RESEARCH ARTICLE

A STUDY TO DEVELOP AND EVALUATE THE EFFECTIVENESS OF SELF INSTRUCTIONAL MODULE ON MECHANICAL VENTILATORS INTERMS OF KNOWLEDGE AND SKILL OF STAFF NURSES WORKING IN CRITICAL AREAS IN SELECTED HOSPITAL OF DELHI

*Milan Tirwa, Dr. Harinderjeet Goyal and Dr. Rajinder Mathur

Medical Surgical Nursing, India

ABSTRACT

A Study to "develop and evaluate the effectiveness Of Self Instructional Module on Mechanical Ventilators in terms of Knowledge and Skill of Staff Nurses working in Critical areas in selected Hospital of Delhi" was done in the year 2011-2012. The objectives of the study were: (1) To develop Self Instructional Module for the Staff Nurses on Mechanical ventilator. (2) To assess the knowledge and skill of Staff Nurses on Mechanical ventilator before and after administration of Self Instructional Module. (3) To determine the relationship between knowledge and skill of Staff Nurses on Mechanical Ventilator after the administration of the Self Instructional Module. (4)To see the acceptability and utility of Self Instructional Module on Mechanical Ventilator for the staff nurses of critical areas. The conceptual framework of the study was based on the System model for development, utilization and evaluation of self instructional module for the staff nurses. The model consists of three phases: Input, process and output in specific context including evaluation of all the phases (WHO SEARO, Technical Publications No. 6, 1985). The study adopted an evaluative research approach using one group pretest and post-test design. The independent variable of the study was the Self Instructional Module on Mechanical Ventilator. The dependent variables were the knowledge and skill of staff nurses on Mechanical Ventilator. The Self Instructional Module was developed based on the review of literature and non research literature, books and according to the objectives stated for the knowledge and skill. It was developed for enhancing the knowledge and skill of staff nurses regarding Mechanical Ventilator. The tools used for data collection were a structured questionnaire, observation checklist and a structured opinionnaire. The SIM and the data tools were prepared in simple English and were validated by eleven experts from the field of Medicine, Anesthesia, Surgery and Nursing field. The reliability of the knowledge questionnaire was established by calculating Kuder Richardson-20 formula. The reliability coefficient was found to be 0.80. The reliability of observation checklist, interobserver reliability was calculated by using rank order coefficient of correlation and it was found to be 0.99. The reliability of the opinionnaire was established by using Chronbach alpha formula and it was found to be 0.83. The Study was conducted at one of the renowed hospital in New Delhi. Multistage sampling technique was used to obtain the sample. The sample comprised of 60 staff nurses by total enumeration technique. Data were collected from 12th December 2011 to 31st December 2011 as per the research design. The data obtained was analyzed using both descriptive and inferential statistics in terms of frequency, percentage, mean, standard deviation, 't' value and coefficient of correlation. The significant findings of the study were the mean post test knowledge scores of staff nurses were significantly higher than their mean pre test knowledge scores. The mean post test skill scores of the subjects were significantly higher than their mean pre test skill scores and there was a positive significant relationship existed between pre test and post test knowledge and skill scores of staff nurses. Thus the findings of the study revealed that Self Instructional Module was effective in enhancing the knowledge and skill of staff nurses regarding Mechanical Ventilator.

On the basis of the study findings the following recommendations were made for the future research:

1. The study can be replicated on a large sample of staff nurses selected from various hospitals thereby the findings can be generalized for a large population.
2. A similar study can be conducted for the staff nurses working in general areas to test the effectiveness of Self Instructional Module on Mechanical Ventilator.
3. A study can be done to assess the attitude of nursing personnel and trained Emergency Medical Technician towards the need for developing knowledge and skill in using Mechanical Ventilator.
4. Other teaching strategies i.e. planned teaching programme, guidelines etc can be used to assess the Knowledge and Skill of staff nurses on Mechanical Ventilator.
5. A study can be undertaken to ascertain the patient's health status outcome who is on long term ventilator support in relation to nursing care.
6. A comparative study can be used to find out the survival rate in both private and public hospitals.

Key words: Develop and evaluate the effectiveness, Mechanical Ventilators.

INTRODUCTION

The Roman physician Galen is 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. George Poe demonstrated his mechanical respirator by asphyxiating dogs and seemingly bringing them back to life. (1908) In a study done by Lynn Botha, Department of Nursing Education (August 2009) on nurses in ICU knowledge of basic Mechanical Ventilation, the results showed that the perceptions of nurses with regard to competency unrealistic with regard to actual scores, in spite of poor scores nurses are taking charge of unit, manipulating ventilator settings and feel they are competent to nurse the patient. Nine trained nurses taking charge and manipulating settings needs to review how mechanical ventilation is taught and learnt. And finally, she concludes by saying "ARE OUR MECHANICALLY VENTILATED PATIENTS SAFE?" The American Medical Association has published new and revised ventilator management codes for 2007 that were implemented on January 1, 2007. A recent consensus conference has recommended that prolonged mechanical ventilation be defined as the need for continual assistance from a Mechanical Ventilator for at least 6 h/d for at least 21 days. As yet, this consensus definition has not been uniformly accepted or implemented but appears to be a useful way of defining prolonged mechanical ventilation. Mechanical ventilation is one of the most common medical therapies administered within ICUs. Mechanical ventilation is the second most frequently performed therapeutic intervention after treatment for cardiac arrhythmias in intensive care units today. Countless lives have been saved with its use despite being associated with a greater than 30% in-hospital mortality rate. As life expectancies increase and people with chronic illnesses survive longer, artificial support with mechanical ventilation is also expected to rise. The expertise and knowledge of the nurse caring for the mechanically ventilated patient is pivotal to move the patient from the acute stage through to liberation from the ventilator Burn (2005). The knowledge of nurses with regard to Mechanical Ventilation who currently care for the mechanically ventilated patient is unknown, and therefore it is very important to determine the knowledge level of the nurses who currently care for mechanically ventilated patients, if the knowledge is found to be below the set competency of 70% the patient is at risk of deterioration and increased mortality and morbidity Cox (2005); Tobin (2001).

A plethora of literature both locally and internationally suggests only a specialist nurse with specialist knowledge gained from additional specialist training should care for the ventilated patient Alfonso (2004); Tobin (2001). Mechanical Ventilation has prolonged the lives of many patients whose respiratory function has been compromised by drugs, disease, trauma, surgical procedures and other conditions that do not permit adequate breathing without assistance. These critically ill and chronically ill patients who require mechanical ventilation for survival are a diverse population. Hence, the continuing growth of critical care nursing challenges nurses to expand their scope to meet the needs of this rapidly advancing specialty. For ICU teams to function to the best of their ability, the skills and input of each team member must be recognized. One of the main functions of an intensive care unit is the provision of an advanced respiratory support. An understanding of the indications and types of mechanical ventilation is therefore essential for anyone working in this environment. The prevalence of mechanical ventilation in skilled nursing facilities in the United States is difficult to estimate. A MEDLINE search combining the terms "nursing home" and "mechanical ventilation" yielded five relevant articles published from 1997 to 2007. Review of these articles indicates that patients in some states (*eg*, Maryland) do undergo mechanical ventilation in skilled nursing facilities, but comprehensive epidemiologic data are difficult to find. There are approximately 50 nursing homes in New York State that offer ventilator services. The critical care nurse will be faced with the continued challenge of being knowledgeable regarding the current trends in ventilator support and their potential advantages and disadvantages, while keeping in perspective those areas where clinical research is lacking. Possibilities for future nursing research related to mechanical ventilation are endless. The application and refinement of assessment parameters to evaluate the impact of nursing interventions on mechanically ventilated patients should be a key focus. The growing use of SVO2 monitoring in conjunction with other assessment parameters may prove to be useful tools to measure the impact of interventions such as suctioning, positioning, muscle reconditioning, weaning techniques, and comfort measures on mechanically ventilated patients.

Mechanical ventilatory support is a major component of the clinical management of critically ill patients admitted into intensive care. Closely linked with the developments within critical care medicine, the use of ventilatory support has been increasing since the polio epidemics in the 1950s. Initially used to provide controlled mandatory ventilation, today with advances in technology, most mechanical ventilators are triggered by the patient, increasing the awareness of the complexity of patient/ventilator interaction Tobin (1994). Though ventilator appearance and design may have changed quite significantly and the variety of options for support extensive, the basic concepts of mechanical ventilatory support of the critically ill patient remains unchanged. Nursing staff new to intensive care can often be apprehensive when observing, recording and interpreting ventilator observations. This review of ventilation and the necessary observations involved offers a description of the observations performed, with a problem-solving approach to cause, rationale and possible action that may be required. Calculations related to spontaneous and mechanical respiratory function are discussed, with recommendations for individual requirements. Explanation of available settings, demonstrating the functions and delivery methods of different ventilators is included, and a discussion on alarm settings and rationale.

METHODS

Research design: Pre experimental "one group pretest post-test design". The purpose of the study was explained to the staff nurses and informed written consent was taken. The questionnaire was given to the staff nurses and practices were observed using checklist. No major problem was faced during the data collection period.

Research approach: Evaluative research.

Conceptual framework selected for the study is Systems Model.

Table 1. Schematic representation of Research Design

Group	Pre-test assessment (day-1)	Intervention (day -1)	Post-test assessment (day – 08)	Method of data collection
Staff Nurses working in Critical areas in selected hospitals of Delhi	-Structured knowledge questionnaire -Observation Checklist	-Administration of Self Instructional Module on Mechanical Ventilator and Demonstration of procedure.	-Structured knowledge questionnaire. -Observation Checklist -Opinionnaire	-Paper and Pencil method -Observation

Table 2. Schematic Representation of reliability of the tool

Sl.No.	Tool	Formula Used	Results
1.	Structured Knowledge Questionnaire	KR-20	0.80
2.	Observation Check List	Inter observer reliability	0.99
3.	Opinionnaire	Cronbach alpha	0.83

Table 3. Frequency and Percentage Distribution of Staff nurses by Sample Characteristics N=60

Sl. No	Sample Characteristics	Frequency	Percentage (%)
1.	**Gender**		
	Male	5	8.33
	Female	55	91.67
2.	**Professional Education**		
	GNM	30	50
	B.Sc Nursing	30	50
	Post Basic Nursing	0	0
	Any other	0	0
3.	**Duration of clinical experience**		
	Less than 2 years	28	46.66
	2-4 years	30	50
	4-6 years	2	3.333
	More than 6 years	0	0
4.	**Any type of training in critical care nursing/ respiratory nursing care**		
	Yes	35	58.33
	No	25	41.66
5.	**If yes, indicate the type of training you have had**		
	Formal Planned inservice education	13	37.14
	On the job training	21	60
	Any other	1	2.85

Independent Variable: Self Instructional Module on Mechanical ventilator.

Dependent Variable: Knowledge and skill on Mechanical Ventilator Opinionaire for the acceptability and utility of Self Instructional Module.

Population: The population of the present comprised of staff nurses who were working in hospital.

Sample: The sample of the study comprises Staff nurses working in ICU, ICCU and Emergency ward of selected hospital of Delhi.

Multi stage sampling technique for the final study

- Selection of State: Convenient Sampling
- Selection of Hospital: Simple random technique
- Selection of Ward: Purposive Sampling
- Selection of Staff Nurses: Total enumeration technique

Reliability of the Tool

Setting: Formal administrative approval was obtained from the setting of the study for the time period of 11th December 2011 to 31st December 2011. The data collection procedure was carried in the ICU, ICCU and Emergency Ward of selected hospital of Delhi.

Analysis and Interpretation: The data collected were organized and analyzed according to objectives of the study using both descriptive and inferential statistics.

Section I

Frequency and Percentage Distribution of Samples in terms of Sex, Professional Qualification, Duration of experience, any type of training in critical care nursing or respiratory nursing care. The type of training to be mentioned as per the training obtained. Data given in Table 3 shows that 91.67% of the subjects are female while the remaining are male nurses. Among them 50% of them are having professional qualification as G.N.M and 50% of them as B.Sc Nursing. Majority of them (50%) are having experience between 2-4 years. Maximum (58.33%) have undergone training in critical care areas and (60%) have availed the opportunity as on the job training.

Section II: Findings related to pre test and post test knowledge scores of staff nurses regarding Mechanical Ventilator

Data given in Table 4 shows that the mean for pre test knowledge is 31.78 and post test is 41.36. The median for pre test is 31 and for post test is 41. The standard deviation of post test is 3.57 that is lower than the standard deviation of pretest i.e. 3.78 indicating that there is an increase in the knowledge of the staff nurses after the reading the Self Instructional Module. The data presented in Table 5 shows that the mean post test knowledge score (41.36) of the staff nurse is higher than the mean pre test knowledge score (31.78). The obtained mean difference (9.58) between the post test knowledge scores is found to be statistically significant as evident from the 't'-value 10.89 at 0.05 level.

Table 4. Mean, Median, Standard Deviation of Pretest and Post Test Knowledge Scores of Staff Nurses N=60

GROUP	Knowledge test	Mean	Median	Standard deviation
Staff Nurses	Pre-test	31.78	31	3.78
	Post-test	41.36	41	3.57

Table 5. Mean, mean difference (MD) , standard deviation difference (S.D$_D$), standard error mean difference (SE$_{MD}$) and 't' value of pre test and post test knowledge scores of staff nurses N=60

Group	Knowledge test	Mean	MD	S.D $_D$	SE$_{MD}$	't' value
Staff nurses	Pre-test	31.78	9.58	0.21	0.88	10.89*
	Post-test	41.36				

*Significant at 0.05 level of significance at df (59) (p>2.00)

Table 6. Mean, Median, Standard Deviation of Pretest and Post Test Skill Scores of Staff Nurses N=60

GROUP	Skill test	Mean	Median	Standard deviation
Staff Nurses	Pre-test	27.95	28	1.92
	Post-test	35.73	36	1.74

Table 7. Mean, mean difference (MD), standard deviation difference (S.D$_D$), standard error mean difference (SE$_{MD}$) and 't' value of pre test and post test skill scores of the staff nurses N=60

GROUP	Practice test	Mean	MD	S.D $_D$	SE$_{MD}$	't' value
	Pre-test	27.95	7.78	0.18	0.428	18.09*
Staff Nurse	Post-test	35.73				

*Significant at 0.05 level of significance at df 59 (p>2.00)

Table 8. Correlation showing the relationship between knowledge and skill of Staff Nurses on Mechanical Ventilator after the administration of the Self Instructional Module N=60

GROUP	Post test score	Mean	Median	Standard deviation	Correlation
Staff Nurses	Knowledge score	41.36	41	3.57	0.280*
	Skill score	35.73	36	1.74	

*Significant at 0.05 level of significance at df 58 (p>.250)

Table 9. Obtained range of scores, mean and standard deviation of acceptability and utility scores of Self Instructional Module by the staff nurses

Group	Obtained range of Scores	Mean	SD
Staff Nurses	17-20	19.61	0.71

Maximum possible score=20

difference and not by chance. Hence null hypothesis H01 is rejected and research hypothesis H1 is accepted. This indicates that the Self Instructional Module is effective in enhancing the knowledge of the staff nurses on Mechanical Ventilator.

Section III: Findings related to pre test and post test skill score of staff nurses regarding Mechanical Ventilator

The data given in Table 6 shows that the mean post test skill score of the staff nurses (35.73) is higher than the mean pre test skill score (27.95). The findings also shows that the median of the post test skill score (36) is higher than the median of pre test skill scores (28). The standard deviation of the post test skill score is 1.74 and that of pre test score is 1.92. Hence, it shows that the group have improved skill after the administration of Self Instructional Module and demonstration of the procedure. The data presented in Table 7 shows that the mean post test skill score (35.73) is higher than the mean pre test skill score (27.95). The obtained mean difference (7.78) is found to be statistically significant as evident from the   't'- value 18.09 for df (59) at 0.05 level. Therefore the obtained mean difference is a true difference and not by chance. Hence the null hypothesis H02 is rejected and research hypothesis H2 is accepted.

effective in enhancing the skill of the staff nurses in performing on Mechanical Ventilator.

Section IV

The data presented in Table 8 shows that the computed correlation (0.280) between the post test knowledge scores and skill scores is found to be statistically significant at 0.05 level of significance. The findings suggests that there is marked relationship between the post test knowledge and skill scores of staff nurses regarding Mechanical Ventilator. Hence, the null hypothesis H03 is rejected and research hypothesis H3 is accepted. Thus, it suggests that with the increase in knowledge there is an improved skill of the staff nurses after the administration of Self Instructional Module followed by a demonstration.

Section V: The data presented in Table 9 reveals that the mean acceptability scores of the staff nurses was high and close to maximum possible acceptability and utility score. Thus this indicates that the Self Instructional Module was acceptable and useable for the staff nurses. The responses of the statements of acceptability and utility of the Self Instructional Module are presented in Table 8.

Table 10. Item wise response of staff nurses on acceptability with and utility of Self Instructional Module in frequency and percentages N=60

Sl.No	Statement	to a great extent (2)		to some extent (1)		not at all (0)	
		No.	%	No.	%	No.	%
1.	Self instructional module (SIM) is a good source of learning.	60	100%	0	3.34%	0	00%
2.	I feel the information provided in SIM is adequate and upto date	57	95%	3	5%	0	00%
3.	The language of SIM is simple and easy to understand.	59	98.33%	1	1.7%	0	00%
4.	The SIM is interesting to read	57	95%	3	5%	0	00%
5.	The SIM can be used without anybody's help	59	98.33	1	1.7%	0	00%
6.	The aspects included in the SIM are of practical use.	58	96.66%	2	3.34%	0	00%
7.	The material is concise and handy.	58	96.66%	2	3.34%	0	00%
8.	I can take my own time to read and learn about Mechanical Ventilators	56	93.33%	4	6.66%	0	00%
9.	Most of the nurses will be in need of this material.	58	96.66%	2	3.34%	0	00%
10.	My knowledge has improved about the Mechanical Ventilators through the material.	56	93.33%	4	6.66%	0	00%

The data presented in Table 10 shows the response of 60 staff nurses regarding acceptability and utility of Self Instructional Module. Majority (100 %) of the staff nurses agreed 'TO A GREAT EXTENT' to item no 1. Few of them (6.66%) agreed "TO SOME EXTENT" and no one (00%) opted for 'NOT AT ALL'. This indicates the high acceptability and utility of the Self Instructional Module.

DISCUSSIONS

Rose L and Nelson S (2006) states that a responsibility of critical care nurses for management of mechanical ventilation differs. Organizational interventions, including weaning protocols, have a variable impact in settings that differ in nursing autonomy and interdisciplinary collaboration. Critical care nurses have high levels of responsibility for, and autonomy in, the management of mechanical ventilation and weaning. The investigator conducted "A Study to develop and evaluate the effectiveness of Self Instructional Module on Mechanical Ventilators in terms of Knowledge and skill of Staff Nurses in critical areas in Selected Hospital of Delhi" Suzanne M Burns (2005) stated that knowledge and understanding of mechanical ventilation are central to ensuring patients' safe passage from the acute stage to weaning. Mechanical ventilation is one of the most commonly used technologies in critical care. Despite the prevalence of ventilators, care planning is heavily influenced by anecdote and clinical preference. A vast array of ventilator mode options exist, and claims of what works and what does not. Critical care nurses' knowledge and understanding of mechanical ventilation are central to ensuring patients' safe passage from the acute stage of ventilation to weaning. Of key importance is the use of evidence that may improve patients' outcomes. The study results revealed that the post test knowledge and skill was more than pre test knowledge and skill. This is quite similar to the findings of the study conducted by Sumitra, P.S (1998) "To assess the knowledge and practices of nursing personal regarding immediate post operative care of cardiac surgery client on ventilator in Cardio Thoracic Intensive Care Unit in Selected Hospitals of Hyderabad". It was a descriptive study where 30 nurses working in CTICU with at least 6 months experience were selected by purposive sampling. Data was collected by observational checklist and questionnaire. The study revealed that majority of nurses had below average knowledge and practices and more than one third of nurses had above average knowledge and practices. The investigator's study findings revealed that there was a significant correlation between knowledge scores and skill scores of staff nurses. A study was done to see the application of theory into practice.

Debra M Melson (1993) conducted a study to assess the theoretical knowledge of the nurses and endotracheal suctioning and their ability to apply this knowledge regarding suctioning. 24 registered nurses were asked a series of questions regarding suctioning. All participants believed that the clients require suctioning every 1 to 3 hours with 17 performing it every 2 to 3 hours. No differences were apparent between experienced and less experienced nurses. It is a concern that many nurses rely upon deterioration in the client's condition to indicate when suctioning is required. The study suggested that there is need for a policy for suctioning and provision of clear guidelines for education of all staff. The study results revealed that the Self Instructional Module was effective in increasing the knowledge and skill of the staff nurses regarding the Mechanical Ventilator. This is similar to the findings of the study conducted by Bhaduri, A et al (1998) "Oxygen therapy for children. Need based preparation and evaluation of a self instructional module for staff nurses on care of a child receiving oxygen therapy", and evaluating the effectiveness of the self instructional module or SIM. The study was conducted in two phases. A survey approach was used for Phase I and one group pre test post test design was adopted for Phase II. The total sample sample of the study was 30 Staff Nurses, of 6 months experience in Pediatric Ward. The findings of the study showed high learning need status in most of the areas and the Staff nurses also expressed the desirable need for learning in detail. It was found that age, total years of experience, experience in Pediatric Ward and married with or without children were independent of their learning need. SIM effective in terms of gain in knowledge score as well as acceptability and utility scores of Staff Nurses.

In another study conducted by Santopietro MC (1980) "Effectiveness of a self instructional module in human sexuality counseling" The nursing profession has begun to address the issue of sexual health counseling by nurses, thus moving toward the goal of providing holistic patient care. Since the professional preparation of the nurse as a sexual health teacher and counselor requires substantive changes in existing nursing curricula, some nursing educators and practitioners have initiated efforts to determine appropriate educational experiences for nurses. This study evaluated the effectiveness of a self instructional module developed by the investigator to prepare nursing students for dealing with the sexuality concerns of male myocardial infarction patients. Using a pretest posttest control group design, the evaluation was carried out through field testing of the module on a convenience sample of 161 nursing students in four baccalaureate programs in the United States. Field testing

consisted of administration of the module, together with pre post testing of subjects on a knowledge inventory and a behavioral intensions/ comfort inventory. Following administration of the module , experimental subjects' scores indicated significant increase in knowledge of sexuality counseling of MI patients (p less than .001) and comfort in dealing with patients' sexuality concerns (p less than .001).

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