

## **The effectiveness of simulation based learning (SBL) in ICU management among physiotherapy students – A comparative study**

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### **Abstract**

**Introduction:** The ICU requires a unique combination of abilities, including the safe management of a complex patient care environment, communication in an interdisciplinary team, the capacity to swiftly detect and respond to changes in the physiological condition of a patient, and a comprehension of readiness. A key advantage of the SBL program was the reproduction of emergency scenarios in critical care facilities

**Aim and objective:** Aim of the study is to develop ICU skill knowledge acquisition among Physiotherapy Students through Simulation Based Learning (SBL) by using High Fidelity Human Simulation (HFHS).

**Methods:** This hospital based comparative (pre-test and post-test) quasi experimental study conducted in GSL College of Physiotherapy at Rajahmundry, Andhra Pradesh for a period of 1 year in 100 final year physiotherapy students who were further divided into two groups (SBL study group and conventional control)

**Results:** All 17 tasks knowledge was gained significantly in SBL group where as in control group only at 8 levels study population showed significant increase. The difference in the increasing percentage was also higher in SBL group that is out 13 tasks, 9 tasks were performed well by the SBL group.

**Conclusion:** When compared with conventional method, SBL shows superior learning in skills in all the ICU

domains, so it is advised to introduce the same in physiotherapy curriculum.

**Keywords:** Simulation Based Learning SBL, High Fidelity Human Simulation (HFHS), ICU.

### **Introduction**

In medical and para medical education, majority of learning skills will be acquired by exposing to live patients. On the other hand, it is not always possible to provide a live patient for demonstration, especially in emergency care. Inadequate training was identified as the most common cause of adverse events in ICU cases<sup>1</sup>. This scenario poses a dilemma in entire medical education.

Simulation has been defined as a situation during which a specific set of condition is created artificially so as to review or experience something that is possible in real life; or a standard term that refers to the artificial representation of a real world process to achieve educational goals via experimental learning<sup>2</sup>. Simulation is a practice and learning approach that may be employed in many various disciplines and training kinds<sup>3</sup>.

Simulation is not a novel modality in the field of physiotherapy<sup>4</sup>. The development of clinical skills encountered by 'actual' patients is seen as a vital component in professional skills training and has been employed for example physiotherapy since it began in 1895<sup>5</sup>. Simulation-based education offers an essential road to safer patient care. Simulation also creates a safe setting to develop clinical communication, collaboration and clinical decision-making abilities<sup>6</sup>.

A key advantage of the SBL program was the reproduction of emergency scenarios in critical care facilities. It helps the physiotherapist to get further information and allows new tactics and enhanced emergency abilities to be developed<sup>7</sup>.

### **Rationale of study**

The ICU requires a unique combination of abilities, including the safe management of a complex patient care environment, communication in an interdisciplinary team, the capacity to swiftly detect and respond to changes in the physiological condition of a patient, and a comprehension of readiness. Physiotherapists must build trust in their capacity to execute in each of the areas that may be characterized as clinical self-efficiency<sup>8</sup>. This study gives a fresh analysis of simulation based educational methods in intensive care setting among physiotherapy.

**Aims and Objective:** Aim of the study is to develop ICU skill knowledge acquisition among Physiotherapy Students through Simulation Based Learning (SBL) by using High Fidelity Human Simulation (HFHS). The main objective of the study is to determine and compare the improvement of ICU skill knowledge in both SBL , and conventional groups.

### **Methodology**

**Study Design:** This hospital based comparative study used a two groups, for pre-test and post-test, quasi experimental design In regard to the ICU simulation orientation and ICU scenario development This study deals with qualitative information which will be collected from the students by questionnaires and will be analysed.

**Time frame to address the study:** The study is conducted for 1 year, from march 2020 to February 2021.

**Study Area:** Study conducted in GSL College of Physiotherapy at Rajahmundry, Andhra Pradesh.

**Study Population:** The sample size to consist of 100 Under Graduate Final Year studying in GSL Educational Institutions at Rajahmundry. 50 students were allotted in each group by simple random technique. Study Group

includes, students undergoing SBL method. Control group includes, students undergoing conventional training.

**Data Analysis:** Data was entered in MS-excel 2007 and data was analysed using IBM SPSS (Statistical Package for the Social Sciences ) software trail version 22. Relevalant statistical tests (McNemar’s test, chi-square test etc) were applied and  $p < 0.05$  is considered as Tables 1

Statistical significance. Results were expressed in numbers and frequencies.

**Ethical Clearance :** Ethical clearance taken from Ethical committee of GSL Educational Institutions at Rajahmundry and informed consent was taken from the study subjects before doing this study.

Question *	No To Yes (N=43)		Study Group P Value (Mcnemar Test)	No To Yes (N=47)		Control Group P Value (Mcnemar Test)	Difference In Percentage
	N	%		N	%		
1	16	37.2	Significant	19	40.4	Significant	-3.2
2	19	44.2	Significant	24	51.1	Significant	-6.9
3	24	55.8	Significant	21	44.7	Significant	11.1
4	17	39.5	Significant	14	29.8	Not	9.7
5	11	25.6	Significant	15	31.9	Not	-6.3
6	33	76.7	Significant	10	21.3	Significant	55.5
7	32	74.4	Significant	10	21.3	Not	53.1
8	35	81.4	Significant	16	34.0	Significant	47.4
9	30	69.8	Significant	-	-	Data not supported	-
10	16	37.2	Significant	33	70.2	Significant	-33.0
11	-	-	Data not supported	15	31.9	Significant	-
12	29	67.4	Significant	-	-	Data ot supported	-
13	35	81.4	Significant	6	12.8	Not	68.6
14	36	83.7	Significant	2	4.3	Not	79.5
15	-	-	Data not supported	4	8.5	Not	-
16	17	39.5	Significant	14	29.8	Not	9.7
17	37	86.0	Significant	15	31.9	Significant	54.1

## **Results**

- \*1. Do you know the Oxygen therapy devices (including recognition of equipment)?
2. Do you know endotracheal tubes and tracheostomy (including recognition of equipment)?
3. Do you know intercostal catheters (including recognition of equipment) ?
4. Can you independently interpret findings from imaging investigations (excluding the imaging report) including: Chest radiographs
5. Can you perform and accurately interpret the results of common respiratory examinations including: Observation of respiratory rate , Patterns of breathing Palpation, and chest wall Auscultation
6. Do you know the key principles of providing the following differing modes of mechanical/assisted ventilation including: CPAP , PEEP/EPAP , PS/IPAP , SIMV (volume)/(pressure)
7. Can you interpret indices from blood-gas measurement including: pH , PaCO<sub>2</sub> , PaO<sub>2</sub>, SpO<sub>2</sub>, SaO<sub>2</sub> , HCO<sub>3</sub> Base excess
8. Can you provide the following technique (including an understanding of indications, contraindications, evidence for the technique and progressions): Intermittent positive pressure breathing
9. Can provide the following techniques,(including an understanding of indications, contraindications, evidence for the technique and progressions): Humidification
10. Can you provide the following technique (including an understanding of indications, contraindications, evidence for the technique and progressions): Active Cycle of Breathing Technique (ACBT)
11. Can you provide the following technique (including an understanding of indications, contraindications, evidence for the technique and progressions): Manual airway

clearance techniques – percussion, vibration, chest shaking

12. Can you provide the following techniques, (including an understanding of indications, contraindications, evidence for the technique and progressions): Supported coughing, Directed coughing/instructing the patient to cough effectively and Assisted coughing – chest wall

13. Can you provide the following technique (including an understanding of indications, contraindications, evidence for the technique and progressions):Cough stimulation – oropharyngeal catheter stimulation

14. Can you provide the following techniques (including an understanding of indications, contraindications, evidence for the technique and progressions): Nasopharyngeal airway suctioning, including insertion of NP airway

15. Can you provide the following techniques (including an understanding of indications, contraindications, evidence for the technique and progressions): Oropharyngeal airway suctioning, including insertion of OP airway

16. Can you provide the following techniques (including an understanding of indications, contraindications, evidence for the technique and progressions): Patient positioning for respiratory care – including use of side lie, sitting upright, postural drainage (modified or head down tilt)

17. Can you provide the following techniques (including an understanding of indications, contraindications, evidence for the technique and progressions): Mobilization of ventilated patient

## **Discussion**

In present study, study population was divided into two groups and one group (study group) was allotted for SBL, and another group (control group) was allotted the regular

convention method of learning. After SBL module was successfully applied on study group, both the groups were subjected to a posttest analysis by pretested questionnaire.

Knowledge level was apparently increased by both the methods; significant increase was mainly seen in SBL group only. All 17 tasks knowledge was gained significantly in SBL group (except 11<sup>th</sup> task, which was not tested statistically due to its failure in fitness for the test), where as in control group only at 8 levels study population showed significant increase.

When comparing even in common increasing tasks, in both the study groups, the difference in the increasing percentage was higher in SBL group, that is out 13 tasks, 9 tasks were performed well by the SBL group. Control group performed slightly better in 3 tasks (1.2.5) and well in task 10, that includes an understanding of indications, contraindications, evidence for the technique and progressions): Active Cycle of Breathing Technique (ACBT).

In a similar study done medical students by Joseph N, Nelliyanil M et al<sup>9</sup>, in Mangalore, Karnataka found that most participants (72.5%) had favourable perceptions of SBL, with scores of 92 out of a possible 118 points, And concluded that SBL was perceived as favourable by a large number of participants, indicating a bright prospect for its implementation in the medical curriculum. These findings are similar to present study where the ICU management skills and knowledge improved significantly in the study group in the post-test results.

In the present study the difference between post-test results of study group and control group is highly significant in ability to recognize and also knowledge about Endotracheal tubes and tracheostomy, knowledge about intercostal catheters, interpreting indices from

blood-gas measurement. Similarly in study in physiotherapy students by Neil Tuttle et al<sup>10</sup> with 1 week taring, found that there was a significant effect of SBL with higher APP marks for the experimental group and post hoc analysis indicated marks were significantly higher for all seven areas of assessment. Similar findings are also seen in study done by D. Dennis et al<sup>11</sup> in First-year physiotherapy students.

Diane M. Dennis et al<sup>12</sup> from Australia did a study to develop and introduce simulation activities into the physiotherapy curricula at an Australian University and evaluate students' motivation to learn found that secondary total IMMS scores for the three units (147, 137 and 156) indicated that overall, students found the simulation-based learning activities motivating which supports the present study. Alette Svellingen, RN et al<sup>13</sup> said SBL has a role in skills, intellectual gains and personal growth, which partially supports our study as personal growth was not evaluated.

In the present study the post test results in hemodynamic monitoring and knowledge about the key principles of providing the mechanical/assisted ventilation was significantly higher compared to pre-test results in both control and study groups. Amarja A Havaladar et al<sup>14</sup> did on Hemodynamic Monitoring and Mechanical Ventilation, the post simulation test scores were higher than pretest scores, which coincides with the present study.

In a meta-analysis of 40 studies done by Junghee Kim et al<sup>15</sup> showed that simulation-based nursing education was effective in all learning domains, which is supporting present study where all 17 skills were enhanced.

McSparron JI et al<sup>16</sup> did SBL based study in Pulmonary and Critical Care setup recommended that it should be incorporated into procedural training within pulmonary and critical care medicine for central venous catheter

placement, airway management, bronchoscopy, advanced bronchoscopy, etc, whereas in our study in the same module/task (Q NO.14,15) almost 80% of more skill was acquired when compared with conventional learning.

In this pandemic situation, the importance of ventilatory management has become a vital role. TC Mouli et al<sup>17</sup> on the same among non anesthesiology and found SBL is the best alternative in the present pandemic and it will also ensure the safety of health care professionals, and same was seen in the present study.

### Conclusion

When compared with conventional method, SBL shows superior learning in skills in all the ICU domains and it is a best and safest alternative method of learning especially in critical care settings for physiotherapists.

Recommendation: SBL based learning should be made mandatory at least in ICU setup by introducing the same into the physiotherapy curriculum.

### References

1. Tuttle, N., Horan, S.A. The effect of replacing 1 week of content teaching with an intensive simulation-based learning activity on physiotherapy student clinical placement performance. *Adv Simul* 4, 14 (2019). <https://doi.org/10.1186/s41077-019-0095-8>
2. Flangan B, Nestel D, Joseph M. Making patient safety the focus: Crisis resource management in the undergraduate curriculum. *Med Edu* 2004; 38:56-66.
3. Lateef F. Simulation-based learning: Just like the real thing. *J Emerg Trauma Shock*. 2010 Oct;3(4):348-52. doi: 10.4103/0974-2700.70743. PMID: 21063557; PMCID: PMC2966567.
4. Zendejas B, Wang AT, Brydges R, Hamstra SJ, Cook DA (2013) Cost: The missing outcome in simulation-based medical education research: A systematic review. *Surgery* 153: 160-176.
5. Murray J, Using video-reflexive ethnography and simulation-based education to explore patient management and error recognition by pre-registration physiotherapists. *Biomed Advances in Simulation*, 2016 1: 9,
6. Maria C, Arciniegas C, Lobelo F, Jiménez MA, Páez DC, et al. (2016) One-day workshop-based training improves physical activity prescription knowledge in Latin American physicians: a pre-test posttest study. *BMC Public Health* 16: 1224.
7. Middleton B, Bloomrosen M, Dente MA, Hashmat B, Koppel R, et al. (2013) Enhancing patient safety and quality of care by improving the usability of electronic health record systems. *J Am Med Inform Assoc* 20: e2-e8.
8. American Physical Therapy Association. APTA Vision Statement for Physical Therapy 2020 and APTA Vision Statement for Physical Therapy 2020 [HOD P06-000 2425]. Available at :- <https://www.apta.org/apta-and-you/leadership-and-governance/vision-mission-and-strategic-plan>
9. Joseph N, Nelliyanil M, Jindal S, Utkarsha, Abraham AE, Alok Y, Srivastava N, Lankeshwar S. Perception of Simulation-based Learning among Medical Students in South India. *Ann Med Health Sci Res*. 2015 Jul-Aug;5(4):247-52.
10. Tuttle, N., Horan, S.A. The effect of replacing 1 week of content teaching with an intensive simulation-based learning activity on physiotherapy student clinical placement performance. *Adv Simul* 2019, vol 4, p 14.
11. Dennis, D, L Ng, and A Furness. "First-Year Physiotherapy Students Who Elect to Participate in Simulation-Based Learning Activities Benefit from the Experience." *Focus on Health Professional Education* 18, no. 2 (2017): 90-102.



12. Dennis, D. , Sainsbury, D. , Redwood, T. , Ng, L. and Furness, A. () Introducing Simulation Based Learning Activities to Physiotherapy Course Curricula. *Creative Education*, 2016 vol 7, p878-885.
13. Alette Svellingen, Anneline Røssland, Kari Røykenes, Students as Facilitators: Experiences of Reciprocal Peer Tutoring in Simulation-Based Learning, *Clinical Simulation in Nursing*, 2021, Volume 54, , Pages 10-16.
14. Havaldar AA, Krishna B, Sampath S, Paramasivam SK. Simulation Training in Hemodynamic Monitoring and Mechanical Ventilation: An Assessment of Physician's Performance. *Indian J Crit Care Med*. 2020 Jun;24(6):423-428.
15. Kim J, Park JH, Shin S. Effectiveness of simulation-based nursing education depending on fidelity: a meta-analysis. *BMC Med Educ*. 2016 May 23;16:152
16. McSparron JI, Michaud GC, Gordan PL, Channick CL, Wahidi MM, Yarmus LB, Feller-Kopman DJ, Makani SS, Koenig SJ, Mayo PH, Kovitz KL, Thomson CC; Skills-based Working Group of the American Thoracic Society Education Committee. Simulation for Skills-based Education in Pulmonary and Critical Care Medicine. *Ann Am Thorac Soc*. 2015 Apr;12(4):579-86.
17. Mouli TC, Davuluri A, Vijaya S, Priyanka ADY, Mishra SK. Effectiveness of simulation based teaching of ventilatory management among non-anaesthesiology residents to manage COVID 19 pandemic - A Quasi experimental cross sectional pilot study. *Indian J Anaesth*. 2020 May;64(Suppl 2)