A Road Map for Simulation Based Medical Students Training in Pediatrics: Preparing the Next Generation of Doctors

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Current Medical training in India is generally didactic and pedagogical, and often does not systematically prepare newly graduated doctors to be competent, confident and compassionate. After much deliberation, the Medical Council of India (MCI) has recently introduced a new outcome-driven curriculum for undergraduate medical student training with specific milestones and an emphasis on simulation-based learning and guided reflection. Simulation-based education and debriefing (guided reflection) has transformed medical training in many countries by accelerating learning curves, improving team skills and behavior, and enhancing provider confidence and competence. In this article, we provide a broad framework and roadmap suggesting how simulation-based education might be incorporated and contextualized by undergraduate medical institutions, especially for pediatric training, using local resources to achieve the goals of the new MCI competency-based and simulation-enhanced undergraduate curriculum

Keywords: *Competency, Integration, Medical education, Undergraduate*.

Graduates, through didactic training and apprenticeships, focus on improving knowledge. However, graduates often have gaps in skills, behaviors and attitudes, so alternative forms of education are necessary to support competence, confidence, communication skills, and compassion in caring for children. Entering internship after the final year of medical school, students are required to perform many critical actions independently. Most of the students in the Indian subcontinent learn clinical care by practicing on real patients which may result in physiological and psychological harm to the patients and families, as well as excessive stress to the new graduate. Simulation is a powerful tool that can facilitate learning in a safe environment by deliberate practice and facilitated reflection. Using simulation to address individual and team skills, behaviors and attitudes was addressed previously in the journal [1] – we add to it in the light of the new MCI curriculum.

New MCI Curriculum

The Medical Council of India (MCI) has proposed an exciting new initiative to revamp medical training by creating a competency based undergraduate curriculum for the Indian medical graduate [2,3]. The new curriculum focuses on Attitude, Ethics and Communication (AETCOM); calls for preparing students to face India's health needs by training to be a "Clinician, Communicator, Team leader, Professional and Lifelong Learner"; emphasizes collaborative and inter-disciplinary teamwork, professionalism, respect and responsiveness to the needs of the patient; limits didactic lectures to less than a third of total schedule; integrates communication skills training; and uses simulation training and guided reflection

The new MCI competency-based pediatric medical graduate curriculum is based on seven core competencies (***Box* I**). MCI emphasises that the teaching should be aligned and integrated both horizontally (across disciplines in a given phase of the course) and vertically (across different phases of the course). This will allow graduates to provide comprehensive care for neonates, infants, children and adolescents based on a sound knowledge of growth, development, disease and their clinical, social, emotional, and psychological correlates in the context of national health priorities [4]. MCI has directed individual undergraduate medical institutes to form their own curriculum committees to implement these standards [5].

Can Simulation Bridge Current Gaps in Training?

The new MCI curriculum aspires to ensure that the medical graduate meets or exceeds global benchmarks in knowledge, attitudes, behaviors, skills and communication abilities, and is able to provide holistic care with compassion. How do we achieve this goal?

Box I The New Medical Council of India Competency-based Pediatric Curriculum of the Indian Medical Graduate Program [4]

Pediatric Competencies students must demonstrate

1. Ability to assess and promote optimal growth, development and nutrition of children and adolescents and identify deviations from normal.
2. Ability to recognize and provide emergency and routine ambulatory and First Level Referral Unit care for neonates, infants, children and adolescents and refer as may be appropriate.
3. Ability to perform procedures as indicated for children of all ages in the primary care setting.
4. Ability to recognize children with special needs and refer appropriately.
5. Ability to promote health and prevent diseases in children.
6. Ability to participate in National Programmes related to child health and in conformation with the Integrated Management of Neonatal and Childhood Illnesses (IMNCI) Strategy.
7. Ability to communicate appropriately and effectively.

Didactic education will help the learner to gain knowledge, whereas simulation-based education (SBE) will help the learner to apply their knowledge by creating realistic experiences in a controlled, low risk and interactive environment. Debriefing, which is an integral component of the simulation experience, facilitates mindful reflection, active learning, abstraction, conceptualisation, and application of theory to real events. Integrating didactic teaching and SBE will provide shorter learning curves, higher retention and improved behavior in future patient care encounters, helping learners emerge as leaders, communicators, professionals and health advocates [1,6-8]. Studies have shown that pediatric trainees become more confident in recognising, assessing, managing sick children, and in communicating after simulation-based training [9-12].

Progress Towards SBE in India

It is encouraging to see a few institutions in India already taking an active interest in incorporating simulation for undergraduate training. At the All India Institute of Medical Science (AIIMS) Delhi, and many other institutions, skills are taught using a blended learning technique with both online and hands-on teaching sessions. The online segment consists of a brief description of the standard operating procedure (SOP) and a video of skills such as intravenous (IV) cannulation, hand washing, gowning and gloving, glucometer use, bag and mask ventilation, chest compressions, endotracheal intubation, laryngeal mask airway (LMA) insertion, basic suturing, and episiotomy suturing. The students need to answer a few multiple-choice questions based on the information given in the SOP and video and then they are allowed to come for hands-on sessions. Apart from the above, a simulation-based neonatal resuscitation program (NRP) is being run for the students during their 6th semester. Future steps include incorporating team training and human factors in simulation. Centres such as Father Muller Simulation and Skills Centre; DY Patil Medical Simulation Laboratory; Kasturba Medical College (KMC), Manipal; and GSL smart lab, Andhra Pradesh have already commenced incorporating simulation in pediatric undergraduate training.

OVERVIEW IN OTHER COUNTRIES

Use of simulation-based education in pediatrics is used in majority of institutions in USA [13]. SBE is based on 13 core 'Entrustable professional activities for entering residency' from the Association of American Medical Colleges [14]. Most centres in USA, Canada, United Kingdom and New Zealand introduce simulation to students in the first year of medical training and gradually increase the duration and complexity from year 2 onwards using both skill laboratories and in-hospital simulation.

Typically, students learn various procedural skills (such as cannulation, blood sampling, suturing, intubation, thoracentesis, aseptic precautions), history taking, basic life support, airway, focussed examination, leadership, handover, interprofessional and family communication in simulation centres, and management of emergencies with team training at hospital. Combinations of task trainers, manikins with varying amounts of technology (low, medium, high), virtual reality (VR) simulations, and standardized patients (SP) are used for training at simulation centres. Simulation is also used as an evaluation tool and to assess knowledge *e.g.,* Objective Structured Clinical Examination (OSCE) stations [15,16].

At the Children's Hospital of Philadelphia (CHOP), medical students undergo pediatric simulation training at a simulation centre at the University of Pennsylvania Perelman College of Medicine. In addition, during year 3 and 4 they undergo *in situ* simulation training at CHOP. Small batches of five third year students participate in simulation once-a-week to learn team training, neonatal apnea, asthma, croup, febrile seizure, hypoglycemic seizures for 5 weeks. Similarly, fourth-year students visit once-a-week to learn team training, identification of sick

child, high quality resuscitation, cardiac arrhythmias, anaphylaxis and septic shock using scripted scenarios and high technology manikins. Debriefing normally takes twice the time of conducting the scenario. Prior to commencing internship, medical students participate in a 5-day intense pediatric boot camp. The boot camp is structured to mimic real work in a Pediatric ward and emergency room involving allied professionals such as radiology, physiotherapy, occupational therapy, speech therapy, child life and lactation specialists. Emphasis on personal wellbeing in addition to skills such as PALS emergencies and handoff communication has made this boot camp a great success [11,17]. CHOP is also helping overseas centres conduct team training and debriefing through tele-simulation.

WHAT IS NEEDED FOR SIMULATION-BASED TRAINING?

To succeed in our mission to provide SBE, we need commitment by the faculty and administration, a clear roadmap, passion to succeed and, willingness to invest for our new generation of young doctors. Now that the need for SBE has been identified [2-5], next steps will be to develop faculty, secure funding, identify space for simulations, procure manikins and other equipment, train personnel, design curricula and script scenarios. Ongoing research and feedback to refine the curriculum will lead to high quality training (***Fig.*** **1** and **2**).

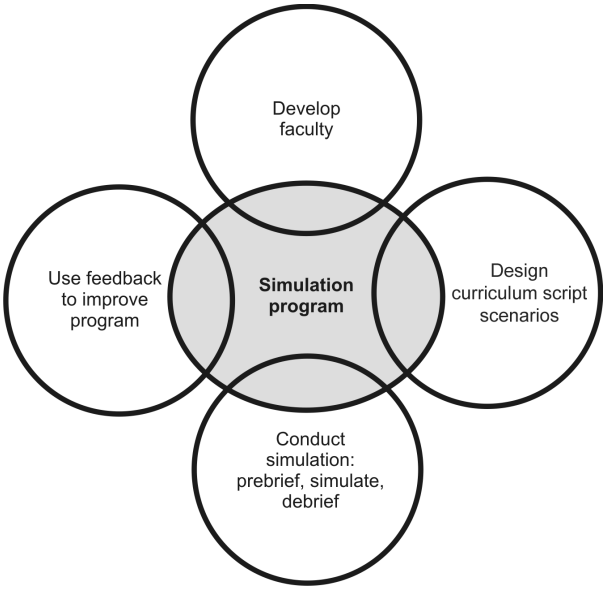


Fig. 1 *Designing a simulation program.*

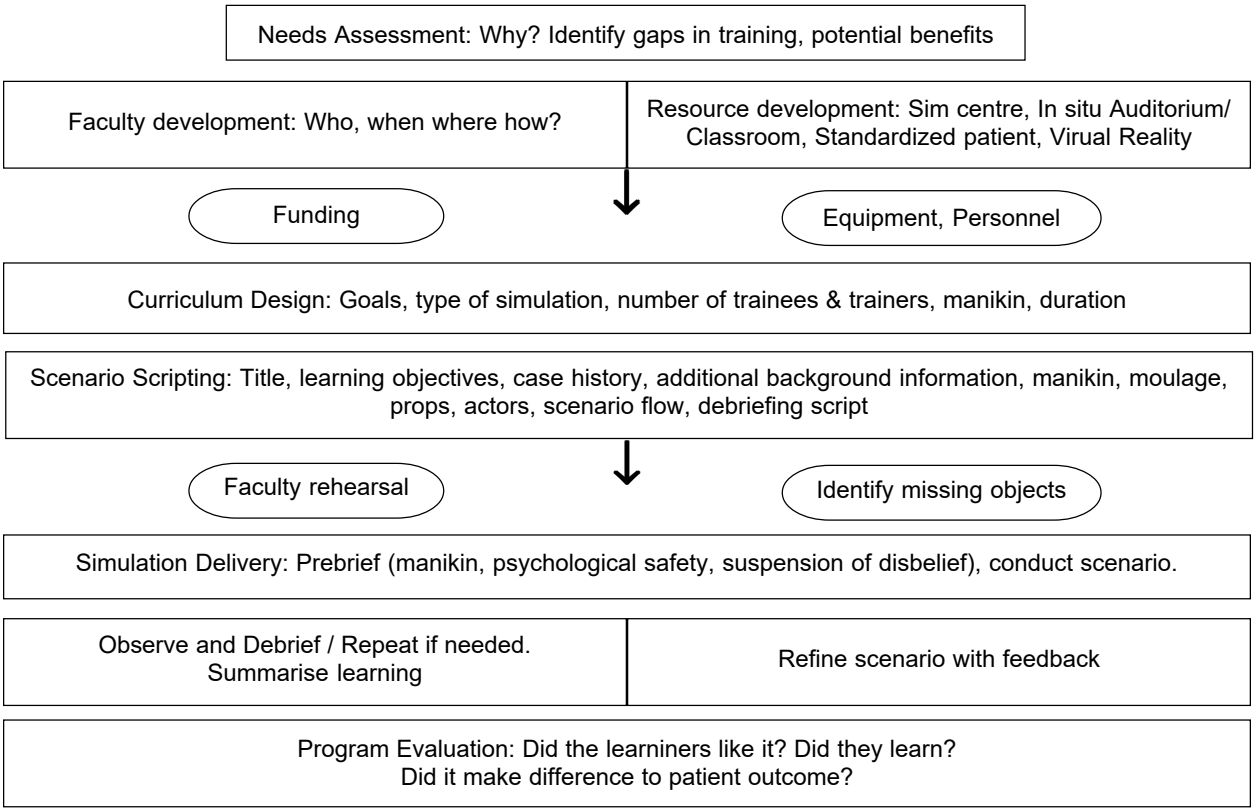


Fig. 2 *A road map for integrating simulation in medical education.*

Faculty development: This is the most vital part of a simulation program. There are 2 or 3-day simulation faculty development courses available, emphasizing curriculum development and debriefing followed by ongoing audit and mentorship.

Access to resources: Funding, identifying space, manikins, audio-visual aids, appropriate equipment to create a realistic patient-care environment, an enclosed observation room, debriefing room and personnel to manage the program are some of the resources required for a successful simulation program.

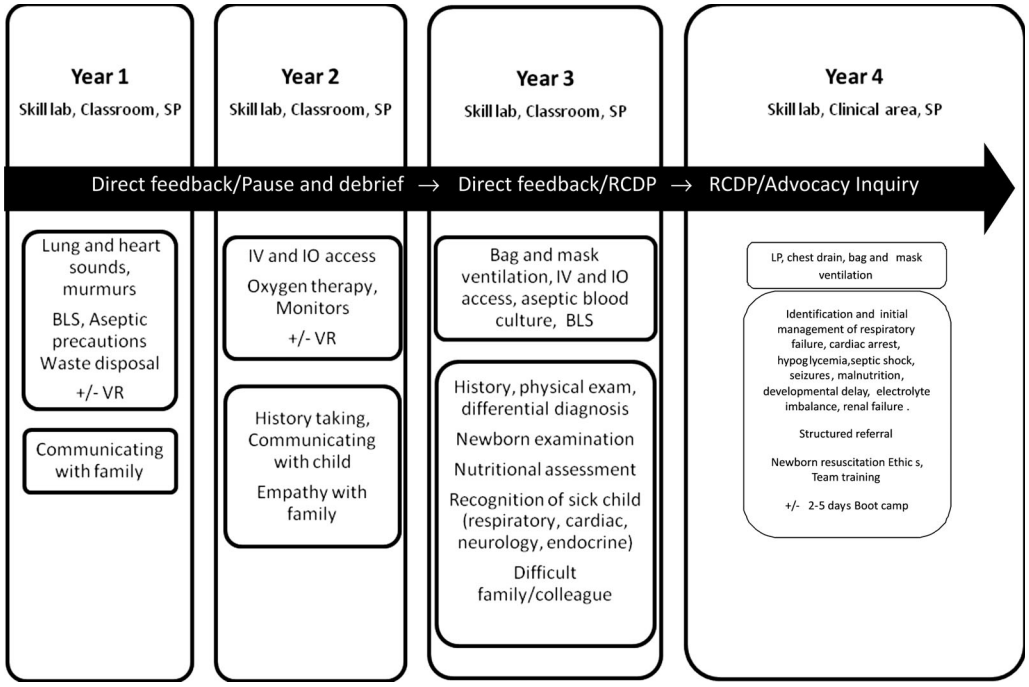
Curriculum design: SBE design involves appropriate needs analysis, clearly defined objectives, selection of the type of simulation, descriptions of learner and trainers, determination of place (simulation laboratory/in situ/other), identification of most appropriate simulation modality, decision about the duration of simulation, contextualized and validated evaluation tools, and any assessment needed. It is important to have specific and measurable objectives [17-19].

Scenario development: It involves scripting the scenario with a title, learning objectives, case history 'stem' to be told to the learners, manikin, props and moulages needed, additional background information for facilitators, scenario flow and debriefing script.

Delivering simulation: Prebriefing for psychological safety of the learners, introduction of the environment, parameters of simulation, capabilities of manikin, and suspension of disbelief about manikin is the key to facilitate learning during formative simulations. For immersive simulation, it is desirable that room should match the clinical area and instructors stay out of sight of the learners during the scenario. Appropriate audio-visual aids add realism to the scenario [18,19].

Debriefing: This is the heart of simulation and converts experience into learning. Learners are guided by a facilitator to reflect on their actions, reinforce correct responses, and plan for better performance. There are various types of debriefing techniques, including direct feedback, plus delta, pause and debrief, rapid cycle deliberate practice (RCDP) and advocacy inquiry [20-22]. Studies have shown that scripted debriefing might be more beneficial to novice faculty [23]. Attention is focused not only on 'what could be improved' but also 'what went well', and often asks learners to develop their own insights into 'why' processes went well or needed improvement.

Research, feedback and refinement: Research into the program to measure the impact of training and ongoing feedback to refine the curriculum and scripts are key for a successful simulation program, but must be carefully



SP: Standardized patient; BLS: Basic life support; VR: Virtual reality; IV: Intravenous; IO: Intra osseous; LP: Lumbar puncture; RCDP: Rapid cycle deliberate practice [21].

Fig. 3 *A guide to integrate simulation for pediatric medical students.*

Table I Suggested Solutions for Overcoming Barriers to Implement Medical Student Simulation

Faculty Training

- Create a central body to govern undergraduate medical simulation
- Collaborate with national and international simulation societies such as the All India Institute of Medical Science (AIIMS), International Pediatric Simulation Society (IPSS), International Network for Simulation-based Pediatric Innovation, Research and Education (INSPIRE)
- Implement tele-simulation with centres pioneered in simulation program.
- Provide incentives to faculty who become simulation facilitators - promotions, decreased clinical responsibilities

Curriculum development and scenarios

- Pilot in apex institutions and share curriculum with other institutions
- Collaborate with international bodies
- Create a pool of scenarios to be banked
- Develop national conferences on medical simulation, to bring together all trainers

Cost

- Pool resources. There are many large simulation labs which are not fully utilized
- Encourage realistic low-cost simulation
- Utilise Virtual reality, in situ and Standardised patient simulation modalities
- Develop 3-Dimensional printing and silicone casting
- Conduct research into developing indigenous low-cost high technology manikins
- Reserve high-cost manikins for specific learning circumstances

Large number of students, limited time

- Use classrooms for didactics followed by simulation so students can take turns learning by observation as well as participation.
- Encourage Virtual Reality
- Develop a library of simulation scenarios that can be re-used, so that subsequent simulation development takes less time

Research

- Form a national central governing body to supervise, encourage and fund simulation research
- Collaborate with organizations already working in this field like INSPIRE, SSH, PediSTARS.
- Publish national medical student simulation education journals

INSPIRE:International Network for Simulation-based Pediatric Innovation, Research and Education; SSH: Society for Simulation in Healthcare; PediSTARS: Pediatric Simulation Training and Research Society.

implemented to preserve psychological safety for learning.

A Framework to Implement Simulation-based-training in Pediatrics

MCI 2018 guidelines describe several competencies in the pediatric curriculum for medical students [4]. A stepwise approach starting with simpler skills in year 1, and adding more complex skills and scenarios in subsequent years would allow learners to build on skills they have developed (***Fig.* 3**). This will also allow trainers with specific skill sets to support skill training and reserve highly trained simulation educators for more complex simulation scenarios.

It is desirable to start with the highest priority competencies, such as identifying a sick child, performing basic procedures such as cannulation, intraosseous (IO) access, handwashing, aseptic precautions, waste disposal, and communicating effectively with families. Other competencies can be gradually integrated as a multistep process. Simulations such as history taking, airway management, basic life support (BLS), lumbar puncture, newborn examination, and nutritional assessment can focus on individual learning. However, emergency scenarios such as management of respiratory distress, cardiac arrest, septic shock, and seizures, and dealing with challenging families should be conducted as team training exercises so students can also develop skills in leadership, role allocation, calling for help, resource utilisation and providing clear instruction to colleagues [20].

Challenges

Faculty comfort will be a major challenge, because of the huge volume of students, the need for specialized training in simulation and a lack of time. Faculty development, manikin availability, cost, and access to space can be a

burden unless management and infrastructure support is available. Psychological safety for the students is extremely important to ensure learning from simulation, and this also applies to faculty who are developing their own simulation skills. Without psychological safety, both the learner and the program may be damaged.

Overcoming Barriers

A previous publication [1] called for exploring and embracing SBE in Indian subcontinent. After 4 years, it is exciting to witness incorporation of simulation by MCI in undergraduate curriculum and watch the breakthrough happening at some of the leading institutions in India. India is one of the most cost-effective countries when it comes to healthcare [24]. It is only a question of time for SBE to be applied across the country in medical education.

Creating a pool of highly trained faculty, optimizing low cost simulation opportunities, sharing resources, combining simulation with didactic classroom lectures [25,26], encouraging development of 3D printing, virtual reality [27], collaborating with simulation training organizations [28-30], and research into the impact of high-quality simulation-based training are some of the answers. Indian students deserve the best education platforms. ***Table* I** provides some insights into how we can make substantial progress.

CONCLUSION

It is now time for the much-needed paradigm shift – the time to incorporate simulation in medical education countrywide. It is no longer acceptable for our medical students to learn and practice on real patients, without first learning and training on simulated patients and situations. Simulation will never replace learning based upon exposure to real patients but will increasingly supplement and augment medical education in India. We need to think differently and be constructively disruptive as we develop simulation-based medical student curricula. The cost of integrating simulation into medical student education is modest compared to the potential number of lives saved and the joy of learning provided to our new generation of caring, able, deserving, and intelligent doctors.

Acknowledgements: Ashok Deorari, All India institute of Medical Science, Delhi. India; Rashmi Ramachandran, All India Institute of Medical Science, Delhi, India; Adam Cheng, KidSIM Simulation Program, Alberta, Canada; Gregg Lipschik, Life Support Training and Undergraduate Curriculum Simulation at Penn Medicine Philadelphia, USA; Erin Pete Devon, The Children's Hospital of Philadelphia, University of Pennsylvania. USA; Harsh Bhoopatka, Clinical Skills Centre, University of Auckland New Zealand; Evan Sanders, Harvard Medical School. USA; Malcolm Smith, Department of Simulation, University of Leicester, UK; Jane Torrie, Faculty of Medical and Health Sciences, University of Auckland, New Zealand.

Contributors: GR: reviewed the literature, drafted and finalized the manuscript. ED, VN: reviewed, revised and finalized the manuscript.

Funding: None; *Competing interests*: None stated.

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