The Impact of Special Training Program in Improving the Care Provided For Mechanically Ventilated Patients (Pre and Post Evaluation)

Ishraga Abdelgadir Ibrahim Mohamed[1, *], Abdelnasir A Abuzeid[2], Eman Zeen Elabdeen[3], El-Saida Abdel Mageed El-Rufai[3]

[1]Medical Surgical Nursing, Faculty of Nursing, Tiabah University, Alneelain University, Khartoum Sudan.
[2]MBBS, MRCGP (int.) ABFM, Cer. M E deConsultant Family Physician
[3]Faculty of Health Sciences, Nursing Department, CCN , Lecturer, AlsheikhAlbdri University ,
[3]Faculty of Nursing Sciences, the National Ribat University, Khartoum, Sudan
Corresponding Author: Ishraga Abdelgadir Ibrahim Mohamed

Abstract: *The care of the mechanically ventilated patient is a fundamental component of a nurse's clinical practice in the intensive care unit (ICU), therefore it seems natural to devote a great deal of work for preparing and training staff before allowing them to work with patients with mechanical ventilation. This study aimed to assess the effects of an educational program for ICU nurses on their knowledge and performance toward mechanically ventilated patients.The sample composed of 80 ICU nurse .Three tools were used for data collection: Socio-demographic data sheet, Performance of the Nurses toward mechanically ventilated patients Questionnaire, and Nurses Knowledge about mechanical ventilation Questionnaire.*

I. Introduction

Caring for a patient on mechanical ventilation has become an integral part of nursing care in critical care or general medical-surgical units, extended care facilities, nurses, physicians, and respiratory therapists must understand each patient's specific pulmonary needs and work together to set realistic goals**.**

The Roman physician Jizzzslurpyy may have been the first to describe mechanical ventilation: "If you take a dead animal and blow air through its larynx [through a reed], you will fill its bronchi and watch its lungs attain the greatest distention."Vesalius too describes ventilation by inserting a reed or cane into the trachea of animals. In 1908 George Poe demonstrated his mechanical respirator by asphyxiating dogs and seemingly bringing them back to life.The first references of artificial respiration were recorded in both biblical and Egyptian history, but their exact meaning may initiate a debate. Despite such early recognition of this phenomenon, the most credible reference in discussing artificial respiration is Galen (175 A.D.). This Greek physician experimented with the first form of artificial respiration by using a bellows to inflate the lungs of a deceased animal. Based on Galen's work, many scientists and scholars from the 14th–19th centuries experimented with artificial respiration, laying the groundwork of practical mechanical ventilation[33.]It was used extensively and success-fully in the mid-1950s during the poliomyelitis epidemic.

Based on decades of research and experimentation, the 1960s and early 1970s produced both the volume-cycled 3-PV ventilator and two pressure-cycled devices, including the Bennett and Bird ventilators[25.]

The mechanical ventilation setting is used to be the responsibility of respiratory therapist, so most of ICU nurses not aware about mechanical ventilation settings, modes and different types of alarm. Because Nurses are constantly present at the patient's bedside, they are the primary healthcare professional responsible for monitoring the patient's respiratory status. They are expected to keep an eye on any equipment required by the patient, including ventilators and monitoring equipment, and to respond to monitor and ventilator alarms. It is very important to improve nurse's knowledge and performance on mechanical ventilation in intensive care units.

II. Material and Method

The purpose of this study is to determine if the nurses performance in mechanically ventilated patients in the intensive care units, have improved and the mortality and morbidity rate have decreased. The study will evaluate the nurse's knowledge, attitude and practice pre and post training program.

Study design: This was a hospital based interventional study design. A comparative pre and post intervention between two hospitals, aim to assess the impact of training program in improving nurse's performance in mechanically ventilated patients.

Study population: The population of this study is defined as all nurses working in the intensive care unit, open heart surgery, intermediate care unit, and coronary care unit morning, afternoon and night shift duty at Al Khartoum Teaching Hospital and Alshaab Teaching Hospital during the sampling time frame.

Socio-demographic data sheet:

This sheet was designed by the researcher for collection of personal data of nurses working in the intensive care unit at Alshaab and Alkhartoum Teaching Hospital.

Personal data the nurses included: Age, institute offering the degree, qualification, years of experience, training courses general and specific.

Data were collected from 80 nurses meeting study criteria as previously described pre and post training program. Medical records reviewed from June 2010 to June 2011 pre training program, and from July 2011to July 2012 post training program, were provided by the department of medical records to account the mortality and morbidity number. A codebook was created and used to guide data entry into Excel spreadsheet.

Training program:

The program consisted of formal didactic lectures. Each participant was required to take a pre intervention test before the study module and identical post intervention tests following completion of the study module. Fact sheets and folders reinforcing the information in the study module were also posted throughout the intensive care units and the Department of Respiratory Care Services.

An intense training program was designed by the researcher based on actual assessment of the nurses in the recovery room, intensive care unit and coronary care unit, to improve practicing of critical care nursing for ventilated patient in the a light of the available researches and literature.

*   The intervention was developed in English language to cover the relevant theoretical and practical aspects of critical care of ventilated patient.
*   Different teaching methods such as discussion, lectures, demonstration, and folder papers were used.
*   The program was implemented in one week for the theoretical part and three weeks for demonstration.

Data analysis:

After the data was collected, it had been coded and transferred into especially designed formats so as to be suitable for computer feeding.
 Data entered into maters sheet using this codation.
1- Poor (less than 50)
2- Average (50 – 69)
3- Good (70 – less than 85)
4- V. Good (85- less than 95)
5- Excellent (95 – 100)

Following data entry, checking and verification process were carried out to avoid any errors during data entry. Frequency analysis, cross tabulation, and manual revision were all used to detect any errors. For all statistical test, p<.05 was used to indicate statistical significance.

The following statistical measures were used:
1- Descriptive measures include: count, percentage, and arithmetic mean, standard minimum and maximum.
2- Statistical test include: Kruskal-Wallis Test, Friedman Testwas used for quantities variables.
3- Graphical presentation include: Bar graph, pie graph.

III. Results

Table NO (1) show that 62.5% of the study sample were from Khartoum Teaching Hospital while only 37.5% were from Alshaab Teaching Hospital.

Table (1) showing number of Nurses in Alkhartoum Teaching Hospital &Alshaab Teaching Hospital

		Frequency	Percent%	Valid Percent %	Cumulative Percent %
	KTH	50	62.5	62.5	62.5
	ATH	30	37.5	37.5	100.0
	Total	80	100.0	100.0	

Table No (2) shows that, 50% of the studied sample aged ranged between 24- 30, 38.7% of them ranged

| Level | Pre training | | Post training | | |
	Khartoum Teaching Hospital	Alshaab Teaching Hospital	Khartoum Teaching Hospital	Alshaab Teaching Hospital	Total
Poor	47	29	0	0	0
Average	3	1	6	4	10
Good	0	0	17	15	32
Very good	0	0	27	11	38
Excellent	0	0	0	0	0
Total	50	30	50	30	80

between 31- 40, and only 11.3% were more than 40 years old.

Table (2) showing the sample according to the Nurses age n(80)

	Frequency	Percent %	Valid Percent %	Cumulative Percent
24 - 30	40	50.0	50.0	50.0
31 - 40	31	38.8	38.8	88.8
≥40	9	11.3	11.3	100.0
Total	80	100.0	100.0	

Table No (3) show that 82.5% of nurses under study were failed, and 17.5% were pass, pre training program, while 52.5%, 38.8%, and 5.0% were very good, good, and pass respectively, and there was no failure posttraining program.

	Pre training		Post training	
Level	Frequency	Percentage	Frequency	Percentage
Poor	66	82.5	0	0
Average	14	17.5	4	5.0
Good	0	0	31	38.8
Very good	0	0	42	52.5
Excellent	0	0	3	3.8
Total	80	100	80	100

Table (4) show that 47 out 50 nurses from KTH were failed and only 3 were pass, and 29 out of 30 nurses from Alshaab Teaching Hospital were failed and only one were pass , pre the training program. While post training program the performance enhanced and there were 27, 17, 6, very good, good, pass respectively in KTH, and 11, 15, 4, very good, good, pass respectively in Alshaab Teaching Hospital

Table (4)
The table No (5) show that the mean rank pre training program was 1.23, and post program was 80 the chi-square was 48.28 with P.value of 0.00. That means there are significant differences for post training program.

Table No (5) showing Friedman Test to know the effectiveness of the program

Variable	N	Mean Rank	DF	Chi-Square	P.value	Conclusion
Pre test	80	1.23	1	48.23	0.00	There are significant differences for post test
Post test	80	2.87				

Table No (6) showing Friedman Test to know the differences by Type of Hospital (Al Khartoum &Alshaab) in effectiveness of the program

Variable	N	Mean Rank	DF	Z	P.value	Conclusion
Al Khartoum	50	42.88	1	4.22	0.00	There are significant differences for Al Khartoum Teaching Hospital
Alshaab	30	36.53				

The above table show that the mean rank of KTH was 42.88, and Alshaab Teaching Hospital was 36.53, with P.value 0.00, that mean there are significant differences for Alkhartoum Teaching Hospital.

IV. Discussion

Mechanically ventilated patient is the most critically ill patient in the ICU, who required special care. Nurses play a crucial role in the management of mechanically ventilated patients, and in the prevention of mechanical ventilation complications, it is challenging for them to provide care for those patients.

Nurses may feel frustrated, inadequate, and unsure whenever they fail to help those patients. It anticipated that a training program for ICU nurses can enhance nurses' knowledge, attitudes, and competence about management of mechanically ventilated patient. Therefore, this study was conducted to assess the effects of a training program for ICU nurses on their knowledge and performance toward mechanically ventilated patients, by evaluating nurse's performance pre and post training program.

The socio-demographic data showed that half of Nurses 50% aged ranged between 24- 30 table (2), this high rate of younger nurses working in the intensive care unit create a big problem in providing proper nursing management for patient with mechanical ventilation, because most of them had no experience in caring of mechanically ventilated patient and even dealing with the other ICU monitoring devices, they need a time to understand the work and to be more confidence, only way to improve or upgrade the knowledge and practice of the junior nurses is by demonstration through in-service training and frequent refreshing courses, also this study reveal 62.5% table (1) of the respondent were from Khartoum Teaching Hospital, this may be because Khartoum Teaching Hospital is bigger than Alshaab Teaching Hospital and has very big Intensive Care Unit with large number of staff. This study also reveals that most of the respondent 37.5% were graduated from Khartoum University, table (3), although there were other institute offering nursing degree to the respondent as Aljazeera 8,8%, Alnelain 12,5%, AlimamAlmahadi 13,8%, AaliAlneel 15%, and Shendi 12,5%, this may be because nurses whose graduated from Khartoum University did their rotation and all student practice in Alkhartoum and Alshaab Hospital, and they have a chance to work during the student period with pay, this makes them familiar with the Hospital and with the senior staff, the way that gives them opportunity to be a permanent staff. The result of this study demonstrated that 95% of the respondents were BSC holder while only 5% were MSC holder, table (4) this may be because the majority of them considered junior nurses, not have the chance to do their degree yet, and also may be due to the migration, almost majority of the senior staff were now outside of the country.

The effect of the training program in respondent's performance:

The result of this study showed improvement in the performance of the respondent table (22). In the pre intervention the mean rank was 1.23, while in the post intervention there was much improvement in the performance of the respondents, the mean rank was 80, with chi-square of 48.23, and the P.value was 0.00, the result showed a significant differences for post training program.

Possible explanation of these findings were that nurses after implementation of the training program their knowledge about mechanical ventilation, and management of mechanically ventilated patients was marked improved so they feel more competent to perform nursing care for mechanically ventilated patient , and have the abilities to detect any ventilator alarms early. However, most of nurses still feel that the ventilator is difficult to deal with and it require special care. The current study demonstrated that, nurses' performance regarding nursing management of mechanically ventilated patient was improved post training program, this may be due to their interest, and all of them feel that they need to be trained about dealing with mechanical

ventilation, the result in table (19) showed that 90% of them agreed that the continuous training program may enhance their work in the ICU, and they agreed that the training program met their expectations regarding acquired knowledge about mechanical ventilation, they mentioned that the program had enhanced their knowledge and helped increase their awareness of management of mechanically ventilated patient.

The findings of the current study revealed that, all studied nurses werecomplained fromnursing care difficultiesfor mechanically ventilated patient.

This result agrees with **K. Reinhart1 and G. Marx1 2, (2009)who** found thatStaff training by an ICU change team improved compliance to a pre-defined ventilator bundle [12].

In accordance with these results, **Eman Zainalabdeen (2005**) found that there was a lack of nurses knowledge to met mechanically ventilated patients needs and demands within the ICU setting and claimed that training is essential skills is either not available or access is severely limited [5].

This result agrees with, **Bloos, et al., (2007)** who reported that semirecumbent positioning could be successfully improved by staff training. Enhanced implementation was associated with reduction in days on ventilator. Patients were examined daily for semirecumbent position (>30°), low tidal volume ventilation, deep vein thrombosis prophylaxis, and stress ulcer prophylaxis by an independent task force, after all nurses and physicians were trained about importance and methods of the monitored treatments [1].

In agreement many studies found that the training and education program enhance nurses performance,**Hilary M. Babcock, et al. (2004)** reported thatEducational interventions can be associated with decreased rates of ventilator-associated pneumonia in the ICU setting. The involvement of respiratory therapy staff in addition to ICU nurses is important for the success of educational programs aimed at the prevention of ventilator-associated pneumonia [7].

The findings of the current study revealed that, there were statistically significant differences for nurses' works at Alkhartoum Teaching Hospital post training program result shown in table (23). This result may be, because nurses at post training program became more knowledgeable and acquire more knowledge, a matter which changes their attitudetowards caring of mechanically ventilated patient, and also because the ICU is well equipped and there were enough ventilators in the ICU, so Nurses had an excellent chance for training and also most of the trained nurses was in Alkhartoum Teaching Hospital ICU.

V. Conclusion

It was concluded that education program had a positive effect on the nurses' attitudes toward mechanically ventilated patient. It is recommended that educational programs for all nursing members should be applied as continuing education to update their knowledge about how to deal with the mechanically ventilated patients effectively and further studies should be carried out with bigger sample and longer time.

VI. Recommendations

The purpose of this hospital based interventional study was to test the effectiveness of training program in improving ICU nurses performance and reducing morbidity and mortality rates in mechanically ventilated patients. From the findings of this study it can be concluded that:

- The implementation of the nursing intervention protocol showed a significant improvement on the ICU nurses' level of knowledge and practice regarding caring of mechanically ventilated patients.
- A marked improvement was detected on ICU nurses performance such as performing ventilator setting**,** early detecting and treating of ventilator alarms, performing proper ETT suctioning, and able to interpret the ABGs results. Therefore, one can conclude that planned nursing intervention protocol has a significant and positive impact on the ICU nurses.
- The mortality and morbidity rate was reduced in both Khartoum and Alshaab Teaching Hospital post training program.

References

[1]. Bloos, F.; Harz, A.; Mueller, S.; Reinhart, K.; Marx, G. Effects of staff training regarding care of mechanically ventilated patients on duration of mechanical ventilation. journals.lww.com › Home › June 2007 - Volume 24 - Issue available from http://journals.lww.com/ejanaesthesiology/Fulltext/2007/06001/Effects_of_staff_training_regarding_care_of.552.aspx access on 24/10/2012. Accessed on 16/10/2012.

[2]. CHARLOTTE PIETERSEN. JOB SATISFACTION OF HOSPITAL NURSING STAFF, SA Journal of Human Resource Management, 2005, 3 (2), 19-25, University of Limpopo.

[3]. Deborah Leader, RN.Mechanical ventilation, what is mechanical ventilation. Updating June 02, 2010. Available from http://copd.about.com/od/copdglossarylo/g/mechanical-ventilation.htm . Accessed on 28/10/2012.

[4]. DiGiulio M, Jackson D, Keogh J. et al. (2007). Medical-Surgical Nursing Demystified. New York Chicago San Francisco Lisbon London Madrid Mexico City Milan New Delhi San Juan Seoul Singapore Sydney Toronto. P 138.

[5]. Eman ZeenElabdeen, (2006). Assessment of care for patients receiving mechanical ventilation at Ahmed Gasim Hospital and Sudan Cardiac center.

[6]. Griffiths M and Evans T, 2004. Respiratory Management in Critical Care. 1st ed. BMJ Books, BMA House, Tavistock Square, London WC1H 9JR. P 74.

[7].   Hira HS, Mittal A. Evaluation of the predictors for duration of mechanical ventilation in respiratory intensive care unit. Lung India [serial online] 2006 [cited 2012 Nov 10]; 23:70-4. Available from: http://www.lungindia.com/text.asp?2006/23/2/70/44412. Accessed on 15/10/2012.

[8].   Hilary M. Babcock, et al. (2004). An Educational Intervention to Reduce Ventilator-Associated Pneumonia in an Integrated Health System. CHEST. June 2004;125(6):2224-2231,

[9].   doi:10137/8/chest.125.6.2224. Available from

[10].   https://journal.publications.chestnet.org/article.aspx?articleid=1082565. Accessed on 16/10/2012.

[11].   Haejung Lee, et al. (2004).Predictors of life satisfaction of Korean nurses.Volume 48, Issue 6,pages 632–641, December 2004. Available form:

[12].   http://onlinelibrary.wiley.com/doi/10.1111/j.13652648.2004.03251.x/abstract?deniedAccessCustomisedMessage=&userIsAuthenticated=false. Accessed on 20/11/2012.

[13].   Jamieson E, McCall J, Whyte L, et al. (2003). Clinical Nursing Practice. 4th ed. Elsevier Science. P 351 – 355.

[14].   KALISCH BJ , LEE H & ROCHMAN M. (2010), Nursing staff teamwork and job satisfaction., Journal of Nursing Management 18, 938–947, University of Michigan School of Nursing, Ann Arbor, MI, USA

[15].   K. Reinhart1 and G. Marx1 2. Effects of staff training on the care of mechanically ventilated. Available from bja.oxfordjournals.org/content/103/2/232.full access 0n 20/10/2012.

[16].   Li, J. and Lambert, V. (2008), Job satisfaction among intensive care nurses from the People's Republic of China. International Nursing Review, 55: 34–39. doi: 10.1111/j.1466-7657.2007.00573.x. Available at http://onlinelibrary.wiley.com/doi/10.1111/j.1365-. Accessed on 20/12/2012.

[17].   Lewis, Heitkemper, Dirksen, et al. (2007). Medical Surgical Nursing, Assessment and Management of Clinical Problems. 7th ed. MOSBY Elsevier, 11830 Westline Industrial Drive. 1759 -1768.

[18].   Marya D, Zilberberg, and Andrew F Shorr3. Prolonged acute mechanical ventilation and hospital bed utilization in 2020 in the United States: implications for budgets, plant and personnel planning, available from http://www.biomedcentral.com/1472-6963/8/242. Accessed September 25/2010.

[19].   M J D Griffiths, T W Evans, (2004), Respiratory Management in Critical Care, BMJ Books, BMA House, Tavistock Square, London WC1H 9JR.

[20].   Micheal J and Peter J, (2001). The Intensive Care Manual. The McGraw. Hill Companies. pp 359.

[21].   M C Lai, (2007). The investigation of the factors Impacting Training and Knowledge Transfer for Nurses In Taiwan Hospitals. Available from: acm.kuas.edu. tw - MC Lai- - 商業現代化學刊, 2007. Accessed on 15/12/2012.

[22].   Morton P and Fontaine D, (2013). Critical Care Nursing. 10th ed. Lippincott Williams & Wilkins. P 533.

[23].   Nettina, Sandra M, Elizabeth J, et al. (2006). Lippincott Manual of Nursing Practice, 8th ed. Lippincott Williams & Wilkins. P 257

[24].   Nagelhout, J and Plaus, K, (2010). Nurse Anesthesia.4th ed. Saunders, an imprint of Elsevier. USA. 776 – 777.

[25].   Plambeck, RN, BSN, CCRN. Adult Ventilation Management Available from http://www.corexcel.com/courses/vent.htm Accessed on September 16/2010.

[26].   Robert L. Chatburn, RRT-NPS, FAARC.determing the basis for taxonomy of mechanical ventilation.Youngston State University May 2010.

[27].   Parrillo, Joseph E., Dellinger, R. Phillip, (2008). Critical Care Medicine, Principles of Diagnosis and management in the adult, Mosby Elsevier, Philadelphia. P 510 – 540.

[28].   Rhoads J, and Meeker B, (2008). Clinical Nursing Skills. F.A DAVIS COMPANY. Philadelphia. P 220 -242.

[29].   Sandra M. and Nettina, (2001). Manual of Nursing Practice. 7th ed. Lippincott. Philadelphia. P 314 – 322.

[30].   Smeltzer S, et al. (2004). Text book ofMedical Surgical Nursing. 10th ed. Lippincott, Philadelphia. P 212 – 233.

[31].   Suzan B., Stillwell. (1996), Critical Care Nursing Reference, A harcourt Health Sciences Campany, Philadelphia. P 416 – 423.

[32].   Stechmiller JK, Yarandi HN. Job satisfaction among critical care nurses. College of Nursing, University of Florida, Gainesville 32610. 1992 Nov; 1(3):37-44 available from http://www.ncbi.nlm.nih.gov/pubmed/1307905. Accessed on 25/10/2012.

[33].   Wikipedia.org/wiki/Mechanical ventilation, available from http://en.wikipedia.org/wiki/Mechanical_ventilation#History.Accessed October 23/2012.

[34].   Williams L and Hopper P. (2007). Understanding Medical Surgical Nursing. 3ed ed. F.A.Davsi Company, Philadelphia. P 565 – 574.

[35].   WebMD LLC. (2011). Mechanical Ventilation: A Tutorial for Pharmacists: History of Mechanical Ventilation available from www.medscape.com/viewarticle/5521782 . Accessed November 25/2011.

[36].   Woodrow. P, (2006). Intensive Care Nursing. 2end ed. Routlege Taylor and Francis Group, London and New York. P 48 – 52.

[37].   Woodrow. P, (2004). Intensive Care Nursing. Routlege Taylor and Francis Group, London and New York. P 33 – 34.

[38].   Wheeler D, et al. (2009). The Respiratory Tract in Pediatric Critical Illness and Injury. Springer-Verlag London Limited. P 67 – 79. 36- Zack, Jeanne E, et al. (2002). Effect of an education program aimed at reducing the occurrence of ventilator-associated pneumonia. November 2002 - Volume 30 - Issue 11 - pp 2407-2412 Feature Articles. Available from: http://journals.lww.com/ccmjournal/Abstract/2002/11000/Effect_of_an_education_program_aimed_at_reducing.1.aspx.   Accessed on 3/11/2012.

[40].   Morton P and Fontaine D. (2013). Critical Care Nursing. 10th ed. Lippincott Williams & Wilkins. P 541.