



**MECHANICAL VENTILATION: TECHNICAL AND SCIENTIFIC KNOWLEDGE OF NURSING PROFESSIONALS IN INTENSIVE CARE UNITS**  
**VENTILAÇÃO MECÂNICA: CONHECIMENTOS TÉCNICO-CIENTÍFICOS DA ENFERMAGEM NAS UNIDADES DE TERAPIA INTENSIVA**  
**VENTILACIÓN MECÁNICA: CONOCIMIENTOS TÉCNICO-CIENTÍFICOS DEL ENFERMERÍA EN UNIDADES DE CUIDADOS INTENSIVOS**

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#### ABSTRACT

**Objective:** to analyze the technical and scientific knowledge of nurses about mechanical ventilation. **Method:** this was a descriptive, exploratory, and with a qualitative approach research executed from August to September of 2010 with 12 nurses working at the ICU of four hospitals in the city of Mossoró/RN. A semi-structured interview was used and recorded with an MP4 player. The study was approved by the Ethics in Research Committee from the FACENE/FAMENE under protocol no. 86/10. The data were analyzed using a qualitative method and expressed by the methodological tool Collective Subject Discourse. **Results:** the results suggested that most of the participants had doubts either related to the adjustment of the basic parameters or modalities of mechanical ventilation. **Conclusion:** it was possible to verify the need to qualify the nursing professional assisting patients through a process of continuing education in health. The objective of this continuing education process is to develop critical thinking by identifying the existing problems and needs, and use the work process as the main object of transformation. **Descriptors:** artificial respiration, nursing care, intensive care units.

#### RESUMO

**Objetivo:** analisar o conhecimento técnico-científico dos enfermeiros acerca da ventilação mecânica. **Método:** trata-se de uma pesquisa descritiva, exploratória com abordagem qualitativa desenvolvida no período de agosto a setembro de 2010 com 12 enfermeiros que trabalhavam nas UTIs de quatro hospitais da cidade de Mossoró/RN. Para coleta de dados foi utilizado um roteiro de entrevista semiestruturada e um aparelho de MP4 usado para gravação das mesmas, conforme aprovação do Comitê de Ética em Pesquisa da FACENE/FAMENE sob protocolo de n°. 86/10. Os dados foram analisados pelo método qualitativo e expressos por meio do instrumento metodológico Discurso do Sujeito Coletivo. **Resultados:** os resultados apontados sugerem que a maioria dos participantes apresentou dúvidas tanto em relação ao ajuste de parâmetros básicos como aos modos de ventilação mecânica. **Conclusão:** desse modo, foi possível verificar a necessidade de qualificar a assistência de enfermagem prestada ao paciente através de processos de educação permanente em saúde, cujo objetivo é desenvolver o raciocínio crítico a partir da identificação dos reais problemas e necessidades existentes, uma vez que toma o processo de trabalho como principal objeto de transformação. **Descritores:** respiração artificial; cuidados de enfermagem; unidades de terapia intensiva.

#### RESUMEN

**Objetivo:** analizar el conocimiento técnico y científico de las enfermeras sobre la ventilación mecánica. **Método:** se trata de una investigación descriptiva, exploratoria con enfoque cualitativo desarrollada durante el período de agosto a septiembre del 2010 con 12 enfermeras que trabajaban en la UCI de cuatro hospitales en la ciudad de Mossoró/RN. Para la recopilación de datos fue utilizada una guía para entrevista semi-estructurada y un reproductor MP4 para grabar las mismas, de acuerdo con la aprobación del Comité de Ética en la Investigación de FACENE/FAMENE bajo el protocolo no. 86/10. Los datos fueron analizados por el método cualitativo y expresados a través del instrumento metodológico Discurso del Sujeto Colectivo. **Resultados:** los resultados presentados sugieren que la mayoría de los participantes presentaron preguntas en relación con el ajuste de parámetros básicos y los modos de ventilación mecánica. **Conclusión:** de esta manera, fue posible verificar la necesidad de calificar la atención de enfermería dada a el paciente a través del proceso de educación permanente en salud, cuyo objetivo es desarrollar un pensamiento crítico basado en la identificación de la base de los problemas y las necesidades existentes, ya que toma el proceso de trabajo como el principal objeto de la transformación. **Descriptor:** respiración artificial; atención de enfermería; unidades de cuidados intensivos.

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## INTRODUCTION

The scientific and technological advances in the field of health have contributed significantly to the increase in life expectancy of users as the result of modern equipments currently available on the market, acquired knowledge, drugs, developed methods, and techniques.

While these advances bring a series of innovations, coupled with the high degree of solvability of health problems, they have also brought new challenges for this area because the incorporation of technology in the health service requires professionals increasingly capable to deal with situations that could offer risks to the integrity of the user.

In bringing the discussion to the hospital structure, the Intensive Care Unit (ICU) is one of the most complex and mechanized areas, in which an arsenal of technological devices is found such as ventilators, heart monitors, and infusion pumps among others.<sup>1</sup>

Among these technologies, the Invasive Mechanical Ventilator (IMV) stands out as one of the main tools used in these units for the treatment of severely ill patients, who are unable to maintain ventilation activity compatible with life.

Proper handling of the mechanical ventilator requires knowledge about the specific lung needs from each patient and the processes involved in the mechanical ventilation procedure by the professional. In this context, the nursing professional must be technically and scientifically qualified to properly handle all the available equipments in the unit.

The care of patients in critical conditions in the ICU has challenged the nurse to integrate technology to care, so as to master the scientific principles that underlie in the use of the equipments and at the same time address the therapeutic needs of the patient.<sup>2</sup>

*The use of mechanical ventilation (MV) involves risks, its use must be prudent and careful, and its application surrounded by specific care.*<sup>3:3</sup>

Studies have shown that Mechanical Ventilation Associated Pneumonia (MVAP) is among the leading causes of morbidity-mortality with rates ranging from 9 to 40% among cases of nosocomial infections in the intensive care centers thus, presenting consequences such as the rise in the rate of hospitalizations and a significant increase in hospital costs.<sup>4</sup>

The patient who presents continuous decrease in oxygenation (PaO<sub>2</sub>), increase in

arterial carbon dioxide levels (PCO<sub>2</sub>), and persistent acidosis (decreased pH) will probably require ventilatory support.<sup>5</sup>

Therefore, the need to qualify the assistance provided to the patient is crucial considering that the execution of activities is no longer mechanical, but taking as a basis, the provision of safe nursing care, humanized and individualized in order to implement and define strategies for the promotion, prevention, recovery, and rehabilitation of health.

On this basis, the present study aimed at answering the following question: To what extent do the nurses working in the Intensive Care Units in the city of Mossoró/RN hold the technical-scientific knowledge necessary for the proper handling of a Mechanical Ventilator?

## OBJECTIVE

- To analyze the technical-scientific knowledge of nurses about the mechanical ventilation procedure.

## METHOD

This was an exploratory research with a descriptive character and qualitative approach. The study was performed at the Intensive Care Units (ICU) of four hospitals in the city of Mossoró/RN because these units involve complex procedures and equipment, in which the IMV is constantly used for the treatment of patients in critical conditions.

The participants in the study were nurses working at the adult ICU's who conformed to the following inclusion criteria: had at least one year's work experience in the ICU and agreed to participate in the study by signing the provided informed consent. The study sample was comprised of 12 nurses of both genders and ages between 20 and 60 years old.

The data was collected from August 21 to September 2 of 2010. A semi-structured interview consisting of six questions targeting to analyze both, the aspects related to the mechanical ventilation procedure, and those involving the surveyed institutions and knowledge acquired by the respondents during graduation and/or as a result of continuing education processes in health, offered by the hospitals involved in the study. All interviews were recorded using a MP4 player and subsequently transcribed in their entirety to be analyzed.

The collected data were analyzed by the qualitative method and expressed through the Collective Subject Discourse-CSD. The

technique consists in the analysis of the verbal material collected during the research; the main anchoring and/or central ideas present in the speeches in the raw state are selected and gathered in a speech synthesis.<sup>6</sup>

*In the CSD technique, the statements are written in the first person, with the goal of producing the effect of a collective opinion on the receiver, expressing itself directly, as empirical facts, by the "mouth" of a single discoursing subject.*<sup>7:18</sup>

*The analysis aims to organize and summarize the data in a way to enable the provision of responses to the problem proposed for research.*<sup>8:156</sup>

During this process, the main or anchoring ideas, and corresponding key expressions of each deposition were extracted, thus, bringing them all together in a single speech - the synthesis-speech/Speech of the Collective Subject.

Taking as a basis the provisions of Resolution 196/96 from the National Health Council, the participants' anonymity and the

right to privacy and autonomy for the freedom to participate in the study was guaranteed with their signature in the provided informed consent. The study was submitted to the Ethics in Research Committee from the FACENE/FAMENE and approved under protocol no. 86/10.

RESULTS AND DISCUSSION

The interviews were analyzed and the responses grouped according to the core ideas drawn from each speech, so that, for each main idea a speech-synthesis (CSD) was built comprising several key expressions taken from every deposition. "The 'key expressions' consist of literal transcriptions of parts in the depositions, which permit the essential recovery of the discursive content from segments composing the deposition".<sup>6:18</sup>

The following results were obtained when the nurses were questioned about the main difficulties encountered in relation to the knowledge necessary for with the optimal proper handling of mechanical ventilators:

| Central Idea                                                                                                                                                                                        | The Collective Subject Discourse                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| My major difficulty is with regards to both the definition of parameters and ventilatory modalities because these arrangements vary greatly from patient to patient depending on their pathologies. | <i>My major difficulty in handling the mechanical ventilator is the settings of parameters, because each patient has the diagnosis that requires specific parameters' settings. I do not have difficulties in adjusting the physiological settings in the ventilator; however that is not the case for handling patients in critical conditions.</i> |

Figure 1. What are you major difficulties among the skills needed for the optimal proper handling of the mechanical ventilator? Source: Direct search (2010).

A clear difficulty encountered by the nurses in defining the ventilatory programmable parameters was observed. The fact that this is not a specific and particular assignment to the nursing staff combined with the lack of the technical-scientific standpoint often limit the performance of the team in the control of these parameters and adjustment of the mechanical ventilation equipment's alarms.

*[...] the inaccuracy with regard to the meaning of the settings or interpretation of the alarms can be explained by the fact that*

*reports in the literature are confusing on the descriptions of these situations and little relevance is given to such an important subject.*<sup>9:453</sup>

Another aspect addressed during the interviews referred to questioning if the institutions involved in the study promote or not processes of permanent education in health related to mechanical ventilation. The following central ideas and respective CSDs were obtained according to the opinions expressed by the participants:

| Central idea 1                                    | The Collective Subject Discourse                                                                                                                                                                                                                                                                        |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No, because the institution has physiotherapists. | <i>No, we do not have this because the physiotherapist handles this part. The physiotherapists work in the mornings and afternoons, and are on call at night; therefore the handling of mechanical ventilation ended up focused on the physiotherapists, leaving the nursing staff distant from it.</i> |

Source: Direct search (2010).

| Main idea 2                                                                       | The Collective Subject Discourse                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Yes, they promote this typically, every two months, however the frequency varies. | <i>Yes, the institution promotes at varied frequency, every two months; some continuing education process is offered in the hospital covering all issues, for all nursing areas and not only with respect to mechanical ventilation.</i> |

**Figure 2.** Does the institution in which you work promote permanent education in health processes related to mechanical ventilation? How often? How does this process happen? **Source:** Direct search (2010).

The analyses of the central ideas and respective discourses indicated that, currently, virtually none of the surveyed institutions promote permanent education in health that is related to the topic and geared toward the nursing team. What has occurred in some of these institutions are moments of continuing education in health, which most often are directed to specific subjects other than mechanical ventilation.

The following two processes are conceptualized to clarify this differentiation. Continuing education in health is understood as "every action developed after the professionalization with the purpose of updating knowledge and acquiring new information and activities, defined through formal methodologies".<sup>10:480</sup>

In the permanent education in health, the individual will develop the ability to relate the theory with practice, that is, the real problems and needs will be identified from the reality experienced in their routine using the process of work as the transformation object with the intention to improve the quality of services.<sup>11</sup>

Another aspect that should be taken into account is the fact that such procedures, be they permanent or continuous education in health, are directed only at physiotherapists in some institutions.

Regardless of this activity being the responsibility of the physiotherapy staff, in the absence of these professionals the team responsible for monitoring and control of the devices connected to the patient is precisely the nursing team, which is present beside the patient almost without interruption for as long as he remains hospitalized in the intensive care unit.

Nursing "usually does not participate in the settings of the ventilatory modality, and maybe that is why their performance in controlling parameters and alarms settings is limited".<sup>12:193</sup> This leads to distancing the nurse from the ventilator from whom the performance of care during certain complications of artificial respiration is required and in which immediate decisions may be decisive for the therapy. In this sense, it is important that the nursing staff is

capable of dealing with urgent/emergencies such as the identification of failures or changes generated by audible alarms, which could be addressed by the team itself.

The nursing staff takes actions of extreme importance to the patient on mechanical ventilation such as aspiration of secretions in the inferior airways, measurement of *cuff* pressure, monitoring the placement of the endotracheal tube, observation of the alarm systems, nursing care planning that fits the patient's needs for each ventilatory modality, and prevention of complications such as low cardiac output, barotrauma, and atelectasis.

The physiotherapist, in turn, assists in the mechanical ventilation procedure, from the artificial respirator fit for intubation, through the evolution of the patient during mechanical ventilation, until the interruption and removal of ventilatory support and extubation.<sup>13</sup>

It is observed that each professional has their share in the collective work. Thus, taking into account that mechanical ventilation is an activity which requires a multi and interdisciplinary work in which the focus is the patient,<sup>12</sup> the joint and integrated action of all these professionals is paramount in the care during artificial respiration.

The study also revealed that the majority of participants acquired little or no knowledge about this subject during nursing graduation programs. The following answers were obtained when the participants were questioned on this subject and if the acquired knowledge was enough:

| Central Idea | The Collective Subject Discourse                                                                                                                                                                                                                                                                                                                                                         |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Virtually no | <i>I received very light information about mechanical ventilation in my graduation courses, I did not learn almost anything; I learned some during work. I know what a mechanical ventilator is, however information provided about handling, assembling, and the settings was minimal during graduation and did not provide support to give me confidence to handle this procedure.</i> |

**Figure 3.** What technical-scientific knowledge necessary for the proper handling of the Mechanical Ventilator did you acquire during graduation? Was it enough? **Source:** Direct search (2010).

On the basis of the above represented speech, it is possible to infer that certain curricular structures of undergraduate courses do not contemplate the need required at the hospital level for aspects related to mechanical ventilation; therefore, part of the knowledge that should have been acquired at the university had to be achieved within the labor market, in the daily activities of each professional.

The advancement of the technology in the area of mechanical ventilation is followed by the construction of new knowledge at the level of undergraduate courses in the area of health, however, many of today's active professionals did not have the opportunity to stay close to these demands during their training period. This is due, in part, to the fact that studies on artificial respiration are relatively new. The emergence of mechanical ventilators and their clinical use were launched at about sixty years ago including the negative pressure ventilators; and only since the late 1980's, important technological advances allowed the construction of microprocessor respirators displaying new ventilatory modalities.<sup>12</sup>

Statements that graduation classes were superficial and that for some, at that time, the mechanical ventilation was seen as almost the death sentence, or type of procedure in which the patient would rarely leave alive, was also reported by the participants in the present study. Nowadays, it is known, for example, that mechanical ventilation has been widely used during the induction of anesthesia in order to compensate for the respiratory depression caused by anesthetic agents while the patient remains in the surgical center.

Contrary to the popular belief, the use of mechanical ventilation is, without a doubt, one of the technological resources that have saved more lives around the world as the result of biotechnological advances. The "use of protocols with the aim of maintaining technical rigor in the control of technical-related routines can still act on the

prevention of complications, reduction of costs, and increase in withdrawal success".<sup>14:27</sup>

CONCLUSION

The performance of nursing care during the treatment and rehabilitation of patients mechanically ventilated has become increasingly intense and complex. At the time when this study was performed, the proximity to these services provided the opportunity to gain a better understanding of the reality in each institution with regard to ventilatory assistance.

It was possible to observe that the difficulty in relation to the definition of parameters and handling procedures of the ventilator itself was common to all interviewed nurses; this is primarily resulting from learning deficiencies during the undergraduate program. The universities still do not offer this training in its curricular structure of disciplines geared specifically to the intensive treatment of severely ill patients. This significantly contributes to the technical-scientific lack of preparation with regard to the mechanical ventilation process in itself from the assemblage of the apparatus to the interpretation of the ventilatory parameters.

Another aspect taken into account was regarded to the deficiency presented by the health institutions in providing permanent education processes focused on this theme. In only one of the four hospitals involved in this study, the physiotherapist is the professional responsible for programming and handling the mechanical ventilation equipment. In the other institutions, this function has been performed by physicians, and in some cases, by the nursing team.

However, the inaccuracy with regard to the meaning of the parameters and ventilatory modalities used has caused in some professionals insecurity and fear when handling the mechanical ventilator. When available, the training courses on mechanical ventilation are either directed to other professional categories or generally not offered frequently.

It is known that despite the numerous benefits, the employment of mechanical ventilation can lead to serious complications such as intracranial pressure elevation, pneumonias, and decreased cardiac output because the installation of the mechanical ventilator can alter the ventilatory mechanics in the patient.

Therefore, the knowledge about the structures involved in this process, the specific needs of each patient, and the possible complications that could happen are invaluable during the search for therapeutic solutions.

Hence, the improvement of nursing care in the quest to achieve excellence must be encouraged so that the nurse, while a member in the health team can become increasingly specialized and trained, together with other members of a multi-professional team.

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