

Symposium

Contextualising Simulation in Emergency Medicine Department and Pediatric Intensive Care Unit in India

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ABSTRACT

Emergency Department and Pediatric intensive care units are acute Pediatric care areas with high risk and require quality and safe care to deliver good outcomes to children. Simulation appears to be adapted well in many Emergency Departments as well as PICUs across the world to understand and optimise the delivery of acute care. We have little data on the adaptability and application of simulation methods into acute Pediatric care provision in India. Simulation is currently limited to a few task-training workshops and is yet to become an integral part of healthcare in day-to-day practice. There is a lot of room to expand the scope of simulation in Emergency Departments and PICUs across the country. There is a need to expand the expertise and numbers of simulation trainers to facilitate the wider application. Further studies are needed to understand the impact on patient outcomes and understand the challenges in wider application to patient care.

Keywords: Simulation, Emergency Medicine, PICU, Context, India

Introduction

Emergency Department (ED) or Pediatric Intensive Care Unit (PICU) is a dynamic acute health-care environment with high risk. Patients present with varying degrees of sickness and it requires a unique skill-set and set-up to assess and manage them in a timely manner and in continuum. There are added challenges such as trained man-power, age appropriate equipment and multiple interactions with various teams. There are seasonal trends of disease burden such as Influenza or Dengue outbreaks, which requires adequate planning to provide high quality acute care. There is a huge gap and variation in the provision of emergency care in rural versus urban set-up, pediatric versus combined adult/pediatric emergency departments as well as the availability of Pediatric intensive care beds. The lack of structured pre-hospital emergency medical systems adds to the complexity of patient acuity at presentation. The leadership in emergency care through trained

emergency care specialists is in evolution over the last decade. The quality of care and the indices for standardisation are currently work in progress. There is clearly a need to consider multi-pronged approach to achieve the expected standards of Pediatric emergency and intensive care.

Simulation in-situ in Emergency medicine and PICU appears to be adapted well in many centres across the world to understand and optimise the delivery of emergency care. We have little data on the adaptability and application of simulation methods into emergency care or intensive care provision in India. This paper aims to explore the options and opportunities to apply simulation based methodology in emergency departments and Pediatric intensive care units in the Indian context and share local experience.

Simulation is a technique involving a wide range of activities to create an artificial scenario based on real-life events or system for the purpose of experiential learning in a risk-free environment. Simulation in health-care has now become a specialty in itself and expanding into broader and more meaningful applications.

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Context of application of Simulation in Emergency Department and PICU

Simulation as a technique can be contextualised broadly into the following categories:

1. Designing of a new Emergency Department or PICU
2. Understanding the Process flow and system errors
3. Studying the Patient-flow and Emergency Department Overcrowding matrix
4. Human factors training and Crisis Resource Management
5. Emergency Skills training including code team trainings
6. Integrating into regular Curriculum Training and Assessment

Designing of a new Department

The designing of a new Emergency Department or PICU is a complex process and requires good communication between the civil contractors/Projects team, hospital administration and clinical teams. The clinical teams can simulate the actual clinical care to determine the specific requirements for the patients. Clinical care requirements in specific areas such as ambulance bays, patient triage area, resuscitation rooms, observation areas, procedure rooms, counselling room can be well simulated. Electrical, plumbing, Medical gas circuits, trolley movements are vital elements that can be planned well through simulation exercise focussing on safety aspects well in time. The safety aspects can be well studied without actual harm to patients. Simulated mock drills can be performed to understand the actual designing flaws during mass casualty incidents and external & hospital disasters.

There are various Computerised simulation models and software available to understand the structural and spatial challenges and hence troubleshoot the issues during the construction process.

In our local experience of setting up a new Emergency Department in a new building, a simulation exercise was conducted to confirm the readiness of the department to handle patients. We were able to identify incompatibility of Oxygen connectors to wall in resuscitation rooms, transport ambulance and ER bay pendants. A modification had to be done to

rectify and unify the Oxygen connecting system. The procurement gaps of equipments and compatibility of various monitoring equipments were identified and rectified. Bed space readiness was tested via simulation specifically to look into space for receiving, use of safe slide for transfer of patient, trolley movements, handling of parents and attenders, movement of crash cart, availability of age appropriate and compatible monitoring equipments, drugs and personnel.

In the newly set-up PICU, we were able to identify space limitations to and from the cubicle areas. Hence, a suitable size patient movement trolley had to be procured. Add-on sessions of training for moving and handling of patient and equipment safely were simulated with various teams such as nursing, medical, house-keeping and ambulance staff.

Understanding the process-flow and system errors

Process flow essentially involves the patient care pathways starting from referral to discharge or transfer out from acute care environment. Standard Operating Procedures for handling every step in the process is vital. Simulation with standardised patients can identify process flow gaps. These may be referrals, triaging, handling of hospital information systems, admission or registration process, communication of staff, calling code blue system, documentation, handling of difficult situations (running a complicated code) and fire hazards. Majority of the institutions do conduct mock drills on a regular basis to identify systems gaps and thus maintain quality care in the hospital. Equipment or techniques and the suitability to a particular team may be studied. For eg: Two types of intubation equipment - traditional laryngoscopes require expertise and experience versus video-laryngoscopes that may be suited for junior or novice Emergency Physicians.

During a routine simulation exercise locally involving the shifting of patients from PICU in the third floor to CT scanner in the ground floor, we identified the gaps in coordinating with the security team to ensure availability of patient-suitable lift on time to the right location. A faulty Oxygen flow-meter was identified in the CT scanner room and immediately rectified without actual patient-harm.

Studying the patient flow

The patient flow of Emergency Department is a dynamic event whereby in a day there could be peak attendances and lean periods. The dynamics can get exaggerated during seasonal epidemics such as Dengue and Seasonal flu. Simulation exercise can identify the challenges and resource limitations if any, during peak and lean periods. During peak periods, there have been many concerns about patients who may not be seen or identified as critically ill. There have been news reports of deaths attributed to prolonged trolley waits and over-crowding in the Emergency Department in Ireland. There may be lack of resources for shift outs to suitable critical care facilities. Regular simulation exercises done in-situ with key multi-disciplinary teams can help to manage critically ill patients and resources effectively and can potentially stand out as a quality marker.

In our setup, we conducted an in-situ simulation exercise to manage Pediatric trauma - a simulated case of an infant accidentally falling off mother's arms from first floor terrace to grassy lawn in the ground floor. Issues such as (i) Patient receiving area, ideally should be in the resuscitation bed due to severity of the mechanism of injury, (ii) Identifying and calling for anaesthetics team assistance for anticipated difficult airway if excess bleeding in mouth, (iii) availability of equipment - videolaryngoscope / bougie for difficult airway, intercostal chest drain for possible hemo-pneumothorax, suitable size splints for control of exsanguinating limb injuries, (iv) Immediate availability of O-negative blood in the blood bank for emergency transfusion suggestive of preparedness of the system, (v) Deferring CT scan and considering emergency laparotomy for unstable hemorrhagic shock patient and discussing team-dynamics. The simulated exercise gave confidence and insight to the team to handle such an emergency and the team was keen to participate in future regular simulation exercises.

Human Factors training and Crisis Resource Management

"To err is human". Human factors account for majority of errors in healthcare. Human factors leading to errors are unintentional actions that lead to unfavourable outcomes to patients. Human errors occur due to

lapses in delivering care in a particular situation rather than due to lack of knowledge or skill. Human errors typically happen in a high stake/stress environment such as Emergency department or intensive care unit. For eg: Not doing what they are meant to do - A new nurse in the Department not familiar with the crash cart and delaying the delivery of emergency care or lapses such as forgetting to do a task – checking the blood sugar in a baby with neonatal seizures. Violation is an intentional action that compromise patient safety despite awareness and familiarity. For eg: Use of hand-hygiene methods, gloves whilst collecting bloods or cannulating, safe sharps disposal, use of safe slide to transfer patients between trolley to bed or vice versa etc.

Crisis Resource Management (CRM) is the concept adapted from aviation industry to healthcare. CRM essentially involves the application and utility of all available resources towards improving patient outcomes and hence quality and safety. The key features of CRM Training are as shown in Table 1.

Table 1: Crisis Resource Management KEY POINTS

1. Know the environment
2. Anticipate and plan
3. Call for help early
4. Exercise leadership and followership
5. Distribute the workload
6. Mobilize all available resources
7. Communicate effectively
8. Use all available information
9. Prevent and manage fixation errors
10. Cross (double) check
11. Use cognitive aids
12. Re-evaluate repeatedly
13. Use good teamwork
14. Allocate attention wisely
15. Set priorities dynamically

(from Rall M, Gaba DM: Human Performance and Patient Safety, in Miller 6th edition 2005)

Simulation exercises and training of teams for human factors and crisis resource management have stood the test of time to provide reflective learning and application without any harm to patients. Human factors training can occur as part of regular training in-situ within the working environment of the ER/PICU team - inter-disciplinary with low cost simulators. A huddle of the team members at the commencement of

each shift can clarify the roles and responsibilities of each team member – for airway, chest compression, drugs, scribe, transport etc. A nano-simulation practice session of individual skills such as CPR on a low cost manikin, checking of equipment in the resuscitation room, creating leader-boards for time management during drugs preparation for intubation and situation awareness will go a long way in preparing the team to anticipate, plan and handle the emergencies safely. Any system or process errors can be immediately rectified without patient harm.

A novel “Rolling refresher” CPR skills training of PICU team “Just in time” and “Just in place” at Children’s Hospital of Philadelphia was found to be well received and effective by PICU staff and such frequent refreshers significantly shortened the achievement of proficiency of CPR skills by the staff. In our centre, we now have a practice of a team huddle each shift in Emergency Department as well as PICU to identify the roles of nursing staff for tasks such as cardiac massage, drugs, airway/intubation in the event of any crisis. If there is a sick patient in the PICU that may need CPR, the particular shift team including nurses and doctors do a nano-simulation practice of the possible cardiac arrest on a low cost resuscitation manikin for role allocation and team performance and thus ensure team preparedness. The consultant for PICU debriefs the team and ensures key tasks are performed and rectified safely before any such patient event. We also perceive the need to video live events where possible for ongoing quality and training purposes.

Emergency Skills Training

Simulation part-task trainers such as resuscitation manikins, manikins specific for airway management, ultrasound guided central lines, chest tube insertion and Intra-osseous models can be used to train Emergency Physicians without causing any actual patient harm. These are time-critical interventions and may not be ethical to learn on real patients who may be very critically ill. Not doing so is a lost opportunity to train in the necessary skill. Simulation provides a safe way of learning time critical skills and practicing till perfection before actually doing so in emergency patients in real-time and under stressful conditions. Learning under stress free conditions facilitate better

reflection and retention too.

Training in non-technical skills such as leadership, team-work and communication play a vital role (See Table 2). There is a need for more structured training to address them during acute care.

Table 2: Communication - Key is to close the loop

1. Meant is not said
2. Said is not heard
3. Heard is not understood
4. Understood is not done

Hebbar et al have demonstrated in the PICU at Atlanta, USA, that bedside simulation based training in Central venous line (CVL) dressing change was associated with improved compliance in CVL maintenance bundle practice. This is an example of application of simulation as a quality improvement initiative to reduce central line associated blood stream infections and hence contribute to good outcomes eventually.

There are various simulation workshops and courses such as Advanced Simulation Training in Emergency Pediatrics, Emergency Airway Management, Non technical and communication skills, Emergency Ultrasound guided procedural workshops etc. Such workshops are run regularly across the country and may offer other opportunities to learn via simulation under the auspices of PediSTARS India (Pediatric Simulation Training and Research Society), Simulation Section of SEMI (Society for Emergency Medicine India) and Society for Trauma and Emergency Pediatrics (STEP).

Integration into Curriculum training and Assessment

Curriculum based training of Emergency medicine and PICU is currently clinical experience followed by written and OSCE examinations. Simulation methods can be applied during the training period to ensure reflective learning occurs with appropriate and adequate debriefing. The quality of education can be further enhanced with regular team training and human factors training. Rare conditions that may not have been encountered in real-life can be learnt via simulation to bridge the gap in clinical experience. Assessment via simulation is now gaining popularity especially for assessing team leadership, CRM

and human factors since the traditional methods of assessment or examinations are unable to effectively do so. Proposed model of Simulation curriculum by Simulation Section of SEMI is shown in Table 3.

Table 3: A Proposed simulation curriculum by Simulation Section of SEMI for PGY 1 of Emergency Medicine Training is given below:

S.No	Procedures	Month
1	1. Resuscitation (Medical & Trauma) 2. I/O Insertion	July
2	1. Orthopedic Reductions 2. Splinting	August
3.	1. Normal Delivery 2. Complicated Delivery 3. Post Partum Haemorrhage Management 4. Perimortem C-Section	September
4.	Non technical Skills and Communication	October
5.	Emergency & Difficult Airway Management (Adults, Child & Infants)	November
6.	ABG Sampling and Interpretation	December
7.	Non Invasive & Invasive Ventilation Support	January
8.	Basic Suturing & Wound management Skills	February
9.	Emergency Ultrasound and USG Guided Procedural Skills (Blocks, Lines)	March
10.	1. Chest Tube Insertion, 2. Pericardiocentesis 3. Transvenous Pacing	April
11.	1. Nasal Packing 2. Leadership in Emergency Department	May

A web-based survey conducted by Thyagarajan S and Shetty R in 2012 involving the teaching faculty from the 20 PICU fellowship training centres across India identified that only 10% of the teaching faculty had exposure to simulation and nearly 90% felt the need for introducing simulation based training to PICU trainees. In a pilot study conducted in a single centre by Thyagarajan S in 2012, 88% of the pediatric residents felt that scenario based training would improve their confidence and performance if integrated into their curriculum.

In order to create a pool of PICU trainers with expertise in simulation, PediSTARS India in association

with International Pediatric Simulation Society and INSPIRE Network worked with the College of Pediatric Critical Care Medicine, India and have now conducted two Training of Trainers workshops. There is now a substantial pool of about 75 trainers who have subsequently been faculty for various simulation workshops and also instituting in-situ simulation in their respective centres for team training.

PediSTARS India and College of Pediatric Critical Care Medicine, India are currently working on developing a simulation curriculum to integrate into PICU fellowship training across India.

How can I apply Simulation methodologies in my Emergency Department or PICU?

A decision to apply simulation methods in the Emergency Department or PICU must be based on the personal and institutional drive to rehearse good quality care focused on patient safety. Simulation enables us to analyse technical and non-technical skills. This exercise must be seen as an opportunity to identify and fix any gaps in service. It is absolutely vital to commit to fact finding and not fault-finding. It is the responsibility of the simulation faculty within the Department to ensure psychological safety to the team participating in the simulation scenario. Experience and commitment play a pivotal role in adapting simulation for enhancing quality care in addition to time and personnel.

Needs Analysis: Identify the purpose of applying simulation methodology, the key learning objectives and what or who the target learners are. For eg: The main purpose of doing simulation in the emergency department is to understand the readiness of the Emergency Department to manage a child with major haemorrhage following trauma.

Set and Script the scenario

Set the scene as an in-situ ear-marking one of the Emergency beds in the current Emergency Department. Identify the target learners as the ER team on duty including medical, nursing and administrative or supportive staff.

Define the expected standards from the team – Assessment of trauma, hemorrhagic shock due to abdominal injury (Liver laceration), Need to trigger massive transfusion protocol, teams to liaise with and stabilisation.

Simulation equipment and personnel – A standardised patient or child actor with a bruise on abdomen, one trainer to be a nurse, a second trainer as technical assistant to portray vital signs either via a smart phone and a tablet with a compatible simulation monitor app, and consumables and equipment as per what is available in the emergency department.

Running the simulation scenario

Pre-briefing – Introduce the child as 6 years old patient with a background history of road traffic accident and brought by ambulance services. The ER team is expected to do the initial assessment and management of the child. Explain how the vital signs can be interpreted from the display on the tablet that resembles the patient monitor. Also, since this is a standardised patient, the cannula may be stuck and presumed done than actually pricking the child. The participating team must be familiar with what they can do and are expected to do in real time and what they are not expected to do in the best interest of safety to personnel and equipment and yet remain focused to the core learning objectives of the simulation exercise. The ER team performance may be video recorded for further reflective learning if preferred and with the consent of the participating team.

Debriefing: This is the essence of simulation and must facilitate reflective learning. Debriefing is about understanding the views of the team and exploring their frames of thinking to resolve any gaps. All observations must be discussed and must be seen as a learning opportunity to identify and bridge the gaps in service, knowledge, skills or attitudes. The exercise must be done in a non-threatening and objective way so that the entire team can contribute to patient safety. The good practice identified must be reinforced within the team and the institution. The Gaps must be recognised and attempted to resolve them with additional training or measures such as hand-over templates, written guidelines, skills workshop, added supervision and mentoring.

Conclusions

Simulation is a promising methodology that can be adapted and applied into acute care settings such as Emergency Medicine Department and PICU in India.

Simulation is currently limited to a few task-training workshops and is yet to become an integral part of healthcare in day-to-day practice. There is a lot of room to expand the scope of simulation in-situ in Emergency medicine Departments and PICUs across the country. There is a need to expand the expertise and numbers of simulation trainers to facilitate the wider application especially at medical and nursing colleges and rural health practice. Further studies are needed to understand the impact on patient outcomes and understand the challenges in wider application to patient care.

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