

## Enhancing Competence in Ventilation Management through Module and Simulation

**Jose Arnold Tariga\***

*Clinical Resource Nurse, Salma Rehabilitation Hospital, Abu Dhabi, United Arab Emirates*

**\*Corresponding Author:** Jose Arnold Tariga, Clinical Resource Nurse, Salma Rehabilitation Hospital, Abu Dhabi, United Arab Emirates.

**Received:** May 11, 2020; **Published:** June 09, 2020

### Abstract

The mortality rates of ventilated patients are influenced by various factors including pre-existing factors prior to ventilation initiation, factors arising during the course of ventilation, and factors related to competencies in managing ventilated patients. Research states that nurses assigned to care for ventilated patients must possess special technical skills and competencies.

With the aim of enhancing the nurses' clinical competence in assessing and managing mechanically ventilated patients, the researcher developed a learning module with simulation and conducted this study to determine its effectiveness. The researcher utilized a quantitative research approach through a pre-experimental one group pre-test and post-test design.

Data were gathered using a competency assessment checklist composed of 10 competency domains. Results were analyzed using frequency counts, percentages, means, standard deviations and paired T-test to assess the difference between the competency levels of nurses before and after the module delivery.

Results revealed that respondents are in their early adulthood age, majority of which are holding bachelor's degree in nursing, with less than 5 years of experience. Paired T-test revealed that there is a significant difference between the nurses' level of competence before and after module exposure ( $p < 0.05$ ). Furthermore, demographic profiles showed no significant correlation with post-test level of competence ( $p > 0.05$ ).

Therefore, it can be concluded that the module helped improve the clinical competence of nurses in managing ventilated patients. The module with simulation can be a useful tool to train new nurses who do not have prior experience in handling ventilated patients.

**Keywords:** *Clinical Simulation; Mechanical Ventilator; Ventilated Patients; Nurses; Clinical Competence*

### Introduction

Clinical education and training for healthcare professionals have come a long way since the Institute of Medicine published its report "To Err is Human" in 1999 which revealed that medical errors account for about 44,000 to 98,000 deaths per year in the United States [1]. Among these mortalities are ventilated patients in critical care units. According to a study conducted by Esteban and colleagues, the mortality of mechanically ventilated patients are influenced by (i) pre-existing factors upon initiating mechanical ventilation, (ii) factors arising throughout the course of ventilation and (iii) factors related to assessing and managing patient on mechanical ventilation [2]. Another study revealed that that nurses need to possess fundamental knowledge on ventilator settings and monitoring and must be competent in assessing and ensuring safety of ventilated patients and preventing complications [3]. Faidy, *et al.* cited that nurses assigned to care for mechanically ventilated patients require special technical skills and competencies [3,4].

### Clinical competence defined

The term “competence” has always remained a complex concept that is very challenging to define and measure particularly in the healthcare field. This presents particular problems for the nursing profession as this can affect patient outcomes, particularly poor nursing practice that can compromise patient safety [5]. In a generic concept, competence is an ability acquired through experience and learning and can also refer to knowledge, skills, abilities and traits gained by health care professionals through pre-service education, in-service training, and study experience [6]. Nursing competency is a complex integration of knowledge including professional judgment, skills, values and attitude. It is an intelligent practical skill set that integrates or combines different factors and issues in complex ways, specific to each circumstance.

Norman., *et al.* describes competency as the combination of skills, knowledge, attitudes, values and abilities that underpin effective and/or superior performance in a profession or occupational area [7]. This definition implies the ability to apply knowledge, skills and abilities successfully to new situations as well as to familiar tasks for which prescribed standards exist. Competent care is provided by a nurse who has the ability to adapt, act intelligently, responsibly and competitively to the demands of change. Such capability can be possessed by nurses through education both formally and non-formally as an effort to achieve and keep their competencies up to date.

A clear and concise definition of clinical competence seems most pressing for assessment purposes. Miller distinguished several hierarchical layers of competence to function as a framework for within which assessment might occur. In his framework for clinical competence a distinction is made between knows (knowledge), knows how (competence), shows how (performance) and does (action) [8]. Knowledge is at the base of this triangle shaped framework and action is at the top. A student, nurse or physician needs the knowledge that is required to carry out professional functions effectively, a prerequisite for being clinical competent. The next two layers, competence and performance, which follow upon knowledge are often used interchangeably, however, competence means that a nurse can apply his/her knowledge in concrete situations, while performance is the ability to use this knowledge to perform concrete actions. The final top layer represents what a nurse actually does during day-to-day practice [9].

### Achieving competency

Acquiring nursing competency requires that the nurse possess the skills and personal traits necessary to effectively perform their duties while integrating multiple elements including knowledge, techniques, attitude, thinking ability and values that are required in specific contexts [6]. Maintaining the skills and competence of nursing staff within a complex healthcare system lies at the heart of providing competent, fit-for-purpose healthcare. In order to maintain or further enhance the skills and competence, a nurse should be exposed to and provided with the necessary and relevant experience and training [10].

### Training and nursing competency

Clinical competency training methods for nurses often use scenario simulation, role-play and objective structured clinical examinations. These modalities improve nursing behavior and performance in various clinical settings. Problem-based learning tutorial training is another well-known method where nurses work in small groups, present a nursing scenario with a problem and situation, create their own learning tasks and engage in active learning. This method involves student-centered learning instead of active teaching. Lessons that encourage active learning are crucial for training thinking skills [6,11].

### Clinical simulation

Nursing is a profession that requires the need to integrate theoretical and practical training. Among the many educational strategies that have been used to improve nurses’ knowledge and skills in the clinical area is simulation. Simulation is described as a strategy, not

a technology, to mirror, anticipate, or amplify real situations with guided experiences in a fully interactive way. In broad, simple terms a simulation is a person, device, or set of conditions which attempts to present and solve the problems authentically. Methods in clinical simulation can be used are role play, skit, standardized patients, models, three dimensional simulations like manikins, virtual reality simulations, computer simulations, video interactions etc. Simulators are used to present concept and practice to nursing students in a very interactive way [12].

### Mechanical ventilation

Advances in technology particularly in critical and long-term care have massively changed over the past decades. One in particular is the increasing rate of utilizing mechanical ventilation to support patients with chronic lung problem who are ventilator dependent in long term care settings. This entails that nurses must possess the right competencies in terms of the technical and clinical aspects of mechanical ventilation since the technology itself is non beneficial unless there is integration between the nurse, the technology and the patient. The competence of the nurse caring for the ventilated patient largely influences the outcome of the mechanically ventilated patient [13].

### Increasing number of long-term ventilated facilities in UAE

Over the past few years, there has been an increasing number of long-term care and rehabilitation facilities that has opened in the Emirate of Abu Dhabi. This is in response to the need of freeing the intensive care units of acute hospitals from patients with prolonged mechanical ventilation needs. According to Abu Dhabi Health Statistics 2017, ICUs in Abu Dhabi government facilities generally have an occupancy rate ranging from 80 to 100% which is beyond the optimal occupancy of 75% [14]. It is estimated that approximately 50% of those critical beds are blocked by patients requiring long-term ventilator support. The congestion in ICU beds within this acute facilities prevents patients who require emergent life saving interventions from receiving the critical care they need.

With the increasing number of long-term facilities comes the increasing demand for available nursing staff. And since these staff will be handling mechanically ventilated patients, it is essential that they are competent to manage mechanically ventilated patients. Despite having a good number of staff, the Training Needs Assessment conducted by the Clinical Resource Nurse (CRN) revealed that some of the nursing staff at Salma Children's Rehabilitation Hospital still require training on the different aspects of mechanical ventilation assessment and management.

To manage this training gap, the researcher in coordination with the medical team and respiratory therapists developed a module focused on assessing and managing mechanically ventilated patients. The module was geared to provide nurses with the right skills, knowledge and abilities to render competent care to mechanically ventilated patients, thereby ensuring patient safety.

Determining the effectiveness of the module in enhancing the competency level of nurses in terms of managing ventilated patients is the ultimate objective of this research work. Specifically, the researcher sought to (a) describe the demographic profiles of the nurses in terms of age, educational attainment, and years of clinical experience; (b) describe the difference between the competency level of nurses before and after the module; and (c) correlate the post-test level of competence with the demographic profiles.

### Materials and Methods

The ADDIE Model of Instruction was utilized as the theoretical foundation in formulating the mechanical ventilation module to enhance the competency levels of nurses. The assumptions were that there is no significant difference between the competency before and after the module with clinical simulation, and there is no correlation between the post-test level of competence and the demographic profiles.

The researcher utilized a quantitative research approach through a pre-experimental one group pre-test and post-test design. Twelve participants were identified via purposive sampling based on inclusion criteria and were subjected to pre-test, intervention (which included the module with clinical simulation), and the post-test.

Data were gathered using a competency assessment checklist. The competency checklist was composed of 10 competency domains including (a) principles of mechanical ventilation, (b) setting up and calibrating a ventilator, (c) ventilation modes and settings and their indications, (d) alarm prompts and troubleshooting, (e) patient assessment and monitoring, (f) assessing and managing respiratory distress, (g) assessing and managing ventilation complications, (h) assessing and managing ventilator associated pneumonia, (i) developing a holistic plan of care for ventilated patients and (j) relevant forms and documentations. Each domain was then rated using a quantified Benner’s Novice to Expert competency level. A score of 1 (novice) is given if the nurse has no background or experience; 2 (advanced beginner) if the nurse has inadequate background and cannot perform without assistance; 3 (competent) if the nurse has adequate background and can perform without assistance; 4 (proficient) if the nurse has a good background, performs with initiative, and has the ability to problem solve; and 5 (expert) if the nurse has substantial background, performs with speed and fluidity and is confident and able to teach others.

Results were analyzed using frequency counts, percentages, means, and standard deviations and paired T-test using SPSS.

## Results and Discussion

### Demographic profiles of the respondents

There were a total of 12 nurses who participated in the study. Table 1 shows the demographic features of the study.

Demographic Profile		F (N = 12)	Percentage
Age	21 to 30 years old	6	50%
	31 to 40 years old	6	50%
	Mean = 30.17 SD = 3.19		
Educational Attainment	Bachelor’s Degree	11	91.67%
	Master’s Degree	1	8.33%
Years of Clinical Experience	0 - 5 years	8	66.67%
	6 - 10 years	4	33.33%
	Mean = 4.92 SD = 2.58		

**Table 1:** Demographic profile.

**Age:** Half or 50% of the respondents belonged to age range of 21 to 30 years old while the other 50% is within the age of 31 to 40 years old. Mean age of all respondents is 30 years. This coincides with a study conducted by Alboliteeh, Magarey and Wiechula (2017) which revealed that the age of nurses in the Middle East falls between 20 to 48 years old [15].

**Educational attainment:** A substantial majority (91.67%) of the respondents hold Bachelor’s Degree in Nursing while only 8.33% possess a Master’s degree. This is in line with the basic educational requirement for nurses to obtain a nursing license and practice as a registered nurse in the United Arab Emirates [14].

**Years of clinical experience:** A greater majority (66.67%) of the respondents have less than 5 years of experience while 33.33% have 6 to 10 years of clinical experience. This finding is also inline with previous studies of Alboliteeh, Magarey and Wiechula and to the minimum licensing requirements of the Department of Health [14,15].

**Difference between the competency level of nurses before and after the module**

The table 2 below shows the paired T-test between the average competency scores before and after the intervention.

	N	Mean	StDev	SE Mean
Pretest Average	12	1.6000	0.2089	0.0603
Posttest Average	12	3.3083	0.2065	0.0596
Difference	12	-1.7083	0.1832	0.0529
95% CI for mean difference: [-1.8247; -1.5919]				
T-Test of mean difference = 0 (vs not = 0): T-Value = -32.30 P-Value = 0.000				

**Table 2:** Paired T-test for pretest average - post-test average.

The above results revealed that there is a significant difference between the competency levels with pretest mean score of 1.6 and post-test means score of 3.3 post module delivery. This implies that the module was effective in enhancing the level of competence of nurses in managing mechanically ventilated residents, with a p value < 0.05. This result correlates to previous studies on competency which states that nurses can achieve clinical competence through adequate training and systematic preparation using a well-designed training module [5]. In another study conducted by Nababan and Saragih (2018) and Tohidi., *et al.* (2019), it was found out that the overall clinical competency skills and confidence of respondents greatly improved after the administration a training and learning modules [9,16].

The results were also noticeable in the clinical area as observed by the researcher. After having been exposed into the module and clinical simulation, majority of the nurses reported an increased level of confidence when being assigned to care for mechanically ventilated patients. Other members of the multidisciplinary team including physicians, allied health and respiratory therapy team verbalized that they have seen an improvement in terms of the nurses’ ability to assess and manage the mechanically ventilated patients as well as to troubleshooting ventilator alarms and other issues.

**Correlation between the demographic profiles and post-test level of competence**

The third table 3 shows the correlation between the demographic profiles of the respondents and their post-test scores.

Correlation of Actual Age and Post Test Average = -0.016 P-Value = 0.960
Correlation of Educational Attainment and Post Test Average = 0.140 P-Value = 0.665
Correlation of Actual years of Experience and Post Test Average = -0.289 P-Value = 0.362

**Table 3:** Correlations: Demographic profiles and post-test average.

The table above reveals that the demographic profiles do not have a significant correlation with the post-test level of competence, as evidenced by the p value > 0.05. This signifies that age, educational attainment and years of clinical experience do not necessarily affect the level competence post intervention. This concurs with the study by Kim and Kim stating that competency is not dependent on years of clinical experience as it can vary when the nurse is in a different area of practice [17]. This finding is also noted by the researcher in the clinical area. Though there were staff who are older and with extensive years of experience, they did not automatically adapt to their new working environment with clinical support from their peers. This could be the reason that demographic profiles are primarily used as the main criteria when employing nurses or when assigning nurses on specific area of specialization as these do ensure competence and quality nursing care.

### Conclusion

Based on the findings of the study, the researcher concluded that the delivery of the module with clinical simulation has improved the competence level of nurses in managing mechanically ventilated residents. This is evidenced by an improvement in the competency rating, which was initially at level 1 or novice level in the Benner's Novice to Expert Scale before module delivery, to a rating of 3 (or competent level) post module exposure.

The researcher also concluded that demographic profiles do not necessarily influence the nurses' level of competence especially if they do not have prior exposure or experience to a specific procedure or skill.

### Recommendations

Based on the findings and conclusion, the researcher recommends the following:

1. The module should be used to train new nurses who do not have prior experience in critical care units, or those who have not handled mechanically ventilated patients.
2. The competency level should be assessed periodically using a standardized checklist to evaluate retention of knowledge, skills and abilities post module exposure.
3. Conduct a quality improvement review on reported events/incidents that involve staff competence in handling ventilated patients.
4. Replicate the study with a larger sample size, to provide additional evidence supporting that modules with clinical simulation can be used as an approach to enhance nurse competencies.
5. Conduct a study on the level of satisfaction on the performance of the nurses exposed to the module as perceived by other members of the multidisciplinary team.

### Acknowledgements

This research was supported by the Management of Salma Children's Rehabilitation Hospital, Abu Dhabi, UAE. I would like to thank our Chief Medical Officer, Dr. Eeva-Liisa Langille and Director of Nursing, Mr. Basel Qandil for fully supporting this initiative. I would also like to thank the Respiratory Therapy Team who shared their expertise during the delivery of the module. And lastly, I would like to acknowledge the assistance of Dr. Jezyl Cempron-Cutamora, Professor, Cebu Normal University, with the statistical treatment of the data.

### Conflict of Interest

The author declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Bibliography

1. Kohn LT, et al. "To err is human: Building a safer health system". Washington DC: National Academy Press (1999).
2. Esteban A., et al. "Characteristics and outcomes in adult patients receiving mechanical ventilation: a 28-day international study". *Journal of the American Medical Association* 287.3 (2002): 345-355.
3. Grossbach Irene., et al. "Overview of Mechanical Ventilatory Support and Management of Patient- and Ventilator-Related Responses". *Critical Care Nurse* 31.3 (2011): 30-44.
4. Faidy, A., et al. "Care of Mechanical Ventilated Patients in General Ward: Nurses Perspective". *GSTF Journal of Nursing and Health Care* 1.2 (2014).
5. Levett-Jones Tracy., et al. "Implementing a Clinical Competency Assessment Model That Promotes Critical Reflection and Ensures Nursing Graduates' Readiness for Professional Practice". *Nurse Education in Practice* 11.1 (2011): 64-69.
6. Fukada M. "Nursing Competency: Definition, Structure and Development". *Yonago Acta Medica* 61.1 (2018): 1-7.
7. Norman Ian J., et al. "The validity and reliability of methods to assess the competence to practice of pre-registration nursing and midwifery students". *International Journal of Nursing Studies* 39.2 (2002): 133-145.
8. Miller GE. "The assessment of clinical skills/competence/performance". *ACMD* 511 (1990).
9. Nababan T and E Saragih. "Designing Training Module to Improve Nursing Clinical Competence Based on Needs Analysis: A Developmental Study". *Asian Journal of Scientific Research* 11 (2018): 319-328.
10. Oshvandi Khodaar., et al. "On the Application of Novice to Expert Theory in Nursing a Systematic Review". *Journal of Chemical and Pharmaceutical Sciences* 9.4 (2016).
11. Nakayama Y and M Yokota. "The Contents of Training of Clinical Nursing Competence between Basic Nursing Education and In-Service Continuing Education". *Bulletin of Fukushima School of Nursing* (2012).
12. Sharma RK. "Emerging Innovative Teaching Strategies in Nursing" (2017).
13. Botha Lynn. "Level of nurses' competence in mechanical ventilation in intensive care units of two tertiary healthcare institutions in Gauteng". CORE - Aggregating the World's Open Access Research Papers (2012).
14. Department of Health - Abu Dhabi. "Abu Dhabi Health Statistics 2017". Department of Health (2018).
15. Alboliteh M., et al. "The Profile of Saudi Nursing Workforce: A Cross-Sectional Study". *Nursing Research and Practice* (2017): 1710686.
16. Tohidi, S., et al. "The Effect of Self-learning Module on Nursing Students' Clinical Competency: A Pilot Study". *Iranian Journal of Nursing and Midwifery Research* 24.2 (2019): 91-95.
17. Kim K and Y Kim. "Variables Affecting Nursing Competency of Clinical Nurses". *Indian Journal of Science and Technology* 8.26 (2015).

**Volume 9 Issue 7 July 2020**

**©All rights reserved by Jose Arnold Tariga.**