.05706

Hammod, H. J., & Mohammed, S. (2016). Effectiveness of an Educational Program on Nurses Knowledge Concerning Complications Prevention of Mechanical Ventilation at Intensive Care Unit in Al-Hussain Teaching Hospital at Nassiryah City. *Kufa Journal for Nursing Sciences, 6*(2) 1-11 https://doi.org/10.36321/kjns.vi20162.2658

Hoo, G. W. S. (2018). Noninvasive Ventilation. *Medscape*. http://emedicine.medscape.com/article/304235. Accessed on 16th February, 2024.

Hyzy, R. C., & McSparron, J. I. (2023). Noninvasive ventilation in adults with acute respiratory failure: Benefits and contraindications. *UpToDate*. https://www.uptodate.com/contents/noninvasive-ventilation-in-adults-with-acute-respiratory-failure-benefits-and-contraindications. Accessed on 19th January, 2024.

Kim, J. Y., Lee, Y. J., & Korean Association of Wound Ostomy Continence Nurses. (2019). Medical Device-Related Pressure Ulcer (MDRPU) in acute care hospitals and its perceived importance and prevention performance by clinical nurses. *International Wound Journal, 16*(Suppl 1), 51-61. https://doi.org/10.1111/iwj.13023

Kothari, C. R. (2004). Research methodology: Methods and techniques. *New Age International*. https://efaidnbmnnnibpcajpcglclefindmkaj/https://eprints.itn.ac.id/13616/1/Research-Methodology-CR-Kothari.pdf . Accessed on 14th October, 2023.

Lomnyack, W. P., Mwansisya, T., Mbelwa, S., Isangula, K., & Abraham, Z. S. (2021). Knowledge about continuous positive airway pressure machine usage among nurses at a tertiary hospital in Tanzania. *South Sudan Medical Journal, 13*(4), 131-135. https://www.ajol.info/index.php/ssmj/article/view/205346. Accessed on 20th March, 2024.

Nyalla, A. M. O. M. (2018). Wastage of imaging materials in medical conventional, specialised imaging and the relationship in continuous professsional development. *Malaysian Journal of Medical Research (MJMR), 2*(2), 8-12. http://dx.doi.org/10.31674/mjmr.2018.v02i02.002

Polit, D. F., & Beck, C. T. (2008). *Nursing research: Generating and assessing evidence for nursing practice.*

Lippincott Williams & Wilkins. https://books.google.co.in/books/about/Nursing_Research.html?id=Ej3wstotgk QC&redir_esc=y. Accessed on 16th August, 2023.

Raurell-Torredà, M., Argilaga-Molero, E., Colomer-Plana, M., Ruiz-García, T., Galvany-Ferrer, A., & González-Pujol, A. (2015). Intensive care unit profesionals's knowledge about non invasive ventilation comparative analysis. *Enfermeria Intensiva, 26*(2), 46-53. http://doi.org/101016/j.enfi.2018:04.006

Raurell-Torredà, M., Argilaga-Molero, E., Colomer-Plana, M., Ródenas-Francisco, A., & Garcia-Olm, M. (2019). Nurses' and physicians' knowledge and skills in non-invasive ventilation: equipment and contextual influences. *Enfermería Intensiva (English ed.), 30*(1), 21-32. https://doi.org/10.1016/j.enfie.2018.04.004

Salmond, S. W., & Echevarria, M. (2017). Healthcare transformation and changing roles for nursing. *Orthopaedic Nursing, 36*(1), 12-25. https://doi.org/10.1097/nor.0000000000000308

Saltürk, C., Kargın, F., Berk Takır, H., Adıgüzel, N., GüNGÖR, G., & Balcı, M. (2012). Yoğun bakım ünitesinde gece noninvaziv mekanik ventilasyon maske uygulama sıklığı. [Frequency of nightly noninvasive mechanical ventilation mask application in the intensive care unit]. *Göztepe Tıp Dergisi, 27*(3), 90-93. https://doi.org/10.5222/J.GOZTEPETRH.2012.090

Sanchez, D., Smith, G., Piper, A., & Rolls, K. D. (2014). Non-invasive Ventilation Guidelines for Adult Patients with Acute Respiratory Failure. *Agency for Clinical Innovation* (N.S.W.). https://www.aci. health.nsw.gov.au/__data/assets/pdf_file/0007/239740/ACI14_Man_NIV_1-2.pdf. Accessed on 15th June, 2023.

Scala, R., & Pisani, L. (2018). Noninvasive ventilation in acute respiratory failure: which recipe for success?. *European Respiratory Review, 27*(149). https://doi.org/10.1183/16000617 0029-20

Schmidt, M., Boutmy-Deslandes, E., Perbet, S., Mongardon, N., Dres, M., Razazi, K., & Demoule, A. (2016). Differential perceptions of noninvasive ventilation in intensive care among medical caregivers, patients, and their relatives: a multicenter prospective study—The PARVENIR Study. *Anesthesiology, 124*(6), 1347-1359. https://doi.org/10.1097/ALN.0000000000001124

Siam, B. H. A., Alenazi, A. M. S., & Mahmoud, S. K. M. (2023). Nurses' knowledge regarding noninvasive positive pressure in acute respiratory failure. *Egyptian Journal of Health Care, 14*(2), 458-465. https://doi.org/10.21608/ ejhc.2023.297446

Spiteri, P. (2022). *Acute and Critical Care Nurses' Knowledge of Non-Invasive Ventilation* (master's dissertation). University of Malta. https://www.um.edu.mt/library/oar/handle/123456789/110110. Accessed on 20th February, 2024

Tarhan, M., Hançer, O., Polat, F., Gokduman, S. A., & Dalar, L. (2015). Non-invasive mechanical ventilation knowledge level of the nurses: A questionnaire survey in a tertiary care training and research hospital. *Eurasian Journal of Pulmonology, 17*, 163-170. https://dx.doi.org/10.5152/ejp.2015.14633

Tobin, M. J. (2020). Basing respiratory management of COVID-19 on physiological principles. *American Journal of Respiratory and Critical Care Medicine, 201*(11), 1319-1320. https://doi.org/10.1164/rccm.202004-1076ED

Tobin, M. J., Jubran, A., & Laghi, F. (2021). Noninvasive strategies in COVID-19: Epistemology, randomised trials, guidelines, physiology. *European Respiratory Journal, 57*(2), 2004247. https://doi.org/10.1183/13993003.04247-2020

Tobin, M. J., Laghi, F., & Jubran, A. (2020). Caution about early intubation and mechanical ventilation in COVID-19. *Annals of Intensive Care, 10*, 1-3. https://doi.org/10.1186/s13613-020-00692-6

Withers, A., Man, T. C. C., D'Cruz, R., de Vries, H., Fisser, C., Ribeiro, C., ... & Patout, M. (2021). Highlights from the respiratory failure and mechanical ventilation 2020 conference. *ERJ Open Research, 7*(1). https://doi.org/10.1183%2F23120541.00752-2020