

## Multidisciplinary Medical Team Development among Medical Students through Role Assignment during Simulation Based Teaching Scenarios; A Randomized, Single Blind Study

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Afshan H. Khattak<sup>1,\*</sup>, Fatima Noor<sup>1</sup>, Muhammad Sami Khan<sup>1</sup>, Jalwa Javed Farooqui<sup>1</sup>, Muhmmad Mamoon Ali<sup>1</sup>, Murtaza Rahman Khan<sup>1</sup>, Muhammad Mustafa Ikram<sup>1</sup>

<sup>1</sup> Peshawar Medical College, Warsak Road, Peshawar, Pakistan

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### ABSTRACT

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Provision of effective healthcare is not possible without functional multidisciplinary teams. Early instruction in healthcare team formation and function cannot be overemphasized in present times. Medical curricula and examinations award grades for and positively re-enforce behaviours required for team function, in an increasing number of medical institutions. There is an urgent need for team-oriented educational strategies at undergraduate level that are backed by evidence. Our research aims to study the effectiveness of "Role Assignment" during simulation scenarios, as a teaching strategy for developing multidisciplinary teamwork behaviours in undergraduate medical students. Randomized, controlled, experimental study; Two groups of medical students were randomly assigned to experimental, (E), and control, (C), groups. 34 members of E were given 4 assignments that required a "Team Leader". 37 members of C were taught in conventional group format aided by 4 PowerPoint lectures. Both groups took pre and post-tests. They were tested with simulation based clinical scenarios requiring stabilization of acute trauma victims. A behaviourally anchored rating scale to rate skills representative of effective teamwork by students was used to rate each group. Data was analysed using SPSS V-21. No statistically significant difference was observed in Post-Test scores between E vs. C. Statistically significant difference was observed in most skills/traits required for effective teamwork. E attained higher mean scores for all teamwork attributes compared with C. Role assignment during scenario based teaching gives higher scores in several skills required for functioning in medical teams compared with conventional teaching through lectures.

#### Keywords:

Medical education, scenario based teaching, multidisciplinary team

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\* Corresponding author.

E-mail address: [Afshan H. Khattak \(palwasha.bibi@gmail.com\)](mailto:Afshan.H.Khattak@palwasha.bibi@gmail.com)

## 1. Introduction

Our world is fast becoming integrated as a result of easily accessible services and data sources through digitization. Modern service delivery is a complex interplay of multiple disciplines. Medical care provision through such networked systems is highly dependent on effective teamwork. Multidisciplinary teams in healthcare are increasing as a result of several factors. Top reasons for this include [1], but are not limited to, populations comprised of a large number of ageing patients with more complex needs associated with chronic diseases [1]; Demands for complex skills and knowledge to provide comprehensive care to patients [1]; Sub and super-specialization within health professions and progressive fragmentation of disciplinary knowledge resulting in need for multi-professional teams to meet all the complex needs of patients [1], International policy documents on multi-professional team work and development of shared learning [1]; and, Pursuit of continuity of care within the move towards continuous quality improvement [1].

The need for teamwork in medicine is clear from current patient care strategies such as use of care plans, algorithms and flow-charts for patient management [2]. Once a patient enters the “system”, several services, medical and non-medical, work in tandem to achieve different goals, depending on their role in the care plan [3]. There is a serious gap between demand and supply of healthcare professionals trained to work in complex teams [4]. It is well known that undergraduate medical education tends to mimic school and college where subjects are taught as separate disciplines, with very few chances for prescribed interactions and even fewer opportunities to actually work together with healthcare providers from other disciplines until post-graduate training [5,6]. Medical education has relied on the “apprenticeship model” for centuries. The “old and noble” messiah, who leads patient rounds in mornings, teaches about disease and its management and supervises performance of procedures by the novices is as alive today, as hundreds of years ago. The messiah is expected to survive a few more centuries and is actually needed, as well. Newer learner-centered trends such as problem based learning, peer tutoring and simulation based teaching are being tested and increasingly inculcated in medical education. Team-based learning, TBL, is another relatively modern label for old “group-study” technique in medical schools.

Although it is well recognized that teamwork ethic needs to be inculcated as early as possible in medical undergraduates, however, major gaps exist in teaching actual teamwork to medical students. Failures related to ineffective teamwork and poor level of interpersonal communication have been cited as a major patient safety issue [7-9]. Reporting of “Adverse Events” and regular Morbidity & Mortality reviews has led to increased reporting of “Preventable” errors in patient care. Breaks in communication, overassertive team members and lack of an effective culture sensitive to patient safety are all cited as contributing factors to adverse patient events [10-12]. Most of the contributing factors can be sub-classified under once umbrella term, “Lack of Teamwork Ethic.” Research has shown that surgical teams that displayed fewer team behaviors had worse patient outcomes [12]. The Institute of Medicine (IOM) report in 1999, *To Err is Human* [13], reported an unacceptably high rate of preventable medical errors resulting from dysfunctional teamwork or poor communication skills. Such failures may be especially high in patients with multiple complex conditions, in emergencies, and during care transitions. The Joint Commission identified communication as a critical factor in more than 65% of reported sentinel events [14].

Terms such as interdisciplinary, interprofessional, multiprofessional, and multidisciplinary are often used interchangeably in the literature to refer to both different types of teams and different processes within them [15]. Development of effective teams in medical care is an area of active research. What makes a team function better than sums of all the parts combined? Known factors that contribute to formation and success of effective teams include clear role definitions, team

consensus about leadership and optimum task assignments [15]. Although, medical students go through performing different roles during their clinical clerkships, however, data about use of “role assignment” as members of teams at undergraduate level is scarce. Main problem with teaching teamwork to undergraduate medical students is concern about learner and patient safety. Overcoming this problem requires planning and expense to replicate real-life situations happening in hospitals into simulated scenarios constructed and acted in skill labs. This saves patients from novice practice and protects unaware students from undesirable and even dangerous exposures from patients.

Our research aims to study the effectiveness of “Role Assignment” as a teaching strategy in undergraduate medical students for developing traits required for multidisciplinary teamwork

## 2. Materials and Methods

This is a Randomized, Single Blind, Interventional study. Six “Skill Stations” with learning outcomes, visual aids such as mounted photographs and flow charts, verbal cue cards and simulated patients and medical equipment were designed. Table-1 gives the detail of skill station designed to teach ABCDE of Initial Trauma Stabilization.

Study was approved by the institutional ethical committee for Undergraduate Medical Research in 2017. Pre-clinical students were given a thirty-minute briefing about the study. They were enrolled after obtaining their informed consent.

**Table 1**  
 Skill Station Designed to Teach ABCDE of Trauma Stabilization

Learning Objectives	Visual Aids & Simulations	Case Scenarios
<ul style="list-style-type: none"> <li>Performs ABCDE assessment in acute trauma victim</li> <li>Clears airway while maintaining C-spine stability</li> <li>Performs rescue breaths</li> <li>Performs ambu-bagging upon indication</li> <li>Describes indications for endotracheal intubation</li> <li>Performs effective CPR on trauma victim</li> <li>Prioritizes IV sites</li> <li>Selects appropriate fluid for resuscitation</li> <li>Performs “Disability” survey</li> <li>Minimizes exposure and heat loss in victim</li> </ul>	<ul style="list-style-type: none"> <li>*Leardal QCPR – Adult</li> <li>*Leardal QCPR – Child</li> <li>*Leardal QCPR – Infant</li> <li>Illustration of trauma victim survey points</li> <li>C-spine collar</li> <li>Parts of ambu bag</li> <li>Endotracheal tube and laryngoscope</li> <li>Color coded IV Cannulas</li> <li>Board for patient transport</li> <li>Patient Transport Kit</li> <li>Warming packs and blankets</li> </ul>	<ul style="list-style-type: none"> <li>Motor vehicle accident victim requiring C-spine stabilization and fluids</li> <li>Bomb blast victim requiring IV fluids and disability survey with prevention of exposure</li> <li>Gunshot injury victim requiring endotracheal intubation and blood transfusion</li> </ul>

\*LeardalResusci QCPR (Simulation Mannequin)

Teaching scenarios and assessment rubrics were vetted in three rounds among principal investigator and the “Skills Committee” comprising of one physician, one cardiologist, two surgeons and three final year medical students. Visual aids were inspected from varying visual angles and distances and in consort with the teaching scenarios by the same committee and approved after revision. Simulation materials were tested and approved as well. Dresses and linen around simulations was designed to resemble our teaching hospital. All intravenous fluids and medications were purchased from local companies. Stethoscopes, thermometers, BP apparatuses and other clinical gadgets were placed on practice stations, as and when required to make the simulated set up look like actual clinical practice, (see Table-1).

Experimental Protocol that was approved and adopted for this study is shown in Figure-1. Demographic detail of students in each group is given in Table-2. Study participants took a Pre-Test which was an MCQ-based exam about ABCDE of Trauma Stabilization. They were given one-hour teaching about emergency management of victims of acute trauma based on principles of ABCDE, of trauma management. The standard, ABCDE, (Used by American Heart Association, Royal College of Surgeons of England and Resuscitation Council of UK), A-Airway, B-Breathing, C-Circulation, D-Disability Assessment and E-Exposure steps of initial trauma assessment were taught. A Post-Test was given at the end of teaching session. All study participants took the post-test. They were randomly assigned to experimental, (E) and control, (C) groups, (Drawing of names). Participants were blind to their group assignments.

**Table 2**  
 Demographic/Academic Data for Experimental and Control Groups

Study Group	Male:Female	Mean Age, (Yrs)	Major Ethnicity	Education %ge *FSc/**Cambridge	Clinical:Pre-Clinical
Experimental, n = 34	14:20	20+/- 2.3	Pushtoon	99.0/1.00	16:18
Control n = 37	16:21	20+/- 1.8	Pushtoon	100/0.00	18:19

Students in C were taught about acute trauma and its management principles in conventional group format aided by four PowerPoint based lectures. An AHA Certified Clinical Instructor taught them. Visual aids, such as photographs and medical equipment used were the same for both groups. Students in E were exposed to four clinical scenarios in skill lab that required a team working together to manage acute trauma patients. They selected a team leader and members of a standard “Code Team” among themselves and worked with the same AHA Certified Clinical Instructor for total of four hours. This instructor was the principal investigator, hence could not be blinded to group assignments and study protocol.

Both groups were observed by a five-member Skills’ Assessment committee, (blind to group assignments), as they were given clinical scenarios about victims of trauma and asked to manage the patients as emergency teams.

A behaviourally anchored score card, “Score Card for Multidisciplinary Teamwork”, was developed after a detailed review of literature, (referenced). Search terms used were, “Multidisciplinary Team work”, “Interdisciplinary Medical Teamwork”, “Multidisciplinary Teamwork in Trauma Teams” and “Interdisciplinary Medical Teams”. Teamwork attributes that emerged after review and discussion of social sciences articles [16-23] are listed in Table-3. Desirable attributes of “Medical Interdisciplinary Teams” were derived from Nancarrow [15], listed in Table-4 A “Yes/No” or “0/1” score-based card was developed, (Table-5). Intra-rater and Inter-rater reliability was calculated

after multiple applications of the tool in test scenarios. We used the percent method [24]. Intra-rater reliability was 0.90 and Inter-rater reliability reached after multiple revisions was 0.85. Data was analyzed using SPSS V-21.

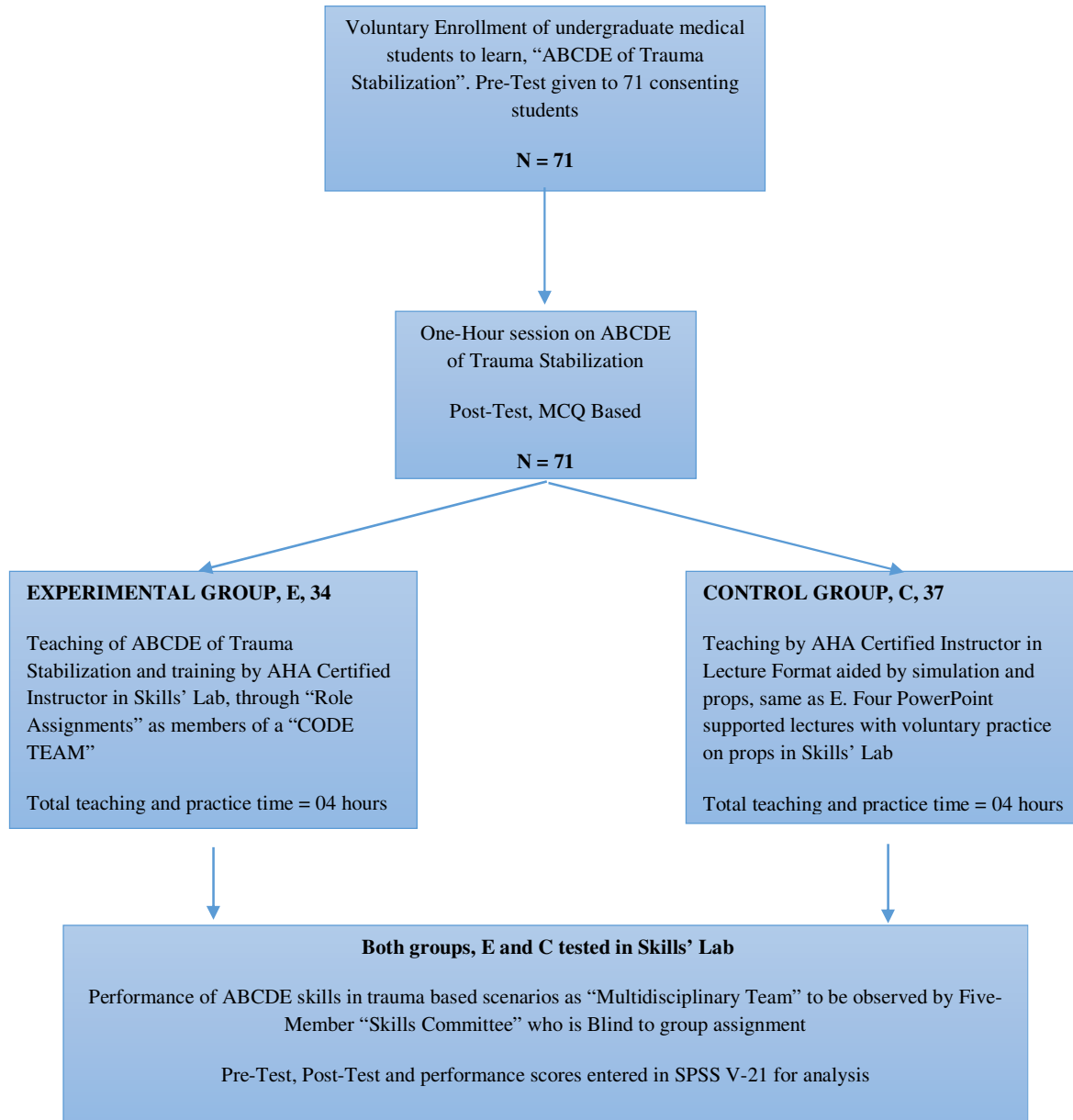


Fig. 1. Study Protocol

### 3. Results

Study Protocol is shown in Figure-1. Total 71 undergraduate students were recruited for the study. All of them took pre and post-test. Pre-Test scores were not significantly different for experimental and control groups. Both groups showed significant improvement in post-test scores

after they received teaching about ABCDE of Trauma Stabilization, (p-value= $<0.001$ ). No statistically significant difference was observed in Post-Test scores between E vs. C.

**Table 3**

Teamwork Attributes in High Achieving Teams [16-23]

S. No	Attribute	Description
1.	Commitment to team success and shared goals	Members engaged in effective teamwork are committed to the success of the team. They share goals for the project. Such teams are motivated, engaged and aim high [16].
2.	Interdependence	Team members create surroundings that are conducive to achievement. Working together, they contribute far more than as individuals. A positive interdependent team environment brings out the best in team members. They promote and boost their fellow team members to contribute, and learn [17].
3.	Interpersonal Skills	Ability to discuss issues openly with fellow team members is crucial to team success [18]. Team members need to be honest, dependable and loyal. They display respect and commitment to the team and to its individuals [19,20].
4.	Open Communication and positive feedback	Members of high achieving, successful teams display active listening <sup>20</sup> . Team members should be willing to give and receive constructive criticism and provide authentic feedback [21].
5.	Team composition	Team members need to be fully aware of their specific team role and understand what is expected of them in terms of their contribution to the team and the project [21,22].
6.	Accountability	Members need to be accountable for their contribution to the team and the project. They know and understand team processes, best practice and new ideas. Effective leadership is essential for team success including shared decision-making and problem solving [18,23]

**Table 4**

Competencies of an interdisciplinary team [15]:

S. No	Interdisciplinary Teamwork Attribute
1.	Identifies a leader who establishes a clear direction and vision for the team, while listening and providing support and supervision to the team members.
2.	Incorporates a set of values that clearly provide direction for the team's service provision; these values should be visible and consistently portrayed.
3.	Demonstrates a team culture and interdisciplinary atmosphere of trust where contributions are valued and consensus is fostered.
4.	Ensures appropriate processes and infrastructures are in place to uphold the vision of the service (for example, referral criteria, communications infrastructure).
5.	Provides quality patient-focused services with documented outcomes; utilizes feedback to improve the quality of care.
6.	Utilizes communication strategies that promote intra-team communication, collaborative decision-making and effective team processes.
7.	Provides sufficient team staffing to integrate an appropriate mix of skills, competencies, and personalities to meet the needs of patients and enhance smooth functioning.
8.	Facilitates recruitment of staff who demonstrate interdisciplinary competencies including team functioning, collaborative leadership, communication, and sufficient professional knowledge and experience.
9.	Promotes role interdependence while respecting individual roles and autonomy.
10.	Facilitates personal development through appropriate training, rewards, recognition, and opportunities for career development.

Demographic details of students assigned to experimental and control group are shown in Table-2. Table-6 shows the mean scores achieved by experimental and control groups in attributes of multidisciplinary teamwork. Experimental group scores significantly better compared with control group. A p-value < 0.000 was seen in comparison of mean scores for all attributes tested.

**Table 5**

Score Card used to Score "Multidisciplinary Teamwork" Attributes in Study Participants

S.N	Multidisciplinary Teamwork Attribute	Observed Action/s	YES '1'	NO '0'
1.	Commitment to TEAM success	Obeyes Leader Verbalizes Vitals Reports Steps Taken		
2.	Interdependence	Asks, "How may I help?"		
3.	Interpersonal Skills	Respectful to peers Encourages peers		
4.	Communication Must demonstrate "Closed Loop Communication"	"Active" Listening Repeats Orders Documents progress Gives Positive Feedback		
5.	Accountability	Accepts feedback positively Answers leader Honestly		

**Table 6**

Mean Multidisciplinary Teamwork Scores\* of Experimental and Control Groups

S.N	Observed Action/s	Experimental N=34	Control N=37	p-value
1.	Obeyes Leader	18.9706±3.84932	13.5135±3.30506	<0.000
2.	Verbalizes Vitals	20.0000±4.08248	13.2432±3.16584	<0.000
3.	Reports Steps Taken	18.9706±3.84932	13.5135±3.30506	<0.000
4.	Asks, "How may I help?"	18.9706±3.84932	17.2973±4.65394	<0.000
5.	Respectful to peers	18.9706±3.84932	13.5135±3.30506	<0.000
6.	Encourages peers	19.1176±4.34682	13.6486±4.02227	<0.000
7.	"Active" Listening	20.4412±4.15015	13.1081±3.79169	<0.000
8.	Repeats Orders	18.9706±3.84932	13.5135±3.30506	<0.000
9.	Documents progress	18.9706±3.84932	14.3243±4.43505	<0.000
10.	Gives Positive Feedback	18.5294±4.17957	12.7297±3.74647	<0.000
11.	Accepts feedback positively	18.5294±3.96340	14.1892±4.16892	<0.000
12.	Answers leader Honestly	19.1176±4.68243	15.6757±4.73787	<0.000

\*Scores are awarded out of 25

#### 4. Discussion

Our research shows that it is possible to inculcate selected attributes of effective interdisciplinary medical team function in undergraduate medical students through assigning roles as members of a Code team to them during simulation-based teaching of critical life-saving skills. This, being an experimental study, is the first of its kind in undergraduate medical education; to the best of our knowledge. There are several facets of our work, that can be termed, "de-novo". First and foremost, the score card that we developed to score key teamwork attributes.

Key attributes identified after literature search shown in Table-3 [16-23] were used to search further for research studies done to find attributes of effective interdisciplinary medical teams. Nancarrow

[15] was selected by unanimous vote as the “benchmark” article. Table-4 shows the key attributes identified by Nancarrow<sup>15</sup> for successful interdisciplinary medical teams.

Mendo et al<sup>25</sup> devised and validated an instrument to measure attitudes towards teamwork among undergraduate students. They recruited 750 university students and used a questionnaire-based survey to collect demographic and academic information and their partiality towards working alone or in a team. They asked the participants whether they *prefer working in a team*) or they *don't care whether they work alone or in a team*) or they *prefer working alone* [25]. They were unable to find a validated tool for their study, just as we were. They developed “*Cuestionario de actitudes hacia el trabajo en equipos de aprendizaje*” (CACTE, Questionnaire on Attitudes toward Learning Teams).

Semler et al. [26] report results for a well designed randomized controlled trial to check comparative utility of didactics, demonstration and simulation in teaching teamwork to students. Their study is the closest in design to our study. They utilized a parallel-group trial with random participant assignments, similar to our methodology. We worked with two parallel groups, the conventionally taught, “Control” group and the simulation-based role playing, “Experimental” group. Semler et al. [26] randomized their study participants 1:1:1 to didactic, demonstration-based, or simulation-based instruction. Their participants were entry level internal medicine interns, while we worked with undergraduate medical students. They evaluated their participants in management of a simulated crisis by five blinded observers. They used the Teamwork Behavioural Rater score. Clinical performance was assessed with a novel “Recognize, Respond, Reassess” score. They concluded that teamwork training through demonstration resulted in similar teamwork scores as resulting from participation in simulation-based scenarios. Both demonstration and simulation-based scenarios resulted in teamwork behavior scores superior to traditional didactics. Our results conform to theirs in principle. It is interesting to note that they also developed a “de-novo” scoring tool, similar to our study, (Table-5). This confirms the lack of available tools to measure teamwork for both, undergraduate and graduate medical students.

Our study has numerous strengths. We feel that it is a replicable forerunner for similar work with undergraduate students in varied healthcare disciplines. It is the first blinded, randomized trial to relate a conventional teaching modality and a novel methodology viz a viz their potential to teach teamwork at undergraduate level. Our study has clearly demarcated and defined teamwork interventions. Our assessment team was comprised of well-trained medical professionals with experience in medical education. With 71 participants, we believe that it is one of the largest, if not “the” largest trial in this area. Although the teamwork scoring tool in our study was devised and validated by us, however, overall scores and difference in mean scores between Control and Experimental groups in our study were reflective and similar to those reported in a previous study of teamwork done by Frengley et al. [27]. They studied trained and experienced intensive care physicians and nurses. They randomized their study participants to case-based learning or simulation-based learning for cardiac or airway scenarios. They used a structured rating tool with technical and behavioral components. Their results demonstrated improvements in scores for overall teamwork and the two behavioral factors, “Leadership and Team Coordination” and “Verbalizing Situational Information”. They found no significant difference between simulation-based learning and case-based learning. They concluded that simulation can improve teamwork in multidisciplinary intensive care teams. They advocated using a simulation and case-based mix for good teamwork teaching.

Our study is limited to one institution. The interventional design and novel measurement tools lead to several objections and resultant revisions in original study design. The investigators faced difficulties in convincing the concerned faculty members to permit implementation of the trial, even



after ethical approval. But this was within the scope of problems that we envisioned at the outset. We hope to be able to extend this study to other institutions of healthcare education and service.

## 5. Conclusion

Role assignment during scenario based teaching gives higher scores in several skills required for functioning in medical teams compared with conventional teaching through lectures.

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