Narrative Review

Establishment of a simulation centre: Challenges and solutions

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Submitted: 18-Dec-2023
Revised: 23-Dec-2023
Accepted: 24-Dec-2023
Published: 18-Jan-2024

Access this article online

Website: https://journals.lww.com/ijaweb

DOI: 10.4103/ija.ija_1232_23

Quick response code

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ABSTRACT

The change in curriculum and increasing need for active healthcare professionals providing quality patient care has emphasised simulation-based regular training, reskilling and simulation centres to deliver these. However, there is limited literature on how to establish a simulation centre and overcome the challenges relating to developing faculty and maintaining the financial viability of these centres. Our review focuses on this gap in the current literature. The findings are presented as 1) identification of the methods of establishing a simulation centre, 2) setting up the resource in a simulation centre and 3) faculty development and curricular integration in a simulation centre. The space of a simulation centre depends on the organisation's or training body's needs. There is no single design which is recommended. Establishing a simulation centre should consider the needs of the organisation, educators and learners along with the available resources and ensure that curriculum integration and standards are met.

Key words: Budgets, curriculum, education, need assessment, setup, simulation training

INTRODUCTION

Healthcare has a poor safety record compared to other industries, including aviation, which appears to have an enviable safety record. The traditional approach to human resource training in healthcare has been limited to classroom teaching, focussing on the knowledge component. However, there is visible change, with overwhelming evidence demonstrating simulation's benefit in education and patient safety.[1] Simulation environments now have high fidelity or realism and allow building and acquiring skills without the emotional stress of learning in a high-pressure, real-world environment. Further deviating from the conventional approach, recent curricular changes have stressed competency-based training,[2] which includes technical skills training and incorporates non-technical skills training through simulation to ensure anaesthetists deliver high-quality care. The National Medical Commission (NMC) guidelines[3] stress using simulators where high risk is involved for patients and encourage their use for assessments. An example is the skill of performing cricothyrotomy, which is rarely performed and can have a failure rate of nearly 33%.[4]

A simulation centre thus becomes a priority for the learner, educator, organisation and the nation. The challenges in implementing simulation-based education (SBE) in India have been described,[5] including increasing demands for professionals and financial resources. However, limited literature exists on establishing a simulation centre and overcoming its common challenges. Hence, our review focuses on these gaps in the literature and postulates approaches and solutions to these issues.

How to cite this article: Kumar EJ, Parameswari A, Manickam A, Purva M. Establishment of a simulation centre: Challenges and solutions. Indian J Anaesth 2024;68:45-51.

METHODS

The review followed the extension of Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines for scoping reviews.[6] The review included 1) identifying objectives, 2) setting up a protocol, 3) study selection, 4) data charting and 5) critical appraisal of results. The objectives of this review were 1) to identify the various methods of establishing a simulation centre, 2) to set up the resources in a simulation centre, and 3) to develop and integrate faculty curricular activities in a simulation centre.

Two authors conducted the initial literature search, while the latter steps were distributed among authors. The search strategy included PubMed and Scopus. A search in Google was also performed to identify articles outside the indices. The terms included 'simulation centre', 'resource', 'budget', 'cost', 'anaesthesia', 'curriculum' and 'faculty development' in the title, abstract or keyword. Only studies limited to publication in English were selected. Reference lists of identified articles were also screened for additional relevant publications. Studies were excluded if a full-text copy could not be sourced. The results were reviewed by the team until consensus was achieved. Of the 287 articles collected, 31 were selected based on objectives by the two authors and were agreed upon by the other two authors.

DISCUSSION

The literature review revealed an absence of directions for establishing a simulation centre. The need for a simulation centre can arise from a department, organisation, community or nation.[7-10] As need-based solutions are beyond the scope of this article, we would like to elaborate on the common challenges and the solutions at various stages of establishing a simulation centre from the viewpoint of an organisation and that of an educator.

Identify the various methods of establishing a simulation centre

To create a successful simulation training model on the lines of how pilots are trained in the aviation industry, a simulation centre must have a realistic setting where the training is 1) repetitive, 2) focused on achieving a mastery standard, 3) maintains quality and 4) environmentally sustainable.[11] The challenges to creating such a model are: 1) finite resources, 2) the need for organisational buy-in, 3) standardising best practices and 4) environmental sustainability. We identify potential solutions to these challenges.

A. *Finite resources*
With the increasing acquisition of expensive simulators by large organisations and buildings, simulation has been labelled an expensive modality. Jeet *et al*.[12] have demonstrated the cost of implementing 20 permanent and ten mobile skills labs in Bihar to be Rs. 8,849,895. The unit cost of training/participant using a permanent lab was Rs. 6856. The unit cost of training/participant using a mobile lab was Rs. 7474. The optimum number of training for maximum efficiency was 70–80 sessions per annum. Such numbers are needed to identify a framework for return on investment (ROI), which should be followed up right from setting up a centre. Repurposing the staff from their clinical work for educational purposes also strains finite resources.

B. *Organisational buy-in*
The stakeholders' perception of establishing a simulation centre has been measured by Najjuma *et al*.[8] The findings included limited experience in SBE, funding, human resource requirements and programme sustainability. Demonstrating simulation's value to organisations is vital to obtaining buy-in. It is essential that simulation centres explicitly demonstrate the benefit in terms of training, cost–benefit, cost-effectiveness, ROI, research output and quality improvement to obtain organisational buy-in.[13]

C. *Standardising best practice*
SBE is a versatile tool, but must be used using an evidence-based approach.[14] However, there is a failure to adopt best practices in programme design, delivery and evaluation. Fundamentally, there is a lack of standardisation in the approach to SBE with failure to adopt best practices in the design delivery or evaluation of SBE programmes. Research has identified best practices but must be formalised and consistently applied.[15-18] The Association of Simulated Practice in Healthcare (ASPiH), the national body of simulation educators in the UK, has published standards under four themes: faculty, activity, resources and values. The ASPiH standards, like other simulation standards, are relevant to those who run

simulation centres. Such standards aim to influence and ensure the best impact for learners and patients.

D. *Environmental sustainability*
SBE is a relatively newer concept, allowing us to develop centres sustainably.[11,19,20] Simulation has also been used to investigate sustainability. The centre should develop a sustainable procurement, maintenance, reuse and waste disposal method.

Setting up the resource in a simulation centre

The solution lies in the right team, place, finances and programme. The literature highlights the significant concerns as resource limitation – space, material and human.[13,21]

Right team

The team should consist of people with varying skill sets, preferably interprofessional. The team should consist of simulation experts, audio–video experts, experts from information technology, architects, administrators and end users, faculty and students.[22] It should have a project manager who can align the centre with the organisation's vision.

The other challenges include a recent change in curriculum, the need for faculty training and the absence of buy-in from stakeholders. Also, adjusting appropriate time slots in the existing teaching curriculum needs restructuring.[7] This can be overcome by setting up curricular committees and implementation strategies, including developing an academic calendar and interdepartmental collaboration. Most centres have less than six employees, suggesting simulation centres are designed to partner with subject matter experts.[23] Thus, a centre can employ lesser permanent staff and rely more on subject experts to come in and do the relevant training.

Right place

The space of a simulation centre depends on the organisation's or training body's needs. There is no single design which is recommended. NMC draft specifies an 800 m^2 skill lab area[3] for undergraduate teaching. Literature suggests 600 and 460 m^2 for medical schools and teaching hospitals, respectively.[23] Innovation centres with spaces up to 4300 m^2 have been quoted. However, the space and the design should be able to connect the vision, business and space.[9]

The design has to be flexible, match the curricular needs, provide for separation of activities and allow learner flow. The basic needs are simulation rooms, skill training areas, storage areas, debriefing rooms, control rooms, waiting rooms and breakout rooms [Table 1]. It should be situated at the site where training is needed. An example of a simulation centre design is provided in Figure 1.

a. Simulation room [Figures 2, 3]: It should be able to provide an immersive environment. The replica may not be needed; for example, vaporisers and anaesthetic gases may not be needed. It is preferable to avoid too many fixed components. The control room should have separate access and should not be accessible to the learners. A two-way mirror or a curtain is used to block the view of the control room.
b. Debriefing room [Figure 4]: It should be adjacent to the simulation room. It should provide for deep learning. The room should be able to accommodate learners, both individually and in large groups. The audio–video system is essential for observers to follow the scenario. Breakout rooms are to be preferably kept different from the debriefing and observation rooms.
c. The audio–video resources: The walls should minimise sound conduction between rooms. Noise interference by various equipment must be checked before the installation of microphones. The lighting of the rooms is essential as video recording and transmission are vital for observing and debriefing.
d. Storage: This area is vital, especially for a versatile simulation centre. The size depends on the inventory and the need to repurpose the area.
e. Others: The centre should provide for data security and learner safety. The centre should be disabled-friendly and equitable and provide a safe learning environment.

Table 1: Design of a simulation centre

	The room	The purpose
1.	Simulation room	Should provide an immersive environment Should avoid too many fixed components
2.	Control room	Contains necessary control equipment for the simulation room
3.	Skill labs	For repetitive practice like suturing, ultrasound, etc.
4.	Storage area	Provides flexibility, safety and cost-effectiveness to the centre
5.	Debriefing room	Should provide for facilitated reflective learning. Should have audio–video facilities
6.	Breakout areas	Where learners can relax and disconnect from immersion

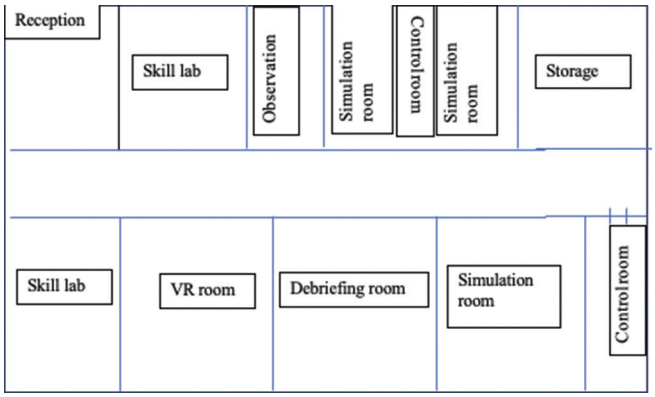

Figure 1: An example of a simulation centre floor plan. VR=virtual reality

Figure 3: Simulated operation theatre with a one-way mirror to console room (photo credit: Hull Institute of Learning and Simulation, Hull, UK)

Right finance (budget)[24,25]

An economic evaluation assesses the healthcare resource's (monetary) cost relative to its outcomes, which can be health-based, financial or other. Administrators primarily focus on economic costs, while simulation experts focus on the educational and health-based benefits of the programme. The correlation of health benefits to the simulation centre is difficult due to multiple confounders. Investment in one department may also benefit outside the area, making budgeting difficult for centres functioning as facility management platforms and training centres. Health outcomes are mostly delayed, while administrators look at favourable cost–benefits locally and in the short term, considering the expenses involved. Economic measurements, like cost avoidance outcomes, value measurement methodology (includes direct, social, strategic, operational and financial value), Frost and Sullivan model (quantitative), and Dr. Jack Phillips approach (evaluates the effectiveness of training programmes) and integrated measures for ROI need to be considered for a sustainable model of training healthcare providers and improving patient care. Most errors in crises are often not related to a lack of knowledge but are rather due to failures in teamwork, communication and lack of clear leadership (cost avoidance outcomes). Also, crisis resource management and patient satisfaction are essential to healthcare quality.

Figure 2: Simulated ward with mannequins and equipment (photo credit: Hull Institute of Learning and Simulation, Hull, UK)

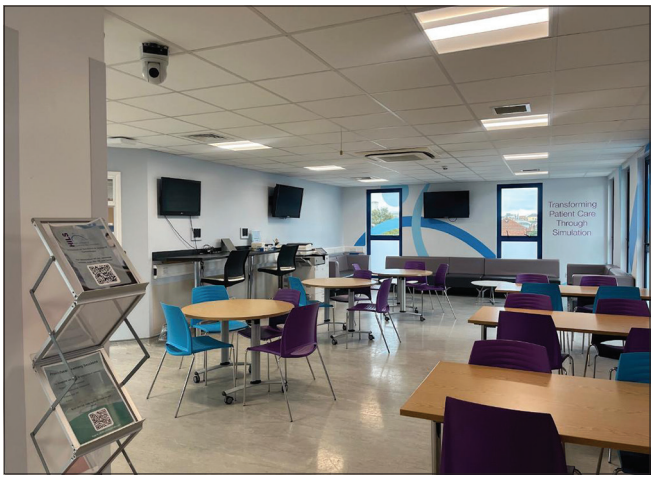

Figure 4: Debriefing room (photo credit: Hull Institute of Learning and Simulation, Hull, UK)

The review of literature focuses on the challenges faced by the healthcare system in human resource management.[26-28] The investment estimated by one study[26] for the required increase in the active health force of doctors is about INR 500–2500 billion, and for nurses, it is about INR 1000 billion. Such investments can contribute to a national income of INR 3400 billion annually. The recommended investments are mainly for funding institutions, creating new infrastructure, training and upgrading skills, and expenses for new employment opportunities, thereby increasing the active health force.[27] The benefits for our country can go beyond the health sector.

In low-resource settings with financial constraints, there is a need for collaboration, context-appropriate equipment, and curricula.[29] Industry partnership is also mentioned as one of the solutions for budgeting constraints.

The other way of driving down costs pertains to equipment purchases. The steps for procuring equipment include the formation of a simulation/skill committee and obtaining the educator's request. The need should preferably come from the end user. The process of evaluating and ultimately purchasing simulation equipment can

be intimidating.[30] Studies show various methods to overcome this challenge, including a scoring system to assess need. The sophistication of the equipment depends on the type of centre and the programme. Also, the creation of cheaper props that do not decrease the immersion has been suggested. A structured inventory control[31] is necessary for equipment management.

Right programme

Unlike a hospital, a simulation centre aims to transmit knowledge, skills, attitudes, quality improvement and research.[22] It can also be used for high-stakes needs (summative assessments), though the validation for the same is yet to be provided in the literature.[32] The simulation centre can be a facility management platform (supportive role and management facilities; the organisational position can be low with moderate to high management support) or a teaching and training centre (responsible for faculty development; the organisational position is reasonable and top management support level is moderate to high) or an innovation centre (education, training, assessment, medical rehearsal and simulation-related research; organisational position and management support level is high).[33] Not all simulation centres are required to be innovation centres. The implementation strategy should be aligned with the hospital's strategic goals to achieve desired outcomes.

Faculty development and curricular integration

Though SBE has been used extensively for educational activities in anaesthesiology and has also been recommended by the National Medical Council (India) and other international bodies, we found limited evidence on where or how to embed simulation in the curriculum for anaesthesiologists. The embedding of simulation in the curriculum needs an evidence-based approach, which the Royal College of Physicians has used. A novel method of linking competencies most likely to benefit from simulation training and improve patient outcomes has been reported.[34] Anaesthesiology, a technical speciality, is most likely to benefit from simulation training, but even more so from non-technical skills training, as over 60% of errors in the operating room are failures of those skills. The need of the hour is to change our paradigm on how we teach and educate[35] our future anaesthesiologists. As per a French study,[36] the modalities used in the centres for first-year residents were procedural training (90%), full-scale simulator (87%), simulated patient (42%), hybrid (10%), numeric/serious games (16%), virtual reality (0%) and cadavers (13%). Of the 16 most taught procedural skills, half (8)

Table 2: Common challenges and solutions in establishing a simulation centre

	Challenges	Solutions
1	Educator needs Is there a need for simulation in the presence of large patient population?	• Evidence of the benefit in the literature • Regulatory requirements • Benefit of repeated practice in the 'digital native' students
2	Resource redirection from direct healthcare needs	• Integrate simulation for organisational needs – quality improvement and research • Builds active healthcare team and sustains them
3	Implementation of simulation at the level of department and organisation	• Curriculum given by national regulatory body • Programme-based needs to be identified locally by educators • Organisational needs to be identified by the management
4	Financial challenges	• Need-based allocation • Use of economic measurements. Collaboration with governmental and private players • Structured procurement process • Use of cheaper props and locally made materials • Organisational buy-in
5	Faculty resources	• Start with a small team • Need-based allocation (teaching/facility management/innovation centre) • Integrate with the existing curriculum
6	Time constraint	• Organisational buy-in • Integrate with curriculum • Analyse needs and benefits
7	Space constraints	• Regulatory body guidelines • Design should be flexible • Should meet the needs
8	Absence of expertise	• Faculty development programmes • Plan for accreditation • Collaboration with national/international bodies

were airway-related. Half of the procedural skills (8) concerned everyday procedures (tracheal intubation, epidural anaesthesia). It is also essential to understand that one-off training is unlikely to sustain benefits. The frequency and dosing of simulation training should be assessed, and the training must be at regular intervals, even for a practising anaesthesiologist.[37] Curricular integration should also focus on non-technical skills of leadership, teamwork and communication skills, which are attributed to at least 50% of medical errors.[38] Non-technical skills training must be contextual and delivered using appropriate fidelity and within the relevant teams. These non-technical skills can also affect students' job prospects and educational progress.[28]

CONCLUSIONS

Establishing a simulation centre presents several challenges, and the organisation's needs, educators, learners and available resources should be considered. Curriculum integration and standards should be ensured [Table 2]. Challenges in resource development can be overcome by putting together the right team in the right place, with suitable finances and for the right programme.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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