

ORIGINAL RESEARCH

IJPHY

TO CONDUCT A MULTI CENTRE SURVEY ON THE AWARENESS OF VENTILATORS AND PULSE OXI METER DISPLAYERS AMONG PHYSIOTHERAPIST AND OTHER INTENSIVE CARE STAFF POSTED IN INTENSIVE CARE UNITS OF VARIOUS HOSPITALS IN NORTH EASTERN STATES OF INDIA

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ABSTRACT

Background: ICU is a specially staffed and fully equipped unit of the hospital where patient requiring intensive care is kept. In order to meet the demand of seriously ill patients a numbers of sophisticated equipments and gadgets are used. Studies have shown that there is a need for knowledge about the operating system of these machines used in ICU to execute the treatment protocols by the ICU staff. Various therapeutic procedures are done depending on the readings of the machines and monitoring of the values is required before and after the treatment sessions. So it becomes mandatory for the ICU staff to have good command over the parameters of the equipment. The objective of the study is therefore to find out the awareness of two important machines namely the Mechanical ventilator and Pulse oximeter among the ICU staff including the physiotherapist in north eastern states of India.

Methods: An observational cross section study has been done with 200 subjects who is working in ICU for more than 6 months.

Result: The data of 200 subjects were analyzed and the scores of the questionnaire was estimated using Karl Pearson Correlation Coefficient which has shown that there is a significant (p value = 0.00) awareness of pulse oximeter displayers and ventilators among physiotherapist and other ICU staff in the north eastern states of India.

Conclusion: Based on the results, it is concluded that 72.5% of the subjects were well aware and 27.5% of the subjects were least aware about the ventilators and pulse oximeter, hence it can be considered that there is an acceptable knowledge among the ICU staff including physiotherapist in north eastern states of India about the ventilator and pulse oximeter displayers.

Key words: ICU- intensive care unit, Continuous mechanical ventilation(CMV), Synchronized intermittent mandatory ventilation (SIMV), Positive end-expiratory pressure (PEEP), Continuous positive airway pressure (CPAP). Pressure support ventilation (PSV), Light emitting diode (LED)

Received 04th August 2015, revised 22nd August 2015, accepted 07th September 2015



www.ijphy.org

DOI: 10.15621/ijphy/2015/v2i5/78220

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INTRODUCTION

"An intensive care unit (ICU) is a specially staffed and equipped hospital ward dedicated to the management of patients with life-threatening illnesses, injuries or complications."¹ It is also described as an "unit in the hospital where seriously ill patients are cared for by specially trained staff". The ICU staffs includes doctors, nurses, respiratory therapist, clinical nurse specialist, pharmacists, physical therapist, nurse practitioners, physician assistants, dieticians, social workers.²

Intensive care unit has become a concentration not only for critically ill patient and advanced technology but also of expert personnel with specialist training.³ Intensive care management includes vigilant nursing care, medical care and physiotherapy, irrespective of their specialty such as neurological ICU, cardiac ICU, or trauma ICU.⁴

All the staff along with the physiotherapist who is working in the ICU must have good knowledge about the different instruments (machines) used in

the ICU like: ECG displayer, Ventilator, Pulse Oxygen meter⁵, Ambu bag, BP apparatus etc. as various treatment procedures are applied keeping in view the readings of the various instruments in the ICU so as to minimize their ICU stay and for the delivery of effective treatment procedure.

A ventilator is a machine designed to mechanically move breathable air into and out of the lungs, to provide the mechanism of breathing for a patient who is physically unable to breathe, or breathing insufficiently. Ventilator parameters vary according to their manufacturer however, basic parameters are present on all machines which includes percent oxygen, tidal volume and/or minute ventilation, respiratory rate, inspiratory time or flow rate, and alarm limit settings. A thorough understanding of common ventilator settings generally assist in optimizing patients' care to meet the overall oxygenation and ventilation goals, maintain safe lung pressures, provide breathing comfort and to carry out the treatment protocols .

The following are some of the modes commonly used in practice:

The most Standard Modes in use	Description
Continuous mechanical ventilation (CMV)	Ventilator delivers preset tidal volume and respiratory rate. No allowance for spontaneous breaths. Since ventilator is not responsive to client, this can lead to agitation and asynchrony.
Assisted Ventilation	Spontaneous aspiratory effort of client triggers ventilator or to deliver preset tidal volume. If client does not trigger an assisted breath, ventilator delivers breaths at preset respiratory rate.
Synchronized intermittent mandatory ventilation (SIMV)	Similar to IMV except that preset ventilator breaths are synchronized with client's spontaneous breaths to avoid "stacking" of, breathes.
Positive end-expiratory pressure (PEEP)	Preset amount of pressure stays in the lungs at the end of exhalation, keeping alveoli open. Used in conjunction with CMV. Assisted ventilation, IMV, Or SIMV
Weaning	Modes Description
Continuous positive airway pressure (CPAP).	Similar to PEEP, but for the client who is breathing entirely on their own
Pressure support ventilation (PSV).	Patient breaths spontaneously, but ventilator provides a preset level of pressure assistance with each spontaneous (inspiratory breaths)
Volume support	Same as pressure support, tidal volume guaranteed.
Intravascular oxygenations	An oxygen /carbon dioxide exchange device is implanted in the inferior venal cava. ⁶

Ventilator graphics are an important part of understanding the pathophysiology in mechanically ventilated patients. These graphics are used in ICU to monitor functions of ventilator to set appropriate tidal volume, PEEP, flow rate, problem identification and correction by adjusting sensitivity, auto PEEP and removal of secretions. It

is also used to find the response to bronchodilator therapy, to calculate compliance, resistance, work of breathing and to evaluate patient's response to ventilator function and help clinician to make adjustment.⁷

It has also been found that, the human eye is poor at recognizing hypoxemia. Even under ideal

conditions, skilled observers cannot consistently detect hypoxemia until the oxygen (O_2) saturation is below 80%.⁸ Hence to combat this obstruction today's physician is looking for other alternatives such as pulse oximeter. Oximeter measures the different absorption spectra of oxygenated and deoxygenated hemoglobin. The method is noninvasive (a clip or tape on a finger), simple to operate, and adaptable to various patient populations. Pulse oximeter monitors continuously and instantaneously, is responsive to change, and is accurate.⁹ Non invasive assessment of oxygen saturation by pulse oximeter (SpO_2) was introduced clinically in 1975 (Kendrick 2001).¹⁰ It works by transcutaneous examination of colour spectrum of haemoglobin which changes the degree of saturation. The normal arterial oxygen saturation is approximately 95-98%.

Pulse oximetry is based on two physical principles: (a) the presence of a pulsatile signal generated by arterial blood, which is relatively independent of non-pulsatile arterial blood, venous and capillary blood, and other tissues; and (b) the fact that oxyhemoglobin (O_2Hb) and reduced hemoglobin (Hb) have different absorption spectra¹⁰. Currently available oximeters use two light-emitting diodes (LEDs) that emit light at the 660 nm (red) and the 940 nm (infrared) wavelengths. These two wavelengths are used because O_2Hb and Hb have different absorption spectra at these particular wavelengths. In the red region, O_2Hb absorbs less light than Hb, while the reverse occurs in the infrared region. The ratio of absorbencies at these two wavelengths is calibrated empirically against direct measurements of arterial blood oxygen saturation (S_aO_2) in volunteers, and the resulting calibration algorithm is stored in a digital microprocessor within the pulse oximeter. During subsequent use, the calibration curve is used to generate the pulse oximeter's estimate of arterial saturation (S_pO_2).^{11,12} In addition to the digital read out of O_2 saturation, most pulse oximeters display a plethysmographic waveform which can help clinicians distinguish an artifactual signal from the true signal.

Noninvasive measurement of arterial oxygen saturation (SaO_2) by pulse oximetry is widely acknowledged to be one of the most important technological advances in monitoring clinical patients as Pulse oximeters compute SaO_2 by measuring differences in the visible and near infrared absorbances of fully oxygenated and deoxygenated arterial blood. Unlike clinical blood gas analyzers, which require a sample of blood from the patient and can provide only intermittent measurement of patient oxygenation, pulse

oximeters provide continuous, safe, and instantaneous measurement of blood oxygenation.¹³

Colin F. Makenzie stated the role of Physiotherapists in ICU as positioning, postural drainage, vibration, manual lung inflation, coughing, tracheal suctioning, breathing exercises, Patients mobilization and application of aerosol, humidification, incentive spirometry, forced expiratory technique, bronchodilator and mucolytic agents. According to the result of a survey, Indian ICU physiotherapists perform both the roles of chest physiotherapy and mobilization. Therapists are also involved in application of non-invasive ventilation, proprioceptive neuromuscular facilitation in respiration, bedsores management, active cycle of breathing techniques and autogenic drainage.¹⁴

Hence it has been emphasized that physiotherapist plays a vital role in ICUs, and among the various techniques used in the treatment procedure, the technique of vibration is applied for clearance of secretion to the ventilated patient is given at the end of inspiration, since there is no objective way of assessing end of inspiratory phase, physiotherapist has to rely on ventilator graphics to apply vibration.¹⁵ So there exist a need for knowledge of ventilators in the treatment of patient in ICUs.

Pulse oximetry monitoring is required before, during and after intervention such as positioning and suctioning. Careful monitoring of oxygen saturation is required during and after respiratory physiotherapy as patients tends to undergo hypoxaemia.

Along with physiotherapist, doctors, nurses and other ICU staffs must also perform complex physical assessments as part of monitoring patient condition and status. They too must be well trained and should develop sound knowledge and practical skills in taking care of client with mechanical ventilator and pulse oximetry in order to develop them as effective potential and competent practitioner. Various studies which are conducted on doctors, nurses, physiotherapist, respiratory therapist, occupational therapist on their knowledge on ventilators and pulse oximeter have concluded that there is a knowledge deficiency among the medical and paramedical staffs.^{16,17}

METHODOLOGY

An observational cross section study was done taking 200 subjects consisting of 125 males and 75 female staffs from Hospitals with well equipped ICU set up in all the North Eastern States.

Physiotherapists and other medical and para medical staff currently working in ICU set up with more than 6 months of working experience were considered after signing the consent form. Trainees and interns were excluded from the study.

Ethical Clearance has been obtained from the ethical committee of College of Physiotherapy and Medical Sciences, Bamunimaidan, Guwahati.

PROCEDURE

A self designed questionnaire was prepared containing 30 questions on ventilators and pulse oximeter and was shown to experts for their suggestions. 10 questions were deducted and 20 questions were approved by them.

PILOT STUDY

The questionnaire was explained and distributed among 80 subjects working for more than 6 months inside the ICU, taken randomly from various hospitals. 2 marks was given for every correct answer and 1 mark was given for every wrong answer, as suggested by experts. The same questionnaire was again distributed to the same population 15 days later and the data was taken. The data was analysed using test retest reliability and proved reliable. As the questionnaire was prepared taking the experts view hence it possessed content validity.

Hospitals were randomly selected all over the north eastern states of India, where Physiotherapist and all other medical and para medical staffs working in ICU's of these Private and government hospitals were approached. The subjects selected were given a Consent form and written consent was taken from them. The subjects were explained about the purpose of the study and the process of filling the questionnaire. Contact information was included, including designation and address.

DATA ANALYSIS AND RESULTS

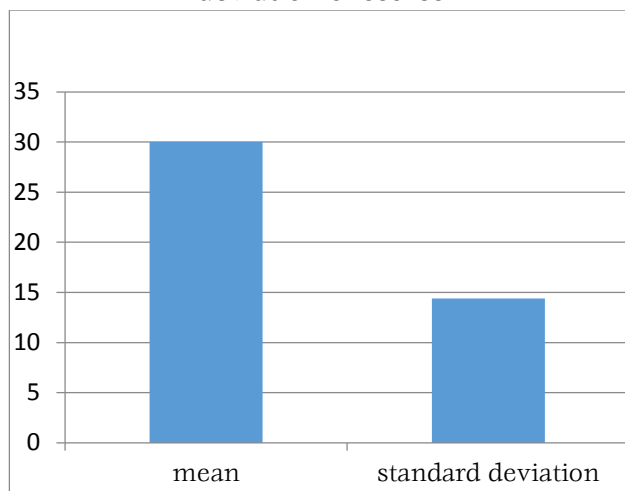
Data of 200 subjects who completed the study was well analysed and interpreted in tabular form as given below

TABLE 1: Demographic data of the score obtained

N	Minimum marks	Maximum marks	Mean	Standard deviation
200	20	40	30	14.142

Table 1 reveals that out of 200 subjects the minimum marks obtained was 20 and maximum marks obtained was 40 , hence mean marks calculated was 30 with a standard deviation (SD) of 14.142

GRAPH 1: Graph showing mean and standard deviation of scores



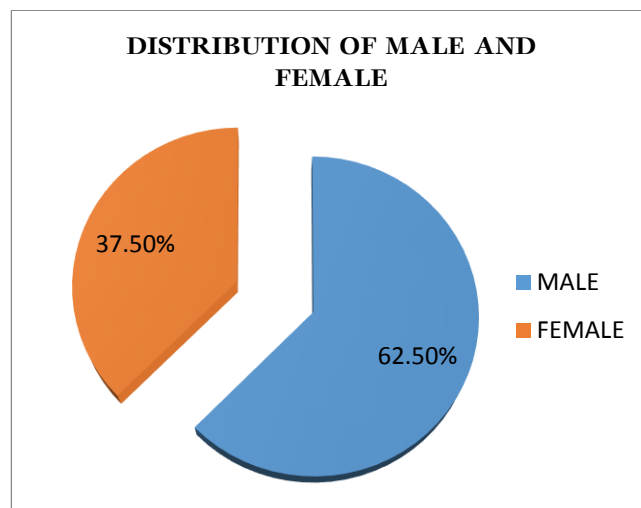
The frequency and percentage distribution of subjects as male and female groups were computed.

TABLE 2: Distribution of data of subjects as male and female in frequency and percentage

	Frequency	Percentage (%)
Male	125	62.5%
Female	75	37.5%
Total	200	100%

Table 2 reveals that there were 125(62.5%)male and 75 (37.5%) female in the study

GRAPH 2: Pie graph showing distribution of male and female subjects



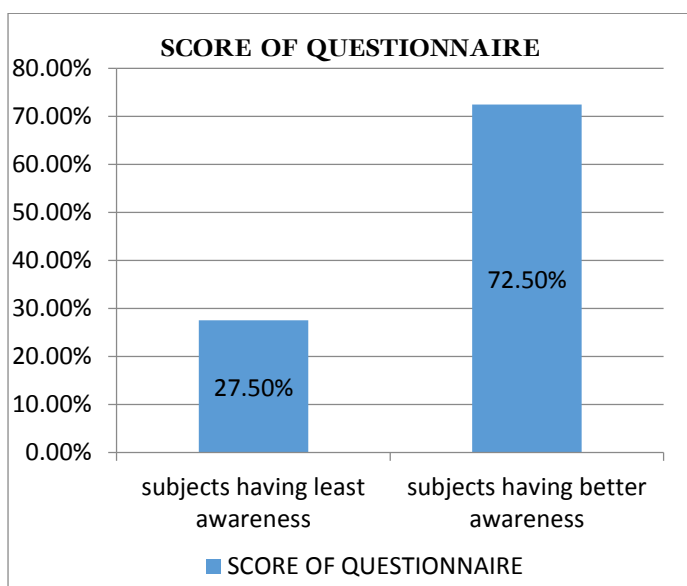
Subjects were categorised according to gender 125 (62.5%) were males and 75 (37.5%) were females. The mean questionnaire awareness of ICU staff including physiotherapist is 30±14.14 (standard deviation) and ranges from 20 to 40. Therefore the subjects were categorised according to their awareness of ventilators and pulse oximeter displays.

TABLE 3: Scores of the questionnaire

	Subjects scoring between 20 and 30	Subjects scoring between 31 and 40
Self customed questionnaire	55	145
Percentage %	27.5%	72.5%

The marks was given taking 20 as the minimum marks and 40 as the maximum marks attained. The table 3 shows that 55 (27.5%) subjects had minimum awareness and 145 (72.5%) subjects had better awareness of ventilators and pulse oximeter.

GRAPH 3: Scores of the questionnaire



Co relation was estimated between total score of knowlegeable questionnaire and less knowlegeable questionnaire for the karl pearson correlation coefficient value, $r = 2.63$ and $p = 0.000$ (very highly significant)

TABLE 4: Table showing karl pearson correlation coefficient and p value

Questionnaire	Karl pearson correlation coefficient value (r)	P value	Significance
Questionnaire	2.63	0.000	Very highly significant

Table 4 shows that the r value is 2.63 for the correlation of aware and unaware questionnaire and the p value is 0.000 which is highly significant.

Therefore it is found that 72.5% of the total subjects who participated in the study has good amount of awareness of ventilators and pulse oximeter and 27.5% of the subjects have less amount of awareness about ventilators and pulse oximeter

The study was carried out in ICU settings among ICU staffs to create awareness of ventilators and pulse oximeter about ventilators and pulse oximeter.

DISCUSSION

This study was intended to find the awareness of ventilators and pulse oximeter among Physiotherapist and other icu staff working in various hospitals in north eastern states. An observational cross section study was done with 200 subjects fulfilling the inclusion criteria were allowed to participate in the study. A pilot study taking 80 subjects were done to prove the reliability of the questionnaire. The questionnaire was then distributed among 200 subjects.

The data obtained shows that 155 (72.5%) of the subjects were seen to have better awareness about ventilators and pulse oximeter and 45 (27.5%) were seen having minimum awareness about ventilator and pulse oximeter. co relation was estimated between total score of knowledgable questionnaire and less knowledgeable questionnaire for the karl pearson correlation coefficient value (r) and it is found to be 2.63 and $p = 0.000$ which is very highly significant . Hence it can be concluded that there is a significant awareness of pulse oximeter and ventilator among physiotherapist and other ICU staffs within the north eastern states of India.

CONCLUSION

Based on the statistical analysis performed, it is concluded that there is significant awareness of ventilators and pulse oximeter among physiotherapist and other ICU staff working in various hospitals of north eastern states of India.

Assessment and analysis of ventilator and pulse oximeter awareness among ICU staff indicated that 72.5% of subjects were well aware of ventilators and pulse oximeter and 27.5% of subjects were minimum aware of ventilators and pulse oximeter .Hence it is necessary to create a mass awareness among ICU staff to generate and built good ICU care for patient of North eastern region. Further study in this context is needed to overcome the deficiency in north eastern states hospitals.

REFERENCES

1. Oh TE. Intensive care manual. 4th ed; 1999.
2. Center for patient and community education in association with the staff and physicians at California pacific medical center. Last updated 6/05 2005 sep; 99(9) at www.cpmc.org
3. M Norrenberg J-L Vincent 'A profile of European intensive care unit physiotherapist' European society of intensive care medicine/ intensive care medicine, (2000)26:988-994

4. Anup Bhat et al. Chest physiotherapy techniques in neurological intensive care units of India: A survey. *Indian J Crit Care Med.* 2014 Jun; 18(6): 363–368.
5. Health directory/www. aarogya.com/ last updated:sat 19 july
6. Becker MA, Donn SM. Real -Time pulmonary graphic monitoring. *Clin Perinatol.* 2007 Mar;34(1):1-17, v.
7. Susan P. Pilbeam mechanical ventilation :physiological and clinical application 3rd edition;1998.
8. Suter, Peter M MD. Principles and Practice of Intensive Care Monitoring. *Anesthesia & Analgesia.* 1999;88 (4); 967-968.
9. Bowes WA 3rd, Corke BC, Hulka J. Pulse oximetry: a review of the theory, accuracy, and clinical application. *Obstet Gynecol.* 1989;74(3 Pt 2):541-6.
10. Jennifer A Pryor and S Ammani Prasad. Physiotherapy for respiratory and cardiac problems, adult and paediatrics.4th edition; 2008.
11. Tremper KK, Barker SJ Pulseoximetry, *Anesthesiology.* 1989;70(1):98-108
12. Wukitisch MW, Peterson MT, Tobler DR, Pologe JA. Pulse oximetry:analysis of theory, technology, and practice *J Clin Monit.* 1988;4:290-301.
13. Y Mendelson, Pulse oximetry: theory and applications for noninvasive monitoring, *Clinical Chemistry.*1992;38(9):1601-1607.
14. Jitendra A Kumar et al. Role of physiotherapist in intensive care units of india; a multicentre survey. *Indian J Crit Care Med.*2007;11(4): 198-203.
15. Chang A,paraz J and rolltson J. Venilatory effctcs of neurophysiological facilitation and passive movement inpatient with neurological injury. *Aust J Physiother.* 2002;48(4):305-10.
16. Fathimath Suhara K.A et al, Assessment of knowledge regarding mechanical ventillation among staff nurses working in selected hospital, mangalore with a view to develop an information pamphlet. *International Journal of Recent Scientific Research.*2013;4(9): 1410-1413.
17. A Akhgar Araghi , A Rahimi Forooshani , A Farzaneh Nejad , S Akhgar. Pulse Oximetry knowledge of Medical and Paramedical Staff in ICUs and Ors. Araghi Journal. 2008;1(2)60-68.

Citation

Urvashi Bhattacharya, Ujwal Bhattacharya, & Barnali Bhattacharjee. (2015). TO CONDUCT A MULTI CENTRE SURVEY ON THE AWARENESS OF VENTILATORS AND PULSE OXI METER DISPLAYERS AMONG PHYSIOTHERAPIST AND OTHER INTENSIVE CARE STAFF POSTED IN INTENSIVE CARE UNITS OF VARIOUS HOSPITALS IN NORTH EASTERN STATES OF INDIA. *International Journal of Physiotherapy*, 2(5), 685-690