

# Effectiveness Of Simulation Based Learning Regarding Defibrillation In Terms Of Competency Of Nursing Students In selected Nursing Colleges Of Haryana

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## Declaration of Interests

**Money Dhingra**, RN, Post Graduate candidate. Her research area concerns the nursing students role in managing the patient with cardiac emergency conditions.

**Eenu**, RN, RM, PhD candidate. Her research interests include nursing management, clinical nursing.

**Amoldeep**, RN, RM. Her area of interest includes improving the competencies of nursing students by using innovative teaching strategies.

**Jyoti Sarin**, RN, RM, MN. Her research focuses on research utilization, applied research and conducting research on current need based areas.

**Dhanesh Garg**, M.Sc, PhD, PGDCA with experience as a consultant regarding data analysis.

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## Abstract

**Background:** According to Advanced Cardiac Life Support, shockable rhythms are mainly responsible for 75-80% of cases of cardiac death. It has been noted that with each minute of postponed of defibrillation to victim of cardiac arrest results in decline survival rate about 7-10%. Simulation based learning is considered as one of accepted learning method with greater attention on patient safety.

**Aims:** To assess the effectiveness of simulation based learning regarding defibrillation in terms of competency of nursing students.

**Methods:** A Quasi-experimental design was adopted. Total 113 nursing students selected by using purposive sampling technique. Data was conducted by using student's profile, structured knowledge questionnaire, objective structured clinical examination checklist and structured clinical decision making ability questionnaire.

**Results:** The mean post-test knowledge, skills and clinical decision making ability scores (17.68±4.37), (28.09±4.57) and (13.13±3.74) of experimental group were higher than the mean post-test knowledge, skills and clinical decision making ability scores (15.25±4.95), (24.81±5.26) and (10.65±4.36) of comparison group. The calculated "Z" value "t" value of post-test knowledge, skills and clinical decision making ability scores were found to be statistically significant at 0.01 and 0.05 level of significance. There was statistically significant moderate positive correlation found between knowledge, skills and clinical decision making ability scores.

**Conclusion:** Simulation based learning was effective to improve competency of nursing students regarding defibrillation.

**Key words:** Clinical decision making ability, competency, defibrillation, effectiveness, knowledge, nursing students, simulation based learning, skills

## INTRODUCTION

Cardiac arrest is one of the emergency and life-threatening conditions of cardiovascular diseases that leads to sudden loss of functions of the heart (Srinivasan et.al., 2018; Patel K. and Hipskind J E, 2022). In cardiac arrest, complete circulation stops that require Advanced Cardiac Life Support including defibrillation and cardioversion (Sandy, 2021). Shockable arrhythmias are life-threatening that can result in sudden death (Harris, P et.al., 2016; Panchal et.al., 2020).

Patient who had a cardiac arrest are most likely to develop ventricular arrhythmias which are mainly responsible for 75-80% of cases of cardiac death which results in 184,000-450,000 people most lives in United States per year (Amandeep et.al., 2022; Jordan et.al., 2022). Early initiation of cardiopulmonary resuscitation with delivery of shock by using defibrillator within 3-5 minutes cardiac arrest produce the rates of survival 49-75% or more. It has been noted that with each minute of delay in defibrillating the victim of cardiac arrest results in decline in survival rate of about 7-10% (Linchak et.al., 2018; Goyalet.al., 2022).

Defibrillation is an emergency life-saving procedure which delivers electric shock to heart by using paddles to revert back the normal sinus rhythm from too fast and irregular rhythm (Rull, 2017; Jacob A, 2019). Behind the times, defibrillation is provided by medical or paramedical personnel those who trained in diagnose the dysrhythmias by observing changes in electrocardiogram and providing emergency care (Ahmed et.al., 2019). Although the training and authorization to nurses and nursing students to perform early defibrillation such practice has not been widely adopted as per recommendation of American Heart Association in hospitals and nursing colleges (Dulandas et.al., 2018).

Most of the nursing institutions are providing training of advance cardiac life support to students within their curriculum to develop the competency in situations of cardiac arrest. They use various educational strategies such as demonstration methods, lecture method, role-play, video based learning but there is lack of standardization in terms of content and methods (Eikeland Husebø et.al., 2017).

Simulation based learning is one of the teaching strategy in health professions including nursing education has developed to provides the opportunity to work in surroundings that are closer and more representative of real situation. (Eyikara et.al., 2017, Mohamed et.al., 2019, Van Beek, 2019). Nursing education includes practice oriented curriculum which gives emphasis on both theoretical knowledge and psychomotor skills (Koukourikos et.al., 2021).

In simulation based learning, students perform a number of patient care activities on high- fidelity manikins, medium-fidelity manikins, low-fidelity manikins and standardized patient for clinical training (Bø et.al., 2022; Kim et.al., 16). Over the previous decades, the use of simulation strategy in nursing education has developed markedly with objective of bridging the gap between theory and practice (Weeks et.al., 2019).

A study was conducted to evaluate the effectiveness of simulated demonstration on the knowledge and practice regarding defibrillation technique in Mumbai, India, found that before intervention nurses had average knowledge and practice. After demonstration, there was significant expansion in knowledge and practice scores of the nurses regarding defibrillation (Gupta Vidya Rajesh et.al., 2014). Furthermore, a prospective cohort study among nurses revealed that there was a significant improvement ( $p = 0.014$ ) in taking decision of defibrillation between pre-test and post-test. The teaching also rise the confidence of 67% of the nurses in handling the patients with ventricular fibrillation and ventricular tachycardia (K Tai C et.al., 2014).

Nurses are presumably to observe a cardiac arrest early in their care by observing the patient's condition and its changes over 24 hours. Therefore, nursing students who will become future nurses are more likely to caught cardiac arrest patients for the first time consequently training them in defibrillation is essential. So, it is recommended that nursing educators should conduct training programs for the nursing students in the nursing curriculum. (Jang et.al., 2021; Zhu et.al., 2022).

Hence, simulation based learning is ideal method for educating the nursing students about the defibrillation. The use of defibrillator during simulation based learning promotes learner familiarization, realistic interaction with the manikin. In particular, understood the core concepts of defibrillation and the effect of simulation based learning on competency of nursing students that contributes to nursing profession development.

## Objectives

1. To assess and compare the effectiveness of simulation based learning regarding defibrillation in terms of competency (knowledge, skills and clinical decision making ability) of nursing students in experimental and comparison group.
2. To determine the relationship between knowledge, skills and clinical decision making ability of nursing students regarding defibrillation in experimental and comparison group.

## METHODS

### Research Design

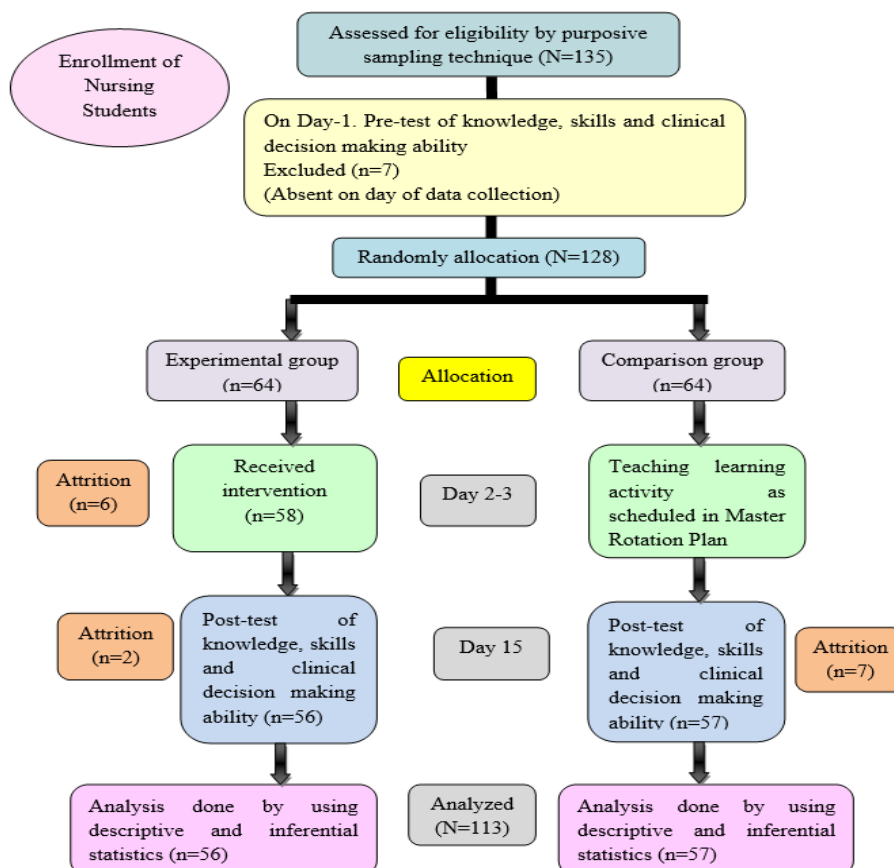
Quasi-Experimental design (Nonequivalent control group pre-test post-test design) was adopted.

## Population and Sample

Target population was nursing students in Nursing Colleges of Haryana and nursing students in selected Nursing Colleges of Ambala was accessible population. B.Sc nursing 3<sup>rd</sup> year students were selected by purposive sampling technique and allocated in experimental and comparison group by using computerized random number method. The nursing students available at time of data collection with willing to participate were included whereas who was absent on day of intervention and post-test were excluded.

## Sample Size and Power

The Power analysis was used to calculate sample size by using Cohen's d formula. The estimated effect size was 0.22 at the power of 0.95. The recommended sample for each group was between 41. Thus, a total eligible 135 nursing students were included in study. (Figure 1)



**Figure 1:** Consort Diagram For Sample Selection

## Setting of the study

The present study was conducted in M.M. College of Nursing, M.M. Institute of Nursing and Clinical Skill and Simulation Centre of M.M. (Deemed to be University), Mullana, Ambala (Haryana).

## Instruments

Content validity and reliability of instruments was established. The reliability co-efficient of structured knowledge questionnaire, structured clinical decision-making ability questionnaire was calculated by Kuder Richardson 20 and found to be 0.74, 0.82 and 0.90 for objective structured clinical examination calculated by Inter-rater reliability. Thus, all instruments were found to be valid and reliable.

## Student's Profile

It comprises of four items such as gender, previous sessional score (Medical Surgical Nursing), clinical evaluation marks (Emergency ward, Intensive Care Unit) and have you ever nursed a patient with defibrillation.

## Structured Knowledge Questionnaire

It was prepared to assess the knowledge of nursing students regarding defibrillation. It consists of 30 items which were divided in following areas: 1. Structure of Heart 2. Concept of Electrocardiography (ECG) 3. Concept of Defibrillation 4. Pre-requisites of Defibrillation 5. Procedure of Defibrillation 6. Post-procedural steps of Defibrillation

## Objective Structured Clinical Examination Checklist

It was developed to assess the skills of nursing students regarding defibrillation. There were seven stations included six

(6) manned and three (3) unmanned. Seven observational checklists were prepared to assess the skills performed in each station. It comprises of 45 items. The time limit for each station was 2 minutes.

Items were divided in following areas: 1. Label the parts of Heart 2. ECG Interpretation 3 (a). Label the parts of Defibrillator 3 (b). Indications and contraindications of Defibrillation 4. Initial steps before performing defibrillation/after the defibrillation decision 5. Perform the Defibrillation 6. Post-procedural steps of Defibrillation

### **Structured Clinical Decision Making Ability Questionnaire**

This tool was prepared to assess the clinical decision making ability of nursing students regarding defibrillation comprises of five (5) case scenarios and each case scenario has four (4) multiple choice questions. Items were divided in following areas: 1. Electrocardiography 2. Energy level for shock 3. Initial steps before performing defibrillation/after the defibrillation decision 4. Procedure of defibrillation 5. Post-procedural steps of defibrillation

### **Technique of Data Collection Instruments**

E-filling technique involves collecting responses through Google form for student's profile and learning management system software for structured knowledge questionnaire and structured clinical decision making ability questionnaire. Observation technique for objective structured clinical examination checklist was used.

### **Intervention**

#### **Conventional Teaching**

Before giving intervention, conventional teaching was administered to study participants by subject teacher of B.Sc Nursing 3rd year in M.M. College of Nursing and M.M. Institute of Nursing.

#### **Development of Simulation Based Video**

Video was made for study participants to orient with new teaching approach that is simulation based learning regarding defibrillation in experimental group before giving intervention.

#### **Simulation Based Learning regarding Defibrillation**

It was developed to enhance or improve the competency in terms of knowledge, skills and clinical decision making ability of nursing students regarding defibrillation with the help of two parallel case scenarios in experimental group. Students were divided into six (6) groups. Each group had 10 students and in last group eight (8) students were there. The duration of completing the one case scenario was about 45 minutes.

It covered the following objectives: 1. Identify the shockable rhythm 2. Demonstrate the defibrillation 3. Perform post procedure care

The simulation based learning was conducted by using the following process:

#### **Planning of Simulation**

In planning of simulation, two templates were prepared that covers all aspects of defibrillation. Triggers were planned during the scenario to stimulate participants learning. Physical set up for running the scenario was prepared and roles were decided for the active participants.

#### **Implementation of Simulation**

##### **Briefing**

Introduction of self, participants and simulation based learning regarding defibrillation were given. Previous knowledge of study participants was assessed. Objectives were displayed and orientation to physical set up for running the case scenario was done. Roles were decided by their own willing of study participants. After that, role of each participant discussed separately to maintain confidentiality. The duration of briefing was about 15 minutes.

##### **Act**

In act, active participants run the given scenario as per their roles as close to the real life situation and responded to triggers accordingly. Observers observe the events during the scenario. The duration of act was about 10 minutes.

##### **Debriefing**

This phase was focused on identifying what was done correctly during scenario also identifying any errors and areas for improvement. Suggestions were collected from observers that they noted throughout the scenario prior to debriefing with all active participants. Active participants and observers were firstly asked to reflect on their personal performance and discussed behaviors that they believe they performed well, response to triggers and areas they need to improve. The nature of discussion was based on active participant's performance and the response to students assessments and interventions. The moderator identified the relevance of events happened during the scenario. It would end with lessons learned, take home message and presents the next parallel case scenario. The duration of debriefing was about 30 minutes.

#### **Data collection and analysis**

Formal administrative approval was obtained from concerned authorities. Final data collection was done from 21<sup>st</sup> February to 9<sup>th</sup> March, 2022. After obtaining informed consent, study participants were assured about confidentiality of

response. SPSS 20.00 software was used for data analysis. Before proceeding with non-parametric test and parametric test normality of data was checked with Kolmogorov-Smirnov test. In present study, the data analysis was done by using both descriptive and inferential statistics i.e. frequency, mean, median, standard deviation, Chi-square, Mann Whitney U test, Wilcoxon Signed Rank test, Independent 't' test, Paired 't' test and Pearson Co-efficient was used for data analysis. The hypothesis of knowledge will be tested at 0.01 level of significance and skills and clinical decision making ability at 0.05 level of significance.

## RESULTS

### Description of Nursing Students Profile

Majority of nursing students (76.79%) in experimental group and 77.19% in comparison group were females. Most of nursing students (69.64%) in experimental group and more than half (52.63%) in comparison group scored previous sessional between 21-40. Majority of nursing students (71.42%) scored 71-90 marks in emergency ward and 73.21% scored 71-90 marks in intensive care unit in experimental group. More than half of nursing students (52.63%) in comparison group scored clinical evaluation marks in emergency ward and intensive care unit between 71-90. Maximum of nursing students (83.93%) in experimental group and 78.13% in comparison group were not ever nursed a patient with defibrillation. Chi-square showed that both experimental and comparison group were homogeneous except previous sessional score and clinical evaluation marks.

### Hypotheses testing

#### Effectiveness of Simulation Based Learning on Competency in terms of Knowledge Score

**H<sub>1a</sub>:** There will be a significant difference in mean post-test knowledge score of nursing students regarding defibrillation between experimental and comparison group.

**H<sub>2a</sub>:** There will be a significant difference in mean pre-test and post-test knowledge scores of nursing students regarding defibrillation within experimental and comparison group.

The results of Mann Whitney U test showed the non statistically significant difference ( $Z=-0.02$ ,  $p=0.98$ ) in pre-test and in post-test showed the statistically significant difference ( $Z=-2.72$ ,  $p=0.00$ ) at 0.01 level of significance between the experimental and comparison group with regards to mean knowledge score. Hence, research hypothesis H<sub>1a</sub> was accepted. Thus, it further interfered that simulation based learning was effective to improve the knowledge of nursing students regarding defibrillation. The Wilcoxon Signed Rank test showed not statistically significant difference ( $Z=-1.56$ ,  $p=0.11$ ) in mean knowledge score in experimental group and in comparison group showed statistically significant difference ( $Z=-2.51$ ,  $p=0.01$ ). Hence, research hypothesis H<sub>2a</sub> was rejected.(Table 1)

**Table 1** Mann Whitney U Test And Wilcoxon Signed Rank Test Shows Difference In Pre-Test And Post-Test Knowledge Scores Of Nursing Students Regarding Defibrillation In Experimental And Comparison Group

N=113				
Group	Experimental group (n=56)	Comparison group (n= 57)	Z <sup>§</sup> value	p value
Pre-test	57.06	56.94	-0.02	0.98 <sup>NS</sup>
Post-test	65.46	48.68	-2.72	0.00*
Z <sup>†</sup> value	-1.56	-2.51		
P value	0.11 <sup>NS</sup>	0.01*		

<sup>NS</sup> Not significant ( $p>0.01$ ) Z= -2.57 to 2.57

\*Significant ( $p<0.01$ ) Mann Whitney U test (Z<sup>§</sup>)Wilcoxon Signed Rank test (Z<sup>†</sup>)

#### Effectiveness of Simulation Based Learning on Competency in terms of Skills Score

**H<sub>1b</sub>:** There will be a significant difference in mean post-test skills score of nursing students regarding defibrillation between experimental and comparison group.

**H<sub>2b</sub>:** There will be a significant difference in mean pre-test and post-test skills score of nursing students regarding defibrillation within experimental and comparison group.

The Independent 't' test revealed statistically significant difference ( $t=3.53$ ,  $p=0.00$ ) in pre-test and post-test skills score between experimental and comparison group at 0.05 level of significance. Hence, research hypothesis H<sub>1b</sub> was accepted. The result of paired 't' test was showed statistically significant difference ( $p<0.05$ ) in mean skills score ( $t=15.68$ ,  $p=0.00$ ) in experimental group and in comparison group ( $t=14.71$ ,  $p=0.00$ ). Hence, research hypothesis H<sub>02b</sub> was accepted and concluded that simulation based learning was effective to improve the skills of nursing students regarding defibrillation in experimental group.(Table 2)

**Table 2** t Test Shows Difference In Pre-Test And Post-Test Skills Score Of Nursing Students Regarding Defibrillation In Experimental And Comparison Group

N=113				
Group	Experimental group (n=56)	Comparison group (n= 57)	t <sup>§</sup> value	p value
Pre-test	16.73±6.54	14.35±6.08	2.00	0.04*
Post-test	28.09±4.57	24.81±5.26	3.53	0.00*
t <sup>†</sup> value	15.68	14.71		
P value	0.00*	0.00*		

\*Significant ( $p<0.05$ ) t at 55, 56= 2.00

<sup>NS</sup> Not significant ( $p>0.05$ ) Independent 't' test (t<sup>§</sup>) Paired 't' test (t<sup>†</sup>)

### Effectiveness of Simulation Based Learning on Competency in terms of Clinical Decision Making Ability Score

**H<sub>1c</sub>:** There will be a significant difference in mean post-test clinical decision making ability score of nursing students regarding defibrillation between experimental and comparison group.

**H<sub>2c</sub>:** There will be a significant difference in mean pre-test and post-test clinical decision making ability scores of nursing students regarding defibrillation within experimental and comparison group.

The Independent 't' test revealed statistically significant difference ( $t=3.23$ ,  $p=0.00$ ) in mean pre-test and post-test clinical decision making ability score between experimental and comparison group at 0.05 level of significance. Hence, research hypothesis H<sub>1c</sub> was accepted. The result of paired 't' test was showed statistically significant difference ( $p<0.05$ ) in mean clinical decision making ability score ( $t=5.76$ ,  $p=0.00$ ) in experimental group and in comparison group ( $t=0.66$ ,  $p=0.51$ ) was found be non statistically significant. Hence, research hypothesis H<sub>02b</sub> was accepted and inferred that simulation based learning was effective to improve the clinical decision making ability of nursing students regarding defibrillation in experimental group. (Table 3)

**Table 3** t Test Shows Difference In Pre-Test And Post-Test Clinical Decision Making Ability Score Of Nursing Students Regarding Defibrillation In Experimental And Comparison Group

N=113				
Group	Experimental group (n=56)	Comparison group (n= 57)	t <sup>§</sup> value	p value
Pre-test	10.18±3.34	10.30±3.06	0.19	0.84 <sup>NS</sup>
Post-test	13.13±3.74	10.65±4.36	3.23	0.00*
t <sup>†</sup> value	5.76	0.66		
P value	0.00*	0.51 <sup>NS</sup>		

\*Significant ( $p<0.05$ ) t at 55, 56= 2.00

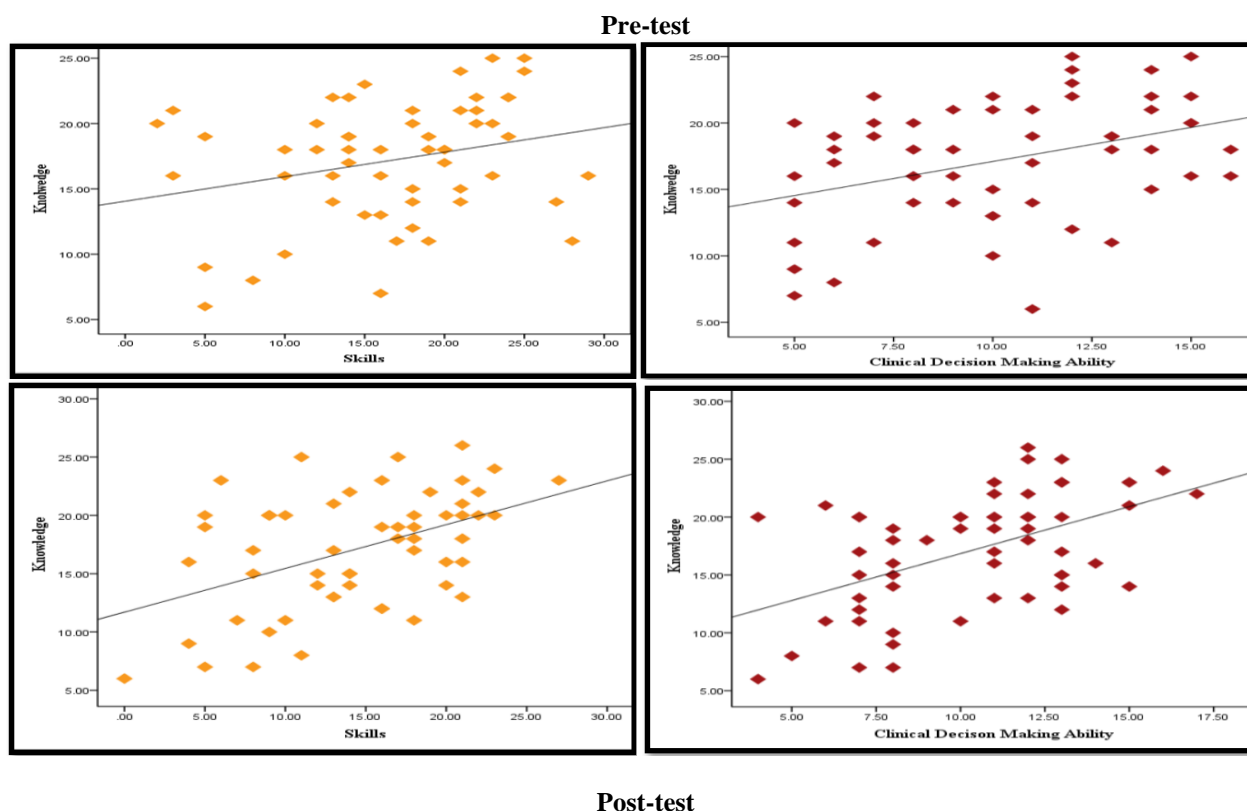
<sup>NS</sup> Not significant ( $p>0.05$ ) Independent 't' test (t<sup>§</sup>) Paired 't' test (t<sup>†</sup>)

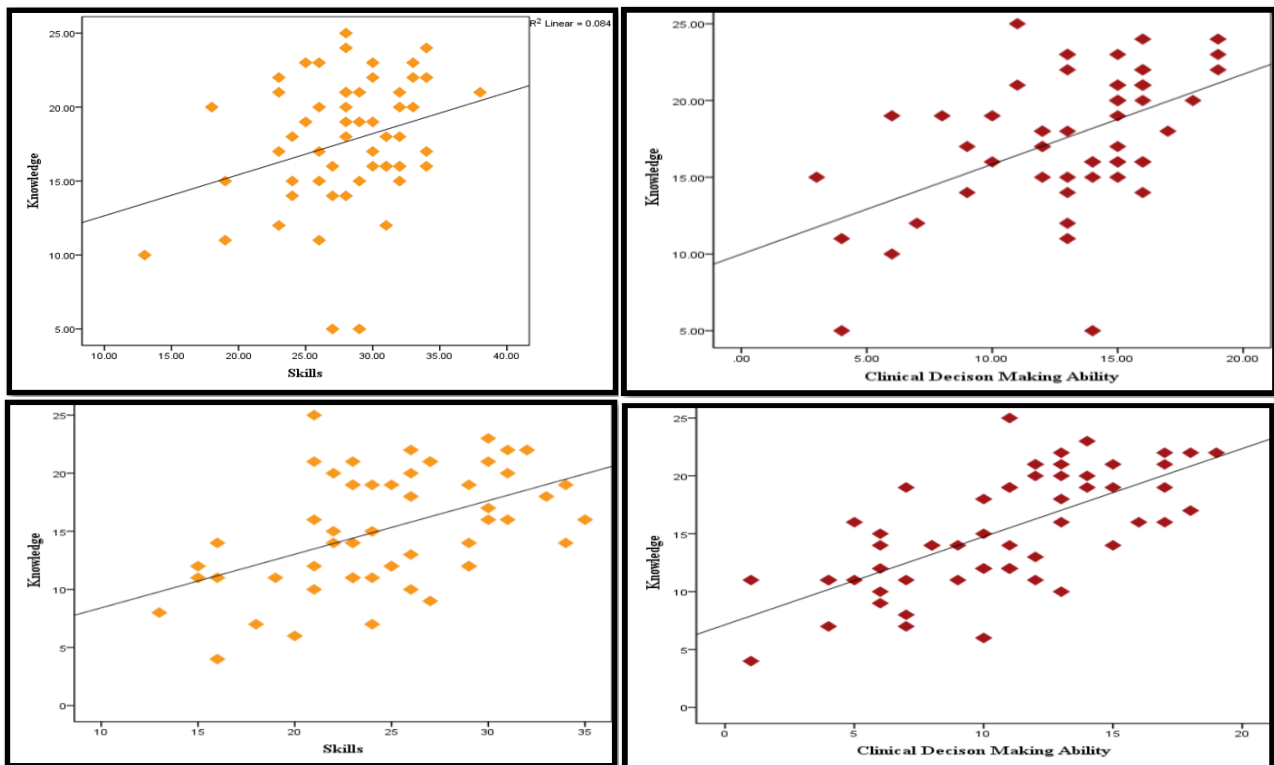
### Correlation between the Knowledge, Skills and Clinical Decision Making Ability Score of Nursing Students

**H<sub>3</sub>:** There will be a significant relationship between knowledge, skills and clinical decision making ability score of nursing students regarding defibrillation in experimental and comparison group will be tested at 0.05 level of significance.

Pearson's correlation depicts that in experimental group, there was statistically significant moderate positive correlation ( $r=0.26$ ,  $p=0.04$ ) between pre-test knowledge and skills score and ( $r=0.29$ ,  $p=0.03$ ) between post-test knowledge and skills score simultaneously ( $r=0.37$ ,  $p=0.00$ ) between pre-test knowledge and clinical decision making ability score and ( $r=0.50$ ,  $p=0.00$ ) between post-test knowledge and clinical decision making ability score at 0.05 level of significance.

In comparison group, the findings showed that there was statistically significant moderate positive correlation ( $r=0.45$ ,  $p=0.00$ ) between pre-test knowledge and skills score and ( $r=0.49$ ,  $p=0.00$ ) between post-test knowledge and skills score simultaneously ( $r=0.50$ ,  $p=0.00$ ) between pre-test knowledge and clinical decision making ability score and high positive correlation ( $r=0.67$ ,  $p=0.00$ ) between post-test knowledge and clinical decision making ability score at 0.05 level of significance. (Figure 2)





**Figure 2:** Scatter Diagram Showing Correlation Between Pre-Test and Post-Test Knowledge, Skills And Clinical Decision Making Ability Scores Of Nursing Students In Experimental And Comparison Group

## DISCUSSION

The purpose of study was to assess the effectiveness of simulation based learning regarding defibrillation in terms of competency of nursing students. In present study, maximum of nursing students (76.79%) in experimental group and (77.19%) in comparison group were females. Maximum of nursing students in experimental group (83.93%) and comparison group (78.13%) respectively were not ever nursed a patient with defibrillation. The post-test mean knowledge, skills and clinical decision making ability scores ( $17.68 \pm 4.37$ ), ( $28.09 \pm 4.57$ ) and ( $13.13 \pm 3.74$ ) were higher as compared to the pre-test mean knowledge, skills and clinical decision making ability scores ( $17.20 \pm 4.57$ ), ( $16.73 \pm 6.54$ ) and ( $10.18 \pm 3.34$ ) in experimental group.

In comparison group, the pre-test mean knowledge, skills and clinical decision making ability scores were ( $17.09 \pm 4.97$ ), ( $14.35 \pm 6.08$ ) and ( $10.30 \pm 3.06$ ) and in post-test mean knowledge, skills and clinical decision making ability scores were ( $15.25 \pm 4.95$ ), ( $24.81 \pm 5.26$ ) and ( $10.65 \pm 4.36$ ). Hence, it inferred that pre-test mean of knowledge score was high as compared to post test. It can be due to at the time of pre-test all nursing students learnt about the defibrillation through conventional teaching but in post-test they not able to retain the knowledge and their previous sessional score and clinical evaluation marks were lower as compared to experimental group. Skills and clinical decision making ability was improved, these finding might be occurred as the students were posted in clinical area (emergency ward, intensive care unit).

These findings were congruent with the result of other which showed that there was a significant improvement in practices and decision of performing the defibrillation among nurses. The pre-test mean of practices score was 07.40 and in post-test mean of practices score was 41.60 (Pradeshi et.al, 2020; Tai et.al. 2014). These findings were also consistent with another study conducted by (Chowdhary et.al, 2020) was showed that there was a significant improvement ( $p=0.00$ ) between the pre-test and post-test scores after the simulation teaching of defibrillation. The pre-test mean knowledge and skills score was 06.98 and 10.06 and post-test mean knowledge and skills score was 11.48 and 12.88 in experimental group.

There were some limitations that have to be contemplated. First, this study was done on a small sample size so findings of the study cannot be generalized. Second, although participants were explicitly asked to maintain confidentiality regarding the purpose of the study and the content of the scenario towards other participants to avoid preparation bias, researcher cannot assure that this instruction was followed by all participants.

## CONCLUSION

From above finding of the study, it concluded that simulation based learning was effective to improve the competency in terms of knowledge, skills and clinical decision making ability of the nursing students as they got an opportunity to perform their roles as close to real emergencies according to the given scenarios and triggers. Although conventional teaching was also showed improvement on skills and clinical decision making ability in comparison group but maximum gain found through simulation based learning. The study recommended that a study can be conducted to

assess the effect of simulation based learning on team performance, team work and communication of nursing students. A comparative study can be conducted to find out the effectiveness of simulation based learning with other teaching strategies like self instructional module, structured teaching program, video based learning and mobile learning etc.

### Key Points for Nursing Practice, Research and Health and Social Care Policy

- Nursing teachers have to develop a schedule for practice session to educate nursing students to gain their competency and decrease their anxiety while dealing with patient in a real life situation.
- The study motivates the beginning and enthusiastic researchers to implement simulation based learning and see its effectiveness on a large scale.
- Nurse administrator has to develop hospital policy and organize in-service or continuing nursing educational programs for staff nurses in the general wards, intensive care units, emergency departments and community settings to update the knowledge, acquire special skills and enable to act promptly in various clinical situations and building team communication.
- The professionals and nursing students can be studied on various aspects of defibrillation and its importance and impacts on health, community and surroundings.

### DECLARATION OF CONFLICTING INTERESTS

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

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### ETHICAL CONSIDERATIONS

Formal administrative approval for conducting the study was obtained from the institutional ethical committee of Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala, Haryana with the ethical number (Project No: IEC-2145).

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