Outcome of triage results between two groups of interns subjected to different model of simulation

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Received: 14 July 2019
Revised: 02 August 2019
Accepted: 03 August 2019

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ABSTRACT

Background: In the emergency department, triaging is a very important for mass casualties and should not lead to any errors while doing so. In spite of subjecting interns to triaging theory classes in their final year of MBBS, they are not confident in triaging when need comes. To address this, we designed this study which aims at understanding the efficacy and type of triage based simulation education for medical interns during their 1 year internship programme.

Methods: A cross sectional study with 186 intern students of a Yenepoya Medical College Hospital of Karnataka was selected for the triage simulation. The interns who could attend the entire programme were randomly divided into 2 groups of n=91 each. One group underwent desktop based triage simulation (n1=91) and the other group faced enacted patient based triage simulation training followed by test. Evaluation comprised of tests to 2 groups of interns. The first group were subjected to test following desktop triage simulation and the second group were subjected to test following enacted patient simulation based triaging.

Results: The test result showed that there was significant improvement in the result obtained from the group that underwent high fidelity simulation (p<0.05).

Conclusions: Simulation based training which is closed to reality leads to a significant increase in learning and recalling output compared to the traditional method.

Keywords: Triage, Simulation, Emergency, Interns

INTRODUCTION

‘Good judgement comes from experience and experience comes from bad judgement’, one among the pinnacle concepts in the journey of a medical student. The aviation industry was one of the first to implement simulation as an educational tool to reduce the mishaps due to human error. This experience provided insights to how simulation based education are successfully incorporated into medicine. Simulation-based educational methods are recognized as an established component of medical training for medical students, residents, and fellows.¹ for applying theoretical knowledge in a better way reducing the human errors. Triage is defined as the initial clinical sorting process in hospital Emergency department. Especially in high risk scenarios such as triaging. The patient has to be sorted out to the right code without any delay for the appropriate treatment to begin.

Hence proper coding in the shortest available time is of prime importance. A watershed study in the simulation fidelity realm specifically identified studies that compared performance outcomes associated with low- and high-fidelity simulators vs. No intervention controls.²
Alessi’s foundational paper addressed not whether high fidelity is a critical, but whether for particular levels or categories of learners or instructional goals, different levels of fidelity might be more or less appropriate and beneficial.3

Many studies showed no significant advantage of high fidelity simulation over low fidelity simulation, with average difference ranging from 1% to 2%.2 Practically it is difficult and dangerous to subject the interns to triaging in real scenarios. Although simulation is identified for its contribution to learning, critics claim this doesn’t portray the complexities of the actual pre hospital environment and question how effective assessment is when undertaken in a controlled setting. Hence the objectives of this study were to subject medical interns of tertiary care hospital to two models of (low fidelity – desktop and high fidelity enacting subjects) simulation on triaging to compare the outcome. Also, to understand the efficacy of such teaching methodologies to integrate it with the curriculum, and to modify it periodically for achieving the best possible outcome.

METHODS

A cross sectional study using complete enumeration sampling method, the interns of Yenepoya Medical College Hospital, Mangalore, Karnataka, India (n=186) were selected who were randomly allocated into two groups of desktop based triage simulation (Group 1, n=91) and enacted patient based triage simulation training (Group 2, n=91) during October 2018 to January 2019. Interns who could participate in both pre and post- test of triage simulation were included in the study. Four interns were excluded as they could not participate in both the simulation and the test. To avoid inconvenience to the operation of the emergency department and interns postings, this intervention was done over the span of 2 weeks. The Institutional Ethics committee approval was obtained for the study. There were no health risks, discomforts, or inconveniences reported due to participation. Both groups underwent a simulation pretest to compare the differences between the two groups. The first group simulation was conducted at Advanced Comprehensive Clinical Training and Simulation Centre (ACTS-YEN), Yenepoya Deemed to be University, Mangalore, Karnataka.

The second group simulation was conducted in the emergency department of hospital. Moulage was applied to each patient actor to create lifelike injuries. They were wheeled/brought on stretchers into the emergency department from the ambulances (Figure 1 and 2). They had their vitals and injury details mentioned on a placard which was tagged in the front of their clothes. The interns who were able to attend the both scenario and the test were included in the study. Paediatric triaging was excluded. Each participant read and noted his/her response according to instructions in the self-administered questionnaire. The collected data was compiled and kept under safe custody of the principal investigator in our simulation centre and confidentially was maintained.

Both the groups were subjected randomly coded specific question paper set before and after simulation. Same set of questions were repeated to the candidates in the pre- and post-test amongst both the groups. There were a total of six question papers each having 5 set of questions about triage, with two separate columns for answering. First column to specify the triage code and the second column to justify the code based on vitals/conscious status.

Simple triage and rapid treatment (START) is currently the most widely used triage system in the United States for mass casualty incidents.4,7 It was developed in 1983 by staff at Hoag Hospital and Newport Beach Fire and Marine Department in California for rescuers with basic first-aid skills.9 First, responders delegate the movement of injured victims to a designated collection point as directed by using four main categories based on injury severity:

- **Black:** (Deceased/expectant) injuries incompatible with life or without spontaneous respiration; should not be moved forward to the collection point.
- **Red:** (Immediate) severe injuries but high potential for survival with treatment; taken to collection point first.
- **Yellow:** Injuries that do not threaten life but do require urgent treatment and transport to hospital.
- **Green:** Injuries that do not require urgent medical treatment and are able to walk.
**Yellow:** (Delayed) serious injuries but not immediately life-threatening.

**Green:** (Walking wounded) minor injuries.

The triage colours were assigned by giving triage tags to patients or simply by physically sorting patients into different designated areas (Figure 3). "Green" patients were assigned by asking all victims who can walk to a designated area. All non-ambulatory patients were then assessed. Black tags were assigned to victims who are not breathing even after attempts are made to open airway. Red tags were assigned to any victim with respiratory rate greater than 30, absent radial pulse or cap refill greater than 2 sec and unable to follow simple commands. Yellow tags were then assigned to all others.

Neurological assessment was done using the mnemonic AVPU (Alert, responds to verbal stimuli, responds to painful stimuli, and unresponsive).

The interns were given a list of victims of different types of injury, assuming that all walking wounded have moved away from the area and that the findings are after they have repositioned the airway of any non-breathing patients. They were asked to categorise them with appropriate reason based on vital parameters and AVPU (Table 1).

![Figure 3: Table for sorting out the patients into different designed areas.](image)

Table 1: Questionnaire items selected for all 6 sets for simulation.

| Victim | Type of injury | Pertinent information |
|--------|----------------|-----------------------|
| #1     | Compound fracture, left femur | Respiratory rate over 30/minute; radial pulse absent; awake |
| #2     | Sudden onset of chest pain with shortness of breath | Respiratory rate under 30/minute; capillary refill under 2 seconds; awake |
| #3     | 90% second degree burns | Respiratory rate none on arrival, spontaneous after repositioning; radial pulse present; unconscious |
| #4     | Facial Injury | Respiratory rate over 30/minute; capillary refill under 2 seconds; awake |
| #5     | Unable to move legs | Respiratory rate <30/min; radial pulse present; awake |
| #6     | No apparent injuries | Respiratory rate normal; capillary refill <2 seconds; awake |
| #7     | Sucking chest wound | Respiratory rate >30/min; radial pulse present; unconscious |
| #8     | Dislocated right shoulder | Respiratory rate <30/min; radial pulse present; awake |
| #9     | No visible wounds | Respiratory rate none; radial pulse absent; unconscious |
| #10    | Scalp wound, estimated blood loss 500 cc | Respiratory rate >30/min; capillary refill <2 seconds; awake |
| #11    | Massive head injury | Respiratory rate <30/min; radial pulse absent; unconscious |
| #12    | Bruising over abdomen, complaining of abdominal pain | Respiratory rate >30/min; capillary refill <2 seconds; awake |
| #13    | Impaled, 1 foot piece of shrapnel in right eye | Respiratory rate <30/min; radial pulse present; awake |
| #14    | Female six months pregnant; broken left, lower leg | Respiratory rate <30/min; capillary refill <2 seconds; awake |
| #15    | Severe difficulty breathing, chest sinks in on inspiration | Respiratory rate >30/min; radial pulse present; unconscious |
| #16    | Unable to move, no verbal response | Respiratory rate <30/min; radial pulse present; awake and staring |
| #17    | Amputated left arm, bleeding controlled | Respiratory rate <30/min; capillary refill <2 seconds; awake |
| #18    | Large head wound, brain matter showing | Respiratory rate absent; radial absent; unconscious |
| #19    | Minor abrasions | Respiratory rate <30/min; capillary refill <2 seconds; awake |
| #20    | Bruise on forehead, blood in ears and nose | Respiratory rate <30/min; radial pulse present; unconscious |
| #21    | Third degree burns over front of both legs | Respiratory rate <30/min; capillary refill <2 seconds; awake |
| #22    | Compound fracture, left arm | Respiratory rate <30/min; radial pulse present; awake |
| #23    | Impaled stick in right chest | Respiratory rate <30/min; capillary refill <2 seconds; awake |

Continued.
The study was assessed based on the comparison of post test results between both the groups. The data of tests were collected and tabulated in excel sheet. Statistical analysis was done using independent t-test with IBM SPSS software ver.23. Data were represented as Mean±Standard deviation. P<0.05 was considered statistically significant. The final results were graphically represented and conclusions were drawn.

### RESULTS

About 186 interns were selected for this study amongst 2 groups of interns over 2 weeks’ time span. There was significant difference noted in the post test results of the second group (Group 2, n=91) who were subjected to high fidelity simulation than the first group (Group 1, n=91) (Table 2). There was no statistical significant difference in pre-test scores of these two groups.

| Victim | Type of injury | Pertinent information |
|--------|----------------|----------------------|
| #24    | Second degree burns, legs | Respiratory rate >30/min; radial pulse present; awake |
| #25    | Blood in right eye | Respiratory rate <30/min; capillary refill <2 seconds; awake |
| #26    | Eighteen year old adolescent, no visible injury | Respiratory rate absent; radial pulse absent; unconscious |
| #27    | Impaled object, RUQ abdomen; difficulty breathing | Respiratory rate >30/min; radial pulse present; awake |
| #28    | Patient saying same words over and over, "what happened?" | Respiratory rate <30/min; capillary refill <2 seconds; awake |
| #29    | Spurting blood from neck injury | Respiratory rate >30/min; radial pulse present; awake |
| #30    | Patient states she is a diabetic; skin, moist and clammy; feels shaky | Respiratory rate <30/min; capillary refill >2 seconds; awake |

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| #30    | Patient states she is a diabetic; skin, moist and clammy; feels shaky | Respiratory rate <30/min; capillary refill >2 seconds; awake |

Feedback was collected from both the group participants which showed that, interns liked the high fidelity simulation session in terms of experience, reality, recollection of the steps, confident levels and they preferred this mode of training to them (Table 3).

### DISCUSSION

Simulation in medical education is gaining more importance in the backdrop of competency based medical education curriculum by the Medical Council of India. It has been proved by earlier studies the effectiveness of students gaining skills and cognitive enrichment in simulated environment. We had subjected our previous batch interns to desktop simulation with a positive feedback and results. We introduced the present batch of interns to the high fidelity simulation and wanted to know the outcome in comparison with the desktop simulation. Our study was designed to subject the medical interns to two different models of simulation on triaging to compare the outcome. The results showed that students exposed to high fidelity simulation scored better compared to the
second group who had low fidelity desktop simulation sessions.

Experiential learning theory serves as the endoskeleton of simulation-based education. Advanced comprehensive clinical training and simulation centre (ACTS-YEN) of our university is equipped with the state of the art high and low fidelity simulators with task trainers for undergraduate and post graduate training for health sciences students.

Kolb characterize learning as a four-stage cycle. A learner engages in a “concrete experience,” in our context, a simulated medical procedure or patient encounter, and the components of that experience form the basis for the second step of the cycle, “observation and reflection.” As a result of this second step, learners develop their internalized operational model for working through a procedure or encounter. In the third step, learners test their operational model in a new situation (another simulation or actual clinical encounter), resulting in additional concrete experience, and the cycle repeats itself, until if and when a learner achieves mastery. According to Iputo et al, the introduction of the problem-based learning/community-based education (PBL/CBE) curriculum coincided with improved academic performance.

In this study we found that, simulation close to reality leads to a significant increase in learning and recalling output compared to the desktop simulation. There was significant statistical improvement in the results following simulation. High-fidelity patient simulation is already integrated into medical training in couple of centres and their results are in accordance with ours. The solution to the dilemma lies in “ascertaining the correct level of fidelity based on the student’s current instructional level. As a student progresses, the appropriate level of fidelity should increase.” Then, as now, this guidance is derived from cognitive-load theory. Early learning should occur in relatively low-fidelity environments to reduce cognitive load. Later learning can involve increased fidelity and resultant load, while approaching clinical practice.

In our study both the groups were not from same fidelity which forms the limitation of the study. Future scope of this study would be to compare high fidelity mannequins and human actors than using desktop simulation.

CONCLUSION
Simulation based training gives better results than compared to traditional teachings. High fidelity simulation is readily acceptable by the students for the close to reality experience and visual and audio remembrance. It’s an advantageous educational tool with the potential to influence a student’s feelings, beliefs and behaviours in relation to patient care. Although there are challenges surrounding the management of student anxiety, assessment and cost, careful preparation and planning for these issues are manageable.

ACKNOWLEDGEMENTS
We would like to acknowledge the contributions of Staff from the ACTS YEN Simulation Centre, the students from the hospital administration for enacting as patients and the emergency department of Yenepoya medical college hospital, Mangalore for handling the situation wisely.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Pereira J, Raghavendra AD, Jayapalan E. Outcome of triage results between two groups of interns subjected to different model of simulation. Int J Res Orthop 2019;5:805-10.