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Symposium

Simulation in Acute Care Pediatrics: New paradigms in care

Rakshay Shetty *, Vinay Nadkarni**
*Lead Pediatric Intensivist, Rainbow Children's Hospital, Bengaluru, India, **Endowed Chair, Professor
Department of Anesthesia and Critical Care Medicine, The Children's Hospital of Philadelphia
University of Pennsylvania Perelman School of Medicine, USA
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ABSTRACT

Simulation offers tremendous promise to improve health care delivery especially in acute care areas. It can be an efficient mode to learn, probe and improve crisis resource management, unit risk assessment, establish an environment for discussing error without punishment, investigating human performance, assessing situation readiness, implement new protocols, test run new instruments, improve interdepartmental co-ordination, learn new concepts or procedural skills and also in establishing systems and usability of a new unit.Simulation based learning relies heavily on reflective practice,a key foundational concept of adult learning. PediSTARS India is actively working towards addressing the challenges of implementing simulation based interventions to better the care of sick children in India.

Keywords: Simulation, training, quality of care

Acute care delivery in Pediatrics is a complex, expensive, potentially error prone, medical specialty and remains the focal point of major improvement efforts in healthcare delivery. We are now in a complex healthcare system where the stakes of accountability and responsibility are high be it patients, health-care providers, administrators or the law-makers. Acute care, especially the emergency room and intensive care, tops the list of time-bound dynamic complexities. There is a need to provide health care with the least harm to the patient.

This review provides an overview on the usage of simulation in acute care areas with special emphasis on training and improvement in the quality of care.

Current Challenges in delivery of care in Acute Care Pediatrics

Delivery of acute care in a diverse country like India is very complex due to the enormous variation in the socioeconomic conditions and also the facilities available. Enormous progress has been made over the last decade particularly in the field of Pediatric intensive care.[1] Many new intensive care units have become operational particularly in the private sector, with many delivering very high standards of care. However, with this rapid expansion of acute care services many challenges have emerged. With limited training facilities, there is a shortage of well-trained Pediatric specialists and healthcare providers. This challenge is accentuated byan acute shortage of nurses trained to work in acute care areas and rapid nursing turn over. Further, variation in the bed occupancy rates especially in private ICU's is leading to challenges in planning adequate workforce logistics. This, in addition to the public demand for economical but safe and effective healthcare in an error prone area coupled with interprofessional tensions in multidisciplinary intensive care units exacerbates emotional fatigue among the health care providers. Simulation-based training and debriefing in acute care areas can potentially offer some solutions to these challenges.

Correspondence
Dr.Rakshay Shetty,Incharge, Division of Pediatric Critical Care, Rainbow Children's Hospital, Outer Ring Road, Doddanekundi, Marathahalli. Bengaluru 560037
Email: rakshayshetty@gmail.com, Mobile: + 91 9535475354

Simulation as a training tool

Curriculum based training in acute care areas are primarily driven by text books and clinical experience gained with real patients under supervision by trainers. This apprenticeship modelis error prone and not without repercussions. The trainers and learners have little opportunity to facilitate training without the added pressure of time and patient safety.

Over the past decade, there have been an increasing number of studies evaluating the effectiveness of simulation as an educational tool[2]. Simulation has been used in various aspects of pediatric acute care training, including

1. Resuscitation, disaster training and trauma management
2. Procedural competency
3. Human factors/team training and
4. Assessment tool

1. Advanced life support and Trauma training

Simulation is an effective tool to improve the efficacy of advanced life support training. A study by Wayne DB et al[3] demonstrated that addition of simulation training in addition to Advanced cardiac life support (ACLS) course for residents led to significantly increased adherence to American Heart Association (AHA). Considering that critical care conditions occur infrequently, simulation can be an effective tool not only to train but also to maintain competency. Review in this issue by T.Ikeyama and P.Khilnani discusses extensively about the role of simulation in Pediatric advanced life support. Similarly, Hunt et al. [4]demonstrated improvement with the trauma team performance using simulation based training. M.Auerbach et al in their recent study demonstrated improved team performance, teamwork and intubation during trauma management after conducting monthly 20 min trauma simulation scenario followed by a 30 minute debriefing over 22 months.[5]

2. Procedural competency:

Procedural skills such as central and arterial line insertions, endotracheal intubationsare commonly encountered in Pediatric Intensive Care Unit (PICU). Often times, patients are sick and need these procedures to be performed as an emergency leading to missed learning opportunity to the novices. Procedural skills may be learnt on simulated models or part-task trainers at the learner's pace with enough practice without causing patient harm. Learning in a non-risk environment facilitates better reflection and retention. Kessler DO et al in their study looked into use of simulation and audiovisual aids on the success of lumbar puncture in infants by interns. They demonstrated a high initial success rate with this training.[6] Inaddition, simulation offers a unique advantage for learning rarely performed procedures. Studies looking into the skill retention showed that a skill learnt in skill laboratories can sustain upto 1 year.[7] McGaghieet al. [8]looked into a specific question of whether simulation with deliberate practice yields better results than traditional education. They screened over 3000 articles published between 1990 and 2010 and demonstrated an improvement in the simulation with deliberate practice group over traditional education. The largest meta-analysis on simulation education, published by Cook et al in JAMA[9], also supported its superiority.

3. Human Factors training

Historically, acute care outcomes have been predominantly attributed to the patient's genetic predisposition, baseline dysfunction, and severity of insult. Data have shed light on the importance of an additional factor: human factor. Epidemiologic data suggests that human factors in addition to delayed or overly aggressive treatments are among the most important drivers of poor outcomes during critical illness[10,11]

Crisis resource management (CRM) is a method of team training that focuses on behavioral skills, resource utilization, communication, leadership, and teamwork. These skills are essential for effective clinical care, yet few medical personnel are exposed to formal training in these areas. Team training has been found to decrease medical errors[12]. Simulation offers an ideal setting to practice methods of CRM in a safe learning environment. A systematic review of team training studies found that 85% of the studies utilized simulation[13]. A 2007study evaluating the effectiveness of a mock code-based educational intervention on the leadership skills of pediatric residents[14] displayed significantly improved leadership skills compared with residents who did not undergo training. Andreatta et al,[15] showed that conducting simulation-based mock codes significantly correlated with improved pediatric patient cardiopulmonary arrest survival rates.

4. Assessment tool

An additional and underutilized potential use of simulation is as a tool to evaluate competency and

credentialing. It is a relatively new concept. Though computer based scenario oriented exams are being conducted, there is not much experience using scenarios based on high fidelity simulators. Recent study by M.Auerbach reported a high degree of correlation between simulation - based assessments at the workplace with the clinical success of infant lumbar puncture in interns[16]. Results of the Israeli study[17] looking into usage simulation for board certification for anesthesiologists are promising. It might find more application in this regard as more studies look into their validity.

Various attempts have been made to integrate simulation into mainstream training curriculum. Dought CB et al have reported that 97% of pediatric emergency programs in US have adopted simulation based training in their curriculum[18]. Nishisaki et al. 19conducted a multi-institutional 'boot camp' for first year PICU fellows. The course targeted airway management, vascular access, resuscitation, sepsis, trauma, and delivery of bad news. Educational methods combined task training, simulation, didactics, and small group interactive discussions. Participants were debriefed after each simulated case and then given an opportunity to practice lessons learned in a second similar case.

Weinstock and colleagues 20 integrated simulation based activities into the work day of trainees and staff of a tertiary-care pediatric intensive care unit while also providing widespread training opportunities for trainees throughout the children's hospital. Their hospital-based simulator suite has shown promise as a new paradigm in pediatric education by offering a comprehensive, cost effective simulation program for a multidisciplinary group of pediatric trainees at all levels of training and experience in the context of their normal work environment.Such an on-site simulator suite represents a new standard that effectively combines the principles of deliberate practice, learning in context, and other key features of high-fidelity simulation.

In India, very few training institutes have adopted simulation based training into their main curriculum. Pediatric Simulation Training and Research of India (PediSTARS India) have conducted 16 boot camps from 2014-2016 years on neonatal and pediatric emergencies. These workshops focussed not only on knowledge component, but also on human factors and team training. These workshops encourage joint training of doctors and nurses to improve the role and team experience. In order to promote the use of simulation, PediSTARS conducts 2 day trainer's camp annually to increase the number of qualified simulation trainers in India. As of July 2016, sixty-two health care professional have undergone training to use simulation education technique in India by PediSTARS.

Simulation as a quality improvement tool

Simulation can address many issues related to the patient care plaguing medical care mentioned earlier in the review by systems level interventions[21] By integrating simulation into the organization process, it can be used as an effective tool to reduce/ prevent accidental or preventable errors, probe etiology and root causes of sentinel events, identify latent threats while testing new technology, test new clinical care protocols, operating a new process and/or operating a new clinical area before exposing real patients. Cheng et al[22] have discussed this topic in their review in JAMA.

1. Simulation for risk assessment:

Simulation can be used as a risk assessment tool to either explore the root cause analysis of an adverse event or also identify potential risks in high risk environments like acute care areas. Recreation of adverse events using simulation followed by debriefing provides us with an opportunity to identify individual, team and systems level factors that contributed to patient harm.[23] Similarly, simulation can be done in actual patient areas in acute care areas for specific clinical contexts to identify latent threats. These identified latent threats can be used to plan the clinical care across the health care system there by making patient care safer. A simple example will be the facilitating the use of code blue carts. A series of simulations can be conducted in patient areas to determine the best location, and also bed space planning for the optimal performance of the team.

2. Simulation to integrate new technology or equipment:

Simulation can be an effective tool to identify patient

threats and optimal integration of new technology in ICU or ER. New technology implementation (eg. Electronic medical records) or use of new equipment (E.g.disposable chest pads for defibrillation) into the clinical environment may have undesirable consequences on workload of health care professionals, team work and resource allocation. Use of simulation not only helps in identifying the optimum way to use new technology or equipment, but also might identify the latent threat which can cause potential threat.

3. Simulation to implement new processes or protocols or new guidelines:

Simulation can be an effective tool to assess any new hospital process, guideline or protocol by creating events to identify challenges and latent safety threats. For example, if hospital has developed a new policy for isolating HINI patients, simulations can be conducted to find out its feasibility, expense, manpower and resource requirement. This can help in fine tuning protocol to minimise patient errors. Similarly, optimum use nurse staffing in emergency room can be tested using simulation by looking into the time to triage and patient flow. Simulation is especially effective when the new defined process is going to be sparsely used but risk to the patient or the environment is high if any component of the care is missed.

4. Optimising clinical areas:

Simulation can be used to optimise the use and planning of clinical work areas.24 For example, if there is a plan to expand pediatric intensive care unit by few beds, a variety of insitu simulations can be conducted in the those areas to assess the functionality, optimal placement of equipment and also identify latent threats.

Pediatric Simulation Training and Research Society of India (PediSTARS India, www.pedistarsindia.com) is working actively to deal with the challenges and bridge the gap in the availability of simulation expertise in Pediatrics and acute care of children. One of the main goals of this society is to improve the outcomes of critically ill children using simulation based interventions. It frequently conducts workshop or bootcamps on different aspects of simulation in Pediatrics.

Conclusion

Simulation offers tremendous promise to improve the quality of training and care in acute care scenario. There is now a growing body of high-quality literature and evidence to support its growth. In the future, it can be expected that simulation will be used by practically aspect of pediatric acute care.

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References

1. Govil YCPediatric intensive care in India: time for introspection and intensification.Indian Pediatr2006;43:675-8.
2. Issenberg SB, McGaghie WC, Petrusa ER, et al. Features and uses of high fidelity medical simulations that lead to effective learning: a BEME systematic review. Med Teach 2005;27:10–28.
3. Wayne DB, Didwania A, Feinglass J, et al. Simulation-based education improves quality of care during cardiac arrest team responses at an academic teaching hospital: a case–control study. Chest 2008; 133:56–61.
4. Hunt EA, Heine M, Hohenhaus SM, et al. Simulated pediatric trauma team management: assessment of an educational intervention. Pediatr Emerg Care 2007; 23:796–804.
5. Auerbach M, Roney L, Aysseh A, et al.In situ pediatric trauma simulation: assessing the impact and feasibility of an interdisciplinary pediatric in situ trauma care quality improvement simulation program. Pediatr Emerg Care2014;30:884-91.
6. Kessler DO, Auerbach M, Pusic M. A randomized trial of simulation-based deliberate practice for infant lumbar puncture skills. Simul Healthc 2011;6:197-203.
7. Boet S, Borges BC, Naik VN, et al. Complex procedural skills are retained for a minimum of 1 year after a single high-fidelity simulation training session. Br JAnaesth 2011;107:533–539.
8. McGaghie WC, Issenberg SB, Cohen ER, et al. Does simulation-basedmedical education with deliberate practice yield better results than traditional clinical education? A meta-analytic comparative review of the evidence. AcadMed2011; 86:706–711.
9. Cook DA, Hatala R, Brydges R, et al. Technology-enhanced simulation for health professions education: a systematic review and meta-analysis. JAMA2011; 306:978–988.
10. Afessa B, Gajic O, Keegan MT, Seferian EG, Hubmayr RD, Peters SG. Impact of introducing multiple evidence-based clinical practice protocols in a medical intensive care unit: A retrospective cohort study. BMC EmergMed 2007,7:10. doi: 10.1186/1471-227X-7-10
11. Li G, Malinchoc M, Cartin-Ceba R, Venkata CV, Kor DJ, Peters SG, Hubmayr RD, Gajic O: Eight-year trend of acute

respiratory distress syndrome: a population-based study in olmsted county, minnesota. Am J RespirCritCare Med 2011,183:59–66
12. Morey JC,Simon R, JayGD,et al. Error reduction and performance improvementin the emergency department through formal teamwork training: evaluation results of the MedTeams project. Health Serv Res 2002; 37:1553–1581
13. Salas E, DiazGranados D, Weaver SJ, et al. Does team training work?Principles for healthcare.AcadEmerg Med 2008; 15:1002–1009.
14. Gilfoyle E, Gottesman R, Razack S. Development of a leadership skills workshop in paediatric advanced resuscitation. Med Teach 2007;29:e276–e283.
15. Andreatta P, Saxton E, Thompson M, et al. Simulation-based mock codes significantly correlate with improved pediatric patient cardiopulmonary arrest survival rates. PediatrCrit Care Med 2011; 12:33–38.
16. Ben-Menachem E, Ezri T, Ziv A, et al. Objective structured clinical examination based assessment of regional anesthesia skills: the Israeli National Board Examination in Anesthesiology experience. AnesthAnalg 2011; 112:242–5.
17. Auerbach M, Fein DM, Chang TP.The Correlation of Workplace Simulation-Based Assessments with Interns' Infant Lumbar Puncture Success: A Prospective, Multicenter, Observational Study.Simul Healthc2016;11:126-33.
18. Doughty CB, Kessler DO, Zuckerbraun NS. Simulation in Pediatric Emergency Medicine Fellowships. Pediatrics2015;136:e152-8.
19. Nishisaki A, Hales R, Biagas K, et al. A multiinstitutional high-fidelity simulation'boot camp' orientation and training program for first year pediatric critical care fellows. Pediatr Crit Care Med 2009; 10:176–182.
20. Weinstock PH, Kappus LJ, Kleinman ME, et al. Toward a new paradigm in hospital-based pediatric education: the development of an onsite simulator program. Pediatr Crit Care Med 2005; 6:635–641.
21. Nishisaki A, Keren R, Nadkarni V. Does simulation improve patient safety? self-efficacy,competence, operational performance, and patient safety. Anesthesiol Clin 2007;25:225-236.
22. Cheng A, Grant V, Auerbach M.Using simulation to improve patient safety: dawn of a new era. JAMA Pediatr 2015;169:419-20
23. Mullan PC, Kessler DO, Cheng A. Educational opportunities with postevent debriefing. JAMA 2014;312:2333-4.
24. PattersonMD, Geis GL, Falcone RA, LeMaster T,Wears RL. In situ simulation: detection of safety threats and teamwork training in a high risk emergency department. BMJ Qual Saf 2013;22: 468-477.

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